
ENCYCLOPÆDIA BRITANNICA.

EIGHTH EDITION.

THE

ENCYCLOPÆDIA BRITANNICA,

OR

DICTIONARY

OF

ARTS, SCIENCES, AND GENERAL LITERATURE.

EIGHTH EDITION.

WITH EXTENSIVE IMPROVEMENTS AND ADDITIONS;
AND NUMEROUS ENGRAVINGS.

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ENCYCLOPÆDIA BRITANNICA.

OROBIO, BALTASAR (sometimes called ISAAC DE CASTRO), a celebrated Spanish Jew, born in the early part of the seventeenth century, and educated in Judaism by his parents, who outwardly professed themselves Catholics. Orobio studied the scholastic philosophy as taught in Spain, and became so skilled in it that he was appointed professor of metaphysics in the university of Salamanca. Afterwards, however, having applied himself to the study of physic, he practised that art with success at Seville, till, being accused of Judaism, he was thrown into the prison of the Inquisition, and suffered the most dreadful cruelties, in order to extort a confession. After a confinement of three years, the inquisitors, finding themselves baffled by his perseverance in denying his religion, ordered his wounds to be cured, and discharged him. As soon as he had obtained his liberty, he proceeded to France, and was made professor of physic at Toulouse. He resided for some time in this city, still outwardly professing the Catholic religion; but at last, weary of dissembling, he repaired to Amsterdam, where he was circumcised, took the name of Isaac, and professed Judaism, still continuing, however, to practise physic, in which he was much esteemed. Upon the publication of Spinoza's work, he is said to have soon discovered the weak points in the system of the great pantheist; and when Bredenburg's answer to it appeared, Orobio, being persuaded that the writer, in refuting Spinoza, had also admitted some principles which tended to atheism, took up his pen against both, and in 1684 published a piece entitled *Certamen Philosophicum*, characterized by great acuteness and power. But the dispute in which he engaged with the celebrated Philip Limborch against the Christian religion made the greatest noise. In this he exerted the utmost force of his metaphysical genius, and conducted himself with great temper. The three papers which he wrote on the occasion were afterwards printed by his antagonist in an account which he published of the controversy, under the title of *Amica Collatio cum Judæo*. Orobio died in 1687. (See *Israel Avenged*, translated and answered by Dr M'Caul, 8vo, London, 1839.)

ORONTES, the most famous river in ancient Syria, rises at the foot of Anti-Libanus, winds along in a northerly course for 200 miles, and then taking a sudden bend near Antioch in a south-westerly direction, flows over a space of 40 miles to the Mediterranean Sea. The notices of its fame in classical times are chiefly found in Strabo. His account is, that the river flowed for a part of its course under ground; that its name was derived from a certain Orontes who built a bridge over it; and that it had been originally called *Typhon*, from a fabulous dragon which, in his flight for shelter, wore out the channel of the stream with his trail, and opened up the fountain-head by his plunge into the earth. In the present day, the Orontes dwindles down into a paltry rivulet during the heat of summer. In winter, however, it becomes swollen by the melting of the mountain snows, and whirls along its deep and narrow bed with a resistless rapidity which has gained for it its modern name of *Aasi* ("The Rebel").

OROSHAZA, a town of Hungary, county of Bekes, 40 miles N.E. of Szegedin. An active trade is carried on in cattle, sheep, and pigs, of which large numbers are reared in the vicinity. The wine made in the neighbourhood is the best in the county. Pop. (1851) 10,915.

OROSIUS, PAULUS, a learned presbyter of Spain, born towards the close of the fourth century at Tarragona, on the shores of the Mediterranean. After spending some time in study in his native country, he passed over to Africa to enjoy the instructions of the celebrated St Augustine, Bishop of Hippo Regius. How long he remained there before returning to Spain cannot be precisely ascertained. It is known, however, that Orosius was despatched by the Spanish bishops Eutropius and Paul (A.D. 414) to consult St Augustine on several abstruse points of doctrine then under dispute. On this occasion Orosius wrote *Consultatio sive Commonitorium Orosii ad Augustinum de errore Priscillianistarum et Origenistarum;* to which Augustine published the reply, *Ad Orosium contra Priscillianistas et Origenistas;* both of which pieces are to be found in the works of the Bishop of Hippo. During the following year Orosius set out for Palestine, at the recommendation of Augustine, to consult St Jerome, the best scholar and critic of the early church, then engaged on his Latin version of the Scriptures. The active intelligence, gentle bearing, and calm modesty of the young Spaniard, won the heart of the great scholar, and he showed him as much kindness as Augustine

had done before him. While resident in Palestine, Orosius had occasion to break a lance with Pelagius. In a synod held at Jerusalem on the 30th July A.D. 415, the Spanish presbyter was called upon to oppose that heretic and his disciples, which led to the publication of the famous treatise *Apologia contra Pelagium de Arbitrii Libertate*, afterwards appended to the author's *History of the World*. On his way home to Spain in 416 A.D., Orosius took occasion, in accordance with his promise, to visit Augustine at Hippo. Rome had just been captured and pillaged a few years previously by the Visigoths, who were converts to Christianity. This gave rise to the calumnious assertion, industriously promulgated by the heathens of that time, that Christianity had been injurious rather than beneficial to mankind. Augustine took up his pen in defence of the cause; and, in his famous *De Civitate Dei*, showed, by an appeal to historical facts, that precisely the opposite was true. On this work the bishop was engaged when Orosius first visited him; and Augustine endeavoured to induce the zealous Spaniard to embark in a similar undertaking, and do for the facts of general history what he had done for the facts of the history of the church in his *City of God*. This was the origin of Orosius' well-known *Historiarum adversus Paganos Libri VII.*, dedicated to St Augustine. Part of it is said to have been put together in Africa; and it was probably completed about A.D. 416, the date at which the narrative closes. It is written with great force and brevity, and soon attained a wide popularity. It was lauded by popes, translated by kings, and read by all. The *editio princeps* of the History was printed at Vienna as early as 1471; but the best edition is unquestionably that of Havercamp, Lugd. Bat., 4to, 1738. A number of other pieces have been ascribed to Orosius, but no complete edition of his works has yet appeared. (For further information respecting Orosius, the reader may consult the works of J. W. Moller, 1689; of Dalmasses y Roz, 1702; of C. A. Haumann, 1732; of G. F. H. Beck, 1834; and of P. T. von Moerner, 1844.)

King Alfred transferred the substance of Orosius' History from the original Latin into Anglo-Saxon for the instruction of his people. Of this royal version three separate editions have been published in this country; one by Daines Barrington, with an English translation, 8vo, London, 1773, full of inaccuracies; another by B. Thorpe, with an English translation, 8vo, London, 1853, appended to Pauli's *Life of Alfred the Great* in Bohn's "Antiquarian Library;" and a third, with the English version only, but containing an introduction and valuable notes by Dr Bosworth, London, 1855.

OROTAVA, a town of the island of Teneriffe, capital of a district of the same name, is built on the slope of a hill on the N. coast, 1200 feet above the level of the sea. It is regularly laid out, the streets extending along the hill one behind the other. Of the two churches of Orotava, one is a handsome building with three naves, and contains a marble tabernacle brought from Genoa. There are also in the town two schools and an hospital. Pop. 8315. About 2 miles off stands a town called Puerto de la Orotava, with a harbour, which serves as the seaport of Orotava. By this a considerable trade is carried on; and it is from hence that the wines of the island are exported. Pop. 4600.

ORPHEUS, a celebrated poet and musician, who lived at such an early period that his history is involved in fable, and many doubt if we have any facts respecting him on which dependence can be placed. According to the common mythology, he was a native of Thrace, being born in a cave at Pimpleia, a city of Pieria, which was then included in Thrace (Schol. Apollon. i. 25; Strab. vii. 330, x. 471). He is said to have been son of Apollo, or of Œagrus, King of Thrace, and of the Muse Calliope (Diodor. ii. 64). He was the brother of Linus (Apollodor. ii. 4, 9), and the pupil of Musæus (Clemens. Strom. i., p. 332), or his master (Syncel., p. 156; Paus. x. 7, 1; Suid.) He is placed by Eusebius eighty-five years before the fall of Troy. He visited Egypt, and was there initiated in all the learning of the priests. When he returned to Thrace, he instituted the mysteries of Bacchus, which, according to Herodotus (ii. 81), included opinions which were afterwards promulgated by Pythagoras. He studied also under the Dactyli Idæi of Crete (Diodor. v. 64), and was the friend and companion of Cadmus, the founder of Thebes. He took a distinguished part in the Argonautic expedition, and saved his companions from the fascination of the Sirens by the charm of his golden lyre (Apollodor. i. 9, 25). On the death of his wife Eurydice, he is said to have visited the infernal regions, and, through the intercession of Proserpine, obtained permission from Pluto that Eurydice should return with him to earth, provided he would engage not to look on her till he reached the upper world. He broke his promise, and Eurydice instantly disappeared (i. 3, 2). A different version of the descent into Hades is given by Plato (*Symp.* and *Polit.*), who represents the gods as having imposed upon Orpheus by showing him only a phantasm of his lost wife, as a mark of their detestation of his cowardice in being afraid to die. How and where he died is variously stated. Some say that he died of grief for the loss of Eurydice; others allege that he was killed by lightning, because he revealed to man what the gods intended should be concealed from them; or that he was torn to pieces by the Mænades of Thrace for some disrespect shown to Bacchus. Olympus, Pangæus, and Hæmus are all named as the place of his catastrophe. The poets indicated the sweetness of his music by feigning that it was capable of moving the very stones and trees. Lucian tells a story of the head and lyre of Orpheus being thrown by the Thracian women into the Hebrus, and, as they floated down, the motion of the water brought them into contact, and the divine instrument gave forth strains of the most doleful and bewitching sweetness. The head and lyre having reached the island of Lesbos, the former was buried on the spot where the temple of Bacchus afterwards stood, and the lyre was long preserved in the temple of Apollo. According to Eratosthenes (*Catast.* 24), it was placed by Jupiter in the heavens, and formed the constellation called Lyra.

There can be no doubt that there was an early poet of this name, but Aristotle considered all the works which were circulated under his name as spurious (Cic., *De Nat. Deor.* i. 38); and Cicero ascribes them to Cercops, a Pythagorean, or to Onomacritus (Clemens, *l. c.*) The hymn to Jupiter, quoted by Stobæus (p. 40), is certainly very ancient, as it is alluded to by Aristotle (*De Mund. Op.*, t. i., p. 475), and is not to be confounded with the productions of the later Platonic school, which we have under the title of the Orphic Hymns. These hymns present a mixture of the theological ideas of the Greeks, Jews, and even Christians; so that there can be no doubt of the period in which they were written. The editions of the *Orphica* have been very various. That of Hermann, Leipsic, 8vo, 1805, is unquestionably the best. An English version of the Orphic Hymns, with a preliminary dissertation, was published by Thomas Taylor in 1787.

ORRERY, EARL OF. See BOYLE, *Charles*.

ORRERY. See PLANETARY MACHINES.

ORSOVA (*Old* and *New*), the name of two towns on the Danube, the former belonging to Austria, and the latter to Turkey. Old Orsova stands on the left bank of the river, 90 miles S.E. of Temesvar, in the Banat Military Frontier. It is fortified, and has manufactories of leather. Pop. 1000. New Orsova, which belongs to the province of Servia, stands on an island in the river W. of Old Orsova, and is strongly fortified. Pop. 2800. (See DANUBE.)

ORTELIUS, ABRAHAM, a celebrated geographer, called the Ptolemy of his time, was born at Antwerp in 1527.

He resided at Oxford in the reign of Edward VI.; came a second time into England in 1577; and is said to have persuaded Camden to write his *Britannica.* His *Theatrum Orbis Terrarum*, published at Antwerp in 1570, was the most complete work of the kind which had yet appeared, and gained him great reputation. He also wrote several other geographical works, the principal of which are, his *Synonymia Geographica*, Antwerp, 1578, and his *Thesaurus Geographicus*, Antwerp, 1594. He died at Antwerp in 1598.

ORTHEZ, a town of France, department of Lower Pyrenees, stands on a hill 892 feet above the sea, on the right bank of the Gave de Pau, 24 miles N.W. of Pau, and 37 E. of Bayonne. The town is regularly laid out and well built, having been recently much improved. The river is here crossed by an old Gothic bridge of four arches, with a tower in the centre. Among the public buildings is a handsome town-hall and an old parish church. On a height above the town stand the remains of the castle of Moncada, built by Gaston de Foix in 1240. These consist of a few dilapidated walls, with one lofty tower. Orthez contains a college and a court of the first instance. Manufactures of linen and woollen stuffs, leather, copper, and other articles are carried on. There is an active and extensive trade in hides, hams, wool, cattle, horses, timber, slates, marble, &c. Orthez was formerly a place of considerable importance, as it was the residence of the princes of Béarn until the end of the fifteenth century, when they removed to Pau. The castle of Moncada was at one time the residence of Jeanne d'Albret, Queen of Navarre, the mother of Henri IV., who established a Protestant college in the town. Orthez suffered much during the civil wars in France after the Reformation. Viscount d'Orthez, governor of the town, was one of the few who nobly refused to obey the royal order for the massacre of St Bartholomew. On the 27th of February 1814 a victory was gained by Wellington, with 37,000 troops, over Soult, with 40,000, in the vicinity of Orthez. In the retreat the French attempted, but unsuccessfully, to blow up the bridge over the Gave de Pau. Pop. 6619.

ORTHOGRAPHIC PROJECTION OF THE SPHERE, that in which the eye is supposed to be at an infinite distance. It is so called because the perpendiculars from any point of the sphere will all fall in the common intersection of the sphere with the plane of the projection.

ORTHOGRAPHY. See GRAMMAR.

ORTONA, a town of Naples, province of Abruzzo-Citra, on the shore of the Adriatic, 11 miles E. of Chiete. It contains a cathedral and several other churches; and gives its title to a bishop. There is a small harbour, by means of which an active trade is carried on in the wine grown in the vicinity, said to be the best in this part of Italy. Ortona occupies the site of the ancient town of the same name, which was the principal maritime town of the Frentani. Some ancient remains have been found here. Pop. 6000.

ORURO, a mining town of Bolivia, capital of a department of the same name, stands on a bare hill, 13,000 feet above the sea, on the right bank of the Desaguadero, where it falls into Lake Aullagus. The population has declined very much, and the town is surrounded by the ruins of houses that were once inhabited. Pop. 6000.

The department of Oruro is bounded on the N. by the department La Paz, E. by those of Cochabamba and Chuquisaca, S. by that of Potosi, and W. by Peru; area, 25,842 square miles. Pop. 117,000.

ORVIETO, a town of the Papal States, capital of a delegation of the same name, stands on a steep hill at the confluence of the Paglia and Chiana, 16 miles N.E. of Bolsena, and about 60 N.N.W. of Rome. It is a clean, well-built town, surrounded by walls; and contains several fine palaces. Besides the episcopal palace, the chief of these are,—the Gualterio, containing frescoes by Domenichino, Albano, and other artists; and the Palazzo Petrangeli, with a fine collection of paintings by Pietro Perugino. The cathedral, founded in 1290, is an Italian-Gothic edifice, with a front richly adorned with sculptures and mosaics, which is considered one of the finest in Italy. In the interior are many valuable paintings, and a large collection of sculptures. Orvieto contains several other churches, a Jesuits' college, and a town-hall; but the principal other object of interest is St Patrick's Well, excavated by order of Clement VII. in the tufo rock, about a mile from the town. Many Etruscan remains have been found here, this town having been built on the site of the ancient Herbanum. Some trade is carried on in cattle, corn, wine, and silk. Pop. 8000. The delegation of Orvieto has an area of 300 square miles. Pop. (1853) 29,047.

OSAKA, or OSACCA, a city of Japan, in the island of Niphon, near the head of a gulf of the same name, on the banks of the Yedogawa, which here divides itself into several branches. It is one of the five cities under the direct government of the Siogoon, or military emperor of Japan; and is defended by fortifications, and by a castle of great size at the north-eastern corner of the city. The middle channel of the river, though narrow, is navigable, and has a great depth; and many of the principal streets have navigable canals running through them. A great number of bridges, built of cedar wood, span these canals and the river; and many of them are large and elegantly adorned. The streets are regularly laid out at right angles to each other, and, with the exception of side causeways for foot passengers, they are quite unpaved, but clean and well kept. Along the banks of the river and canals there are several rows of coarsely-hewn freestone, arranged in the manner of steps, all throughout the town. The houses are in general built of wood, lime, and clay, and are two storeys high. Osaka contains a theatre and race-course; in which, as well as in other places of amusement, so many public exhibitions are carried on, that the city has been called by the Japanese the "universal theatre of pleasure and diversion." Many manufactures are pursued in the town and its vicinity; among which is that of *saki*, a kind of beer obtained from rice, which is exported to other parts of Japan. Some trade is carried on by junks between this place and Hakodadi. Osaka is said to be able to raise from among its own inhabitants an army of 80,000 men.

OSCHATZ, a town of Saxony, circle of Leipsic, on the Döllnitz, an affluent of the Elbe, 31 miles E.S.E. of Leipsic. It is surrounded by ancient fortifications, and contains many fine buildings. The town was in great part destroyed by a conflagration in 1842; and since that time there have been built a handsome new council-house, and an elegant church in the Gothic style, with two open spires, 276 feet in height. Besides another church, Oschatz contains courts of law and an hospital. Cloth, shoes, nets, tiles, and other articles are made. It was here that the treaty of peace was concluded between Frederic the Great and the Empress Maria Theresa which put an end to the Seven Years' War, in 1763. Pop. 5460.

OSCHOPHORIA, a festival celebrated by the Athenians, and which receives its name ἀπο του φερειν τας ὀσχας, *from carrying boughs hung with grapes*, which were called ὀσχαι. The original institution is mentioned by Plutarch, who ascribes it to Theseus, and says it was held in honour of Bacchus and Ariadne; but other writers maintain that it was celebrated in honour of Minerva and Bacchus. On the day of the festival, which probably occurred about the beginning of the Attic month Pyanepsion, two youths, whose parents were still alive, walked in procession, accompanied by a numerous retinue bearing vine branches hung with fresh grapes, from the temple of Bacchus to that of Minerva. Song and dance enlivened the march, and a sacrifice ensued.

The proceedings were concluded by a race, in which young men only whose parents were both alive had permission to engage. It was customary for them to run from the temple of Bacchus to that of Minerva, which was on the sea-shore. The reward of the conqueror was a cup called πενταπλοα, *five-fold*, because it contained a mixture of five different ingredients,—viz., wine, honey, cheese, meal, and oil.

OSERO, or LOSSINI, an island of Austria, in the circle of Trieste, Illyria, lies to the S.W. of the island of Cherso, with which it is connected by a bridge; area, 68 square miles. The inhabitants cultivate vines, olives, and fruit trees, rear sheep, and catch fish. The principal town is Lossini Piccolo, with the chief harbour in the island. It has distilleries, and a considerable trade in wine. Pop. 5179. The other towns are Lossini Grande (pop. 2389); and Osero (pop. 1157). Pop. of the island, 10,600.

OSIMO, a town of the Papal States, in the delegation of Ancona, stands in a rich and lively neighbourhood, on a hill on the Musone, 8 miles S.S.W. of Ancona. It is well built, and has a cathedral and other churches, an episcopal palace, and a town-hall, containing a collection of ancient statues and other remains found in the vicinity. This town occupies the site of the ancient Auximus, a place which became a Roman colony in 157 B.C.; after which period it was of considerable importance, especially in the wars of Belisarius, to whom it offered great resistance. Pop. 7000.

OSIRIS, one of the deities of the Egyptian Pantheon. (See EGYPT, sect. 1.)

OSNABURG (Germ. *Osnabrück*), a town of Hanover, capital of a province of the same name, stands in a valley on the Hase, a tributary of the Ems, 71 miles W. by S. of Hanover. It is surrounded by an old wall and ditch, and is entered by five gates. It is regularly laid out, and the most part of the houses are low and meanly built, but in the vicinity there are many handsome country houses. The cathedral is a fine edifice in the Romanesque style, built in the eleventh and beginning of the twelfth century. It has two square towers, and contains, among other curiosities, a richly-carved comb, said to have belonged to Charlemagne; relics of St Crispin, St Crispian, and other saints; and many valuable gold and silver crucifixes. The Lutheran churches of St Katherine and St Mary, and the Roman Catholic one of St John, are among the edifices most worthy of note in Osnaburg. The town-house, a fine castellated building, contains the hall in which, at the same time as in Münster, the treaty of Westphalia was concluded in 1648. The portraits of the ambassadors at this congress are still to be seen in the hall; and the town-house contains a collection of ancient drinking-vessels, arms, coins, and other antiquities. The town contains also several schools, hospitals, a workhouse, and a house of correction. Manufactures of coarse woollen stuffs, leather, linen, tobacco, and chemical products are carried on; and there is an active trade in these articles, in cattle, and agricultural produce. Linen is also made in large quantities in the vicinity, and sent hither to be stamped and sold. Osnaburg was a village of some importance as early as the time of Charlemagne. In 1082 it was first fortified; and at a later period it entered the Hanseatic League. It did not, however, attain the dignity of a free city. In 1626 a castle was built near the walls of Osnaburg by Bishop Francis William, in order to reduce to obedience the citizens, many of whom had embraced the Protestant faith; but this was destroyed by them in 1647. The province of Osnaburg has an area of 2407 square miles, and is bounded on the N. by the province of Aurich and the duchy of Oldenburg, E. and S. by Rhenish Prussia, and W. by Holland. Belonging to the plain of Northern Germany, the surface is almost entirely level, and the soil, being sandy and barren, yields but a scanty supply of corn. The principal productions are, cattle, hemp, and flax; while coarse linen and woollen fabrics are the chief among the manufactures. The country is famous for its hams, which are largely exported. The present province of Osnaburg nearly corresponds to the ancient bishopric of that name, which was the earliest see founded in Saxony by Charlemagne. Many of the people having become Protestants, it was decided by the treaty of Westphalia that the see should be held alternately by a Roman Catholic and by a Protestant bishop, the latter to be always chosen from the House of Brunswick-Luneburg. The last prince bishop of Osnaburg was Frederic, Duke of York, the second son of George III., who in 1803 made over the see, now only a temporal province, to Hanover. Osnaburg subsequently formed part of the kingdom of Westphalia and of the French empire; but was restored to Hanover after the fall of Napoleon. Pop. of the province (1855), 259,821; of the town (1852), 13,718. Of the inhabitants of the province at the above date, there were 88,814 Lutherans, 25,951 of the Reformed Church, and 144,321 Roman Catholics.

OSORIO, GERONYMO, a learned ecclesiastic, called from the purity and elegance of his Latinity "the Cicero of Portugal," was sprung from a noble family, and was born at Lisbon in 1506. He studied languages at Salamanca, philosophy at Paris, and theology at Bologna. Having secured the patronage of royalty on his return to Portugal, he was raised through successive dignities to the bishopric of Sylves. At the request of the notorious Cardinal Henry, Osorio undertook his *De Rebus Emmanuelis Regis Lusitaniæ, virtute et auspicio gestis, libri XII.* This work appeared at Lisbon in 1571, and *Os Lusiadas* of Camoens in 1572. Thus, while the sublime daring of Vasco de Gama was moving the elegant pen of the good bishop, the same grand exploits were melting into noblest music the heart of the much-suffering poet. Yet the historian was admitted to the friendship of kings, while the poet wandered a beggar through the streets of Lisbon. Both lived to witness the calamitous disasters of King Sebastian's African expedition; but patriotism was too strong in each to outlive it long. Osorio died in 1580, a year after Camoens. After his History, the most noted book of Osorio is the *De Gloria, libri V.*, written with such singular elevation of spirit and felicity of diction that D'Alembert asserted it to be a production of Cicero's palmed off upon the world by the learned bishop as his own. A curious admonition to Queen Elizabeth, exhorting her to return to the bosom of the Church of Rome, is also to be found among the writings of Osorio. In addition to paraphrases and commentaries on various books of Scripture, he also wrote *De Nobilitate Civili et de Nobilitate Christiana* (1552); *De Regis Institutione* (1572); *De Justitia Cœlesti* (1580); *De Sapientia*, &c. (See Jöcher's *Lexicon*.) His entire works were collected and published at Rome, in 4 vols. 4to, with a Life of the author, in 1592, by his nephew of the same name. The more popular writings of Osorio have been translated into English, French, and Portuguese.

OSSA, a lofty mountain in Thessaly, separated by the vale of Tempe from Mount Olympus, from which the ancients conjectured it had been divided by an earthquake. It is conical in form, with a single summit, rising, according to Dodwell, to a height of 5000 feet. Ossa is lower than Olympus and Pelion, the two mountains with which its name is associated in the fabulous wars of the giants and the gods. Its modern name is *Kissovo*.

OSSIAN, or OISIN, a traditionary poet of great celebrity, whose compositions in the Celtic language were for centuries popularly recited in Ireland and the Highlands of Scotland. It was only at a comparatively recent period that the literary world became aware of the existence, or at least the fame, of this Celtic Homer, and by many he is still regarded as a mythical personage.

In the year 1759 John Home, the Scottish dramatic poet, passed part of the summer at the pleasant little watering-place of Moffat, in the south of Scotland; and in his walks, or at the bowling-green there, he became acquainted with another visitor at the spa—James Macpherson, a young intelligent Highlander, then in his twenty-first year. Having completed his education at the university of Aberdeen, and taught a school for a short time at his native place—Ruthven in Badenoch,—Macpherson was engaged as tutor to Mr Graham, younger of Balgowan (afterwards Lord Lynedoch), who was then residing at the house of his relative, Lord Hopetoun. Always enthusiastic about poetry and the Highlands, Mr Home made inquiries of Macpherson relative to the reported traditionary poems of the old Celtic bards, of which he had heard some account from his friend Adam Ferguson, and a specimen of which had appeared in the *Scots Magazine* for 1756. Macpherson confirmed the statements as to the existence of a large amount of ancient Celtic poetry in the Highlands which had been preserved by oral transmission from one generation to another. He produced translations of two pieces, and Home was much struck with the wild beauty and originality of the poetry. On his return to Edinburgh he submitted the translations to Dr Hugh Blair and other friends, by all of whom they were greatly admired. Copies also found their way to England, and Gray the poet was, he says, "so *extasié* with their infinite beauty," that he wrote to Scotland making a thousand inquiries. Blair sought out the translator, and urged him to proceed in rendering versions of all the poems in his possession. Macpherson was reluctant to undertake the task, but at length he complied with the request; and Dr Blair having obtained a sufficient number of pieces to form a small volume, published them in 1760, under the title of *Fragments of Ancient Poetry collected in the Highlands of Scotland, and translated from the Gaelic or Erse language.* To this work Blair prefixed a preface embodying the information communicated to him by Macpherson, and stating that many more remains of ancient genius, and especially one work of considerable length, "deserving to be styled an heroic poem," relating the expulsion of the Danes by Fingal, might still be found in the Highlands. A subscription was entered into to enable Macpherson to make a tour for the purpose of collecting these precious remains. Lord Elibank, Dr Robertson, John Home, Adam Ferguson, and other persons of rank and taste in Edinburgh, subscribed sums; and Horace Walpole tells us he was also a contributor.

Under the patronage of these eminent individuals, Macpherson performed his literary tour in 1760, transmitting from time to time accounts of his progress, and of the various poems which, as he said, he had succeeded in collecting. The districts through which he travelled were chiefly the north-western parts of Inverness-shire, the Isle of Skye, and some of the adjoining islands; places which, from their remoteness, and the state of manners that then existed in them, were thought the most likely to afford, in a pure and genuine form, those traditionary tales and poems in the recital of which the Highlanders were represented as taking so much delight. On his return from the north, Macpherson passed some time with an early acquaintance of his own, Mr Gallie, then a missionary in Badenoch, and availed himself of the assistance of this gentleman, as well as that of Mr Macpherson of Strathmashie, in collating the different copies of the poems which he had collected, in translating difficult passages, and in determining the meaning of obsolete words. He then proceeded to Edinburgh, where he communicated to his patrons the result of his expedition; and in 1762 published *Fingal*, an epic poem in six books, with some other detached pieces of a similar kind. In an advertisement prefixed to *Fingal*, he states, that "some men of genius had advised him to print the originals by subscription, rather than deposit them in a public library;" and, in the preliminary dissertation he says, that "his translation is literal, and that, as he claims no merit on account of his version, he wishes that the imperfect semblance which he draws may not prejudice the world against an original which contains what is beautiful in simplicity, or grand in the sublime." In the year 1765, he published another epic poem, entitled *Temora*, to the seventh book of which he annexed the original Gaelic; but of all the rest he published only translations.

Macpherson had now not only enlarged his plan, but had altered the chronology of the poems. In the preface to the *Fragments* he had instructed Blair to represent them as probably coeval with the infancy of Christianity in Scotland: in one piece a Culdee or monk held a dialogue with Ossian, and this seemed to fix the date as not earlier than the sixth century. In his epic of *Fingal*, however, Macpherson boldly placed his Celtic bard in the end of the second or the beginning of the third century. Several incidents in the poem pointed out this era, particularly the engagement of Fingal (the son of Ossian) with *Caracul*, described by the translator as the same with the son of Severus, the *Caracalla* of Roman history. Fingal, who commanded the Caledonians at that memorable juncture, is said to have eluded the power of Severus, and gained a signal victory on the banks of the Carron, in which Caracul fled from his arms "along the fields of his pride." Here, then, was a startling fact—a text for controversy: could the remote Highlands be in such a state of civilization and refinement at the time of Severus? The parallel, as Gibbon said, "was little to the advantage of the Romans, if we compare the unrelenting revenge of Severus with the generous clemency of Fingal; the timid and brutal cruelty of Caracalla, with the bravery, the tenderness, the elegant genius of Ossian; or the mercenary chiefs who, from motives of fear or interest, served under the imperial standard, with the free-born warriors who started to arms at the voice of the king of Morven?" This eloquent eulogium would be well merited if we could "indulge the pleasing supposition that Fingal fought and Ossian sung" in the reign of Severus. But Gibbon himself offers one objection which destroys the hypothesis. The name of Caracalla was a nickname given to the son of Severus in derision. His real name was Bassianus, but he adopted the honoured name of Antoninus. In the Caledonian war he was known only by the appellation of Antoninus; and it was in the highest degree improbable that a Highland bard, even gifted with the second sight, should describe him by a nickname invented four years afterwards, scarcely used by the Romans till the death of that emperor, and seldom employed by the most ancient historians. This false step in his chronology strikes at the root of the translator's claim of great antiquity. David Hume took a more popular objection, which Johnson afterwards urged with great force. Is it possible that above 20,000 verses, along with numberless historical facts, could have been preserved by memory and tradition during fifty generations by the most turbulent and unsettled of all the European nations? No one, we think, will answer unreservedly in the affirmative. But Macpherson had the aid of at least *some* ancient manuscripts; and we must remember that it was the duty of the Celtic *senachies* or bards to recite poetry of this description, while it was the favourite amusement of the people during the long winter nights to listen to such recitations. National vanity, old associations, a love of song, and the habits and circumstances of the Highland people, all combined to perpetuate this traditional literature. It is undoubted that the tradition of a great hero or chief called Fion, Fion na Gael, or, as it is modernized, *Fingal*, existed in Ireland and in the Highlands, and that certain ballads

containing the exploits of this chief and his brother warriors were the favourite lore of the peasantry. *Ossian dall*, or blind Ossian, was as familiar, we are informed, as *strong Samson* or *wise Solomon*. The ancient Scottish poets, Barbour, Dunbar, and Gavin Douglas, had alluded to the exploits of Fingal; and in 1567 Bishop Carswell printed Knox's Forms of Prayer and Catechism translated into Gaelic—the first book printed in that language—to counteract, he says, "the lying worldly histories concerning warriors and champions and Fingal, the son of Combal, with his heroes." Abundant evidence then existed as to the popular belief in those ancient Celtic chiefs, the actors in Macpherson's epic poem; and the next point was to ascertain the precise nature of the Ossianic poetry which the Highlanders used to repeat and admire, and which Macpherson had professed to translate. The translator himself would render no assistance in solving the difficulty. At first he represented his translation as literal; and in his dissertation, published in 1762, he says, that "the translator, as he claims no merit from his version, wishes that the imperfect semblance which he draws may not prejudice the world against an original which contains what is beautiful in simplicity, or grand in the sublime." But, afterwards, when the success of his translation had been ascertained, he began to hold very different language; and, notwithstanding the strong and pointed assertions of their originality which he had advanced in his prefaces and dissertations prefixed to the earlier editions of these poems, he allowed expressions to escape him which unequivocally indicated an intention of appropriating the *authorship* to himself. In one passage he says that those who have doubted his veracity have paid a compliment to his genius, and that *even* were the allegation true, his self-denial might have atoned for his fault. "I can assure my antagonists," he adds, "*that I should not translate what I could not imitate*;" and again, in a similar vein, he says that "the translator who cannot *equal* his original is incapable of expressing its beauties." As his confidence increased, he became still more explicit, and in one of his prefaces we meet with the following passage:—"Without increasing his genius, the author may have improved his language in the eleven years that the poems have been before the public. Errors in diction may have been committed at twenty-four which the experience of a riper age may remove, and *some exuberances of imagery may be restrained with advantage* by a degree of judgment acquired in the progress of time. *In a convenient indifference to literary fame, the* AUTHOR *hears praise without being elevated, and ribaldry without being depressed.* The writer's first intention was to have published in verse; and as *the making of poetry* may be learned by industry, he had served his apprenticeship, though in secret, to the Muses." His service had been more secret than he at one time desired, for in 1758 Macpherson had published a poem, *The Highlander*, which was utterly worthless, and instantly sunk into oblivion. The imagery and description, however, have something of the Ossianic vein, though at times reduced to the lowest point of tenuity, or swelling into outrageous fustian. Some still earlier pieces by Macpherson, published in the *Scots Magazine*, are feeble paraphrases of passages in Pope and other poets. The controversy as to the genuineness of the Ossianic poems was carried on with much keenness and asperity. Johnson, in his celebrated *Journey to the Western Islands* (1774), had declared his conviction that the poems never existed in any other form than that in which they were published by Macpherson; and that there could not be recovered in the whole Erse language 500 lines of which there was any evidence to prove them a hundred years old! Macpherson replied by sending Johnson a challenge; a proceeding ludicrously absurd and in every sense impertinent, and which Johnson properly met by that memorable short letter of defiance in which he said he should never "be deterred from detecting what he thought a cheat by the menaces of a ruffian;" and that "what he had heard of the *morals* of his opponent inclined him to pay regard, not to what he should say, but to what he should prove." This was sufficient for Macpherson; but Dr Blair felt that his credit was at stake. He had written a dissertation to prove the genuineness of the translated poems, and procured testimonies from a number of clergymen and gentlemen in the Highlands in support of his theory. Still no conclusive ancient document or direct incontestable evidence was brought forward, and the case was rendered still more desperate by a dissertation from Mr Malcom Laing, who reviewed the whole subject—the Roman history of Britain, the middle ages, tradition, the customs and manners of the times, the real origin of the poems, imitations of the ancient and modern poets, the pretended originals, and Macpherson's indirect avowal of the whole imposture—pronouncing emphatically against the translator on all these various heads. This dissertation by Laing is an ingenious and elaborate display of criticism; but the Gothic predilection of the acute Orcadian had carried him too far, and subsequent researches have disproved some of his inferences and allegations. To settle the question, the Highland Society appointed a committee to inquire first, what poetry, of what kind, and of what degree of excellence, existed anciently in the Highlands, and was generally known by the denomination of *Ossianic*, from the universal belief that its author was Ossian, the son of Fingal; and secondly, how far that collection of such poetry published by Macpherson was genuine.

In answer to the first of these questions, the committee state with confidence an opinion "that such poetry did exist; that it was common, general, and in great abundance; that it was of a most impressive and striking sort, in a high degree eloquent, tender, and sublime." The second question, however, the committee found "much more difficult to answer decisively." They were possessed of no documents to show how much of his collection Mr Macpherson had obtained in the form in which he gave it to the world. The poems and fragments of poems they had been able to procure contained often the substance, and sometimes almost the literal expression of *passages* given by Mr Macpherson in the poems of which he published translations. "But the committee has not been able to obtain *any one poem the same in title and tenor* with the poems published by him. It is inclined to believe that *he was in use to supply chasms, and to give connection by inserting passages which he did not find, and to add what he conceived to be dignity and delicacy to the original, by striking out passages, by softening incidents, by refining the language*; in short, by *changing* what he considered as too simple or too rude for a modern ear, and *elevating* what in his opinion was below the standard of good poetry. To what degree, however, he exercised these *liberties*, it is impossible for the committee to determine." In fact, Macpherson had founded his epic poems on the ancient traditionary fragments, as Shakspeare had founded his immortal dramas on the rude though popular basis of old plays, novels, and historical chronicles. Parts of *Fingal* are undoubtedly genuine, and have been written down from the recitation of parties who never read the *Ossian* of Macpherson. The Address to the Sun (which Laing attacked as an imitation of Milton) is also a genuine fragment, and other beautiful passages scattered throughout the poems have been traced to the original traditionary sources. Of the MSS. used by Macpherson one only has descended to us. This is a large collection of Celtic poems composed at various periods, which appears to have belonged to the Rev. James Macgregor, Dean of Lismore, partly written in 1512, and partly in 1527. The volume is now in the Advocates' Library,

 Edinburgh, and has lately been carefully examined by a competent Celtic scholar, the Rev. Thomas M'Lauchlan. Historical incidents and passages in Macpherson's *Ossian* are found in this MS.—as the death of Oscar, the story of Faineasolis (the Maid of Craca in *Fingal*), and the story of Cuchullin, and his son Conlaoch, which was well known both in Ireland and the Highlands. The names of Fingal, Gaul the son of Morni, Oscar the son of Ossian, Garve the son of Starno, the Danes, Cuchullin &c., also abound; but there is one peculiarity in the Lismore MS. on which Macpherson was silent—it agrees with the Irish MSS. in the introduction of St Patrick, and in relating dialogues on Christianity between the Saint and Ossian, thus fixing the era of Ossian as that of St Patrick, and indicating that his country was not Scotland but Ireland.[1] This point does not seem to us of great importance. The unfaithfulness of Macpherson being admitted, it is easy to account for the Celtic poems being found equally popular in both Ireland and the Highlands. The people were of the same race, spoke the same language, and had constant intercommunication. The bards passed from one country to the other; the traditional poetry and legends formed a common inheritance, which would gradually undergo adaptation to the different localities and events. Some fragments may be of great antiquity, describing the prowess of the Fingalians (whose names at least existed at a very early period), and it is in favour of this supposition that the Celtic language seems to have undergone no radical change. The Irish antiquaries have of late diligently explored the ample field of their early literature, and their publications throw much light on the history of the Celtic race in these islands.

The literary merits of Macpherson's *Ossian*, extravagantly overrated at first, have experienced the usual reaction in such cases, of being unduly depreciated and contemned. If the fragments had not possessed poetical imagination and real genius, they would never have excited the warm admiration of Gray, whose taste and sensibility were so exquisite. As pictures of actual society and manners, the poems are of course spurious and deceptive; no one will, in this respect, attempt their defence. But Mr Wordsworth has attacked them on the score of their alleged false imagery and want of descriptive fidelity. "In nature," he says, "everything is distinct, yet nothing defined into absolute independent singleness. In Macpherson's work it is exactly the reverse; everything (that is not stolen) is in this manner defined, isolated, dislocated, yet nothing distinct." This may partly arise from the style of the translator, consisting as it does of broken paragraphs, unconnected and deficient in cadence. The genuine fragments, however, show that such a style is substantially true to the original. The Celtic bards had a peculiar diction, and dealt only in brief strokes of description. They sketched the broad outlines of the mountain landscape, the leading objects of nature or of passion, and attempted no delineation of the finer features, or of the atmospheric phenomena so characteristic and attractive in mountainous districts. With them "autumn is dark on the mountains, gray mists rest on the hills, dark rolls the river through the narrow plain," and "the musing hunter alone stalks over the heath." The enumeration is simple but suggestive; and in the more ambitious passages—in the apostrophes to the setting sun, the moon, or tempest—in pictures of solitary desolation, and in the melancholy superstition which evokes the ghosts of the departed Finian chiefs—we have bursts of true pathos and elevated imagination. The chief drawback to this ancient poetry is the constant repetition of the same ideas, sentiments, and imagery, which, however natural in an early stage of literature and of society, soon palls upon all but very young and romantic readers. No poetry is read with greater avidity in youth, or is so soon and so completely abandoned in after years.

It is worthy of remark that Macpherson's *Ossian*, in a French version, was the favourite reading of the great Napoleon. It stimulated his imagination, and coloured his despatches and addresses to the army. When he told his soldiers in view of the Pyramids, that "the shades of forty centuries looked down upon them," we recognise the vivifying power of genius, but genius lighted at the torch of *Ossian*. The poems made the fortune of their translator. Their first effect was enriching him to the amount of nearly L.2000, and obtaining for him the patronage of Lord Bute. Once brought into public notice, Macpherson's talents and energy soon secured preferment. He obtained a colonial appointment and pension; became, on his return to England, engaged in public affairs; and was an active supporter of government. His political pamphlets and letters at the period of the American war were highly popular, though perishing with the topics of the day that had called them forth. He attempted history, but without success proportioned to his labour or party zeal; and he egregiously failed in a translation of Homer in the style of Ossian. "Few people," as Scott said, "cared to see their old Grecian friend disguised in a tartan plaid and philabeg." In public life Macpherson was now conspicuous, and he obtained the lucrative appointment of secretary to the nabob of Arcot, with a seat in the House of Commons. Finally he retired to his native district, purchased a considerable estate (the old patrimony of the Mackintoshes of Borlum), and, building a splendid mansion on his property, died there at the age of fifty-six, his death occurring in the same year that witnessed the decease of Burns. How different the fate of the two Scottish poets! Macpherson was a man of undoubted genius, but of defective taste and lax principle. His Celtic enthusiasm was the fount of his highest inspiration, and the reign of Ossian may be said to have died with him. The accomplished scholars of Ireland have resuscitated much more of the ancient minstrelsy, but it is immeasurably inferior to the Macpherson fabric; and though interesting to a few as illustrations of a past state of manners and feeling, it has no pretensions to be regarded as adding to the value of our poetical literature. (R. C—S.)

 OSSOLI, Sarah Margaret Fuller, *Marchioness*, the eldest child of Timothy Fuller and Margaret Crane, was born at Cambridge Port, Massachusetts, U. S., on the 23d of May 1810. Her father, who was a lawyer there, took charge himself of her education, but with an imprudence which afterwards cost her much suffering, began too early and exacted too much for the health of his child. She was of nervous and excitable temperament, and of a precocious activity of mind, which required a different regimen from the stimulants of school tasks. She was able to read Latin at six years of age, picked up some knowledge of French, and eagerly devoured all the English books within her reach. Headaches, somnambulism, and spectral illusions were the results of this injudicious excitement of the brain, and, attributing her feeble health to her solitude, her father sent her to a ladies' school at Groton. Afterwards she received instruction in Greek and mathematics from Dr Park of Boston. In 1832 she studied German, and in three months could enjoy the masterpieces of German

[1] The Rev. T. M'Lauchlan. *Archæological Journal*, 1857. Mr M'Lauchlan considers these passages as interpolations of the Irish bardic school, in which so many of the Scottish bards were trained. (See also *Transactions of the Ossianic Society*, Dublin, 1855.) The Irish poems represent Ossian as reciting his strains to St Patrick "in the latter days, when, the glory of the Finians having departed for ever, he alone of them survived, infirm, blind, and dependent upon the bounty of the first Christian missionaries to Ireland." The discipline of Christianity sat most uneasily upon the old pagan bard, who sighed for the harp and feast, the battle and the chase. In the number of the *Archæological Journal* above referred to is an able paper on the Ossianic controversy by Lord Neaves, a Scottish judge.

literature. She was at once brought under the fascination of Goethe, whose doctrine of self-culture the highest aim took possession of her whole soul. Her reading, though diligent and extensive, does not seem to have been systematic, and she never subjected herself to the wholesome discipline of science. She did not lack for her self-culture whatever advantages the most intellectual society of Boston could confer. By her remarkable powers of conversation, and her noble and sympathetic nature, she attracted round her, and personally attached, a very great number of young and ardent friends of both sexes. It is not to be questioned, at the same time, that she was enormously conceited, dogmatic, and exaggerated in thought and feeling, and she was only spoiled by the intense adoration of her coterie. She had a cherished purpose of visiting Europe, and hoped to do so in the society of Miss Martineau, whom she met in 1835; but the death of her father, in October of the same year, laid new responsibilities on her, from which she did not shrink. In the autumn of 1836 she went to Boston to teach Latin and French in a public school, and also formed classes for young ladies in French, German, and Italian. Her success and ability procured her in 1837 the situation of "lady superior" in the Green Street School, Providence, Rhode Island, which she occupied till 1839. After various migrations, she settled with her mother and family in Boston in 1841. In 1839 she had published a translation of Eckermann's *Conversations with Goethe*, and this was followed in 1841 by a translation of the letters of Gunderode and of Bettine. Her intended Life of Goethe was never completed; but she found continuous literary occupation in the *Dial*, a publication established by the so-called Transcendentalists, which she edited for two years from its commencement in 1840, and in which she published three noticeable papers—a criticism on Goethe; "The Great Lawsuit," afterwards expanded into *Woman in the Nineteenth Century*, and "A Summer on the Lakes," also enlarged into a book in 1844. A characteristic undertaking of hers in Boston was her conversation classes, re-unions once a week, in which many of the most cultivated ladies took part, and where such subjects as Greek mythology, the fine arts, the position of women, dæmonology, and the ideal, were discussed, Miss Fuller presiding. What has been reported of the debates of these *ecclesiazusæ* gives no high idea of their practical utility; they have rather a peculiar comic aspect, and bear a striking resemblance to the immortal *conversazione* at which Mr Martin Chuzzlewit was present. On the other hand, her writings, in which she felt herself comparatively cramped, display much sense and vigour, some originality, and a growing felicity of image and expression. In 1844 she went to New York as literary contributor to the *Tribune*, and while there, resided in the house of the editor, Mr Horace Greeley. Her articles were collected and published in two volumes in 1846. That year she made her visit to Europe, passing some time in England and France, and finally fixing her abode in Italy. She had always been attached to that country and its literature, had made the acquaintance of Mazzini in England, and was warmly interested in the progress of liberalism. In December 1847 she was married to the Marquis Giovanni Angelo Ossoli, but their union was kept secret to save his fortune till the establishment of the hoped-for reforms might render an avowal safe. She had a son in September 1848. She was in Rome during the siege in 1848–49, and superintended one of the two hospitals, while her husband fought on the walls, and her child was left in charge of a nurse in the village of Rieti. In September 1849 they retired to Florence, where they lived in painfully narrow circumstances. She occupied her leisure with the completion of a history of the recent events which she had all along been preparing. She determined to return to America with her family, and to resume her literary career with the publication of her work, on which she founded high expectations. They set sail from Leghorn, 17th May 1850, in the barque Elizabeth; and the voyage was prosperous till they reached the coast of New Jersey, when, in a dreadful gale, the ship struck on Fire Island beach, 16th July. Some of the crew and passengers saved themselves, but the Ossolis perished. Margaret Fuller was a woman of very extraordinary endowments, and her loss was deeply regretted as a calamity to American literature and progress. Memoirs of her, compiled by her friends, W. H. Clarke, R. W. Emerson, and W. E. Channing, were published in 1852.

OSTADE, ADRIAN VAN, an eminent painter of the Dutch school, was born at Lubeck in 1610, and studied at Haarlem, in the school of Frank Hals. His genius was early developed, and soon struck out a path for itself in the province of art. He chose for his principal subjects the gambling pastimes, the uproarious merry-makings, the sottish drinking-bouts, or the drunken frays of a country ale-house. He was also fond of painting an alchymist's laboratory, the office of a country lawyer, and the interior of a peasant's cottage. All these scenes, so mean and humble in themselves, were invested with the charms of consummate artistic skill. The characters were well distinguished by different physiognomies, the accessories were successfully arranged, the colouring was warm and harmonious, and the chiaroscuro was unrivalled. Accordingly, the artist enjoyed an extensive reputation and patronage, from the beginning of his career at Haarlem till his death at Amsterdam in 1685. His numerous works have also continued to rise in the public estimation ever since his demise. Specimens abound in several of the English collections, in the galleries at Amsterdam, the Hague, Dresden, Munich, and Vienna, in the Hermitage at St Petersburg, and the Louvre at Paris.

OSTADE, *Isaac van*, the brother of the preceding, was born at Lubeck in 1617. Although a pupil, and at first an imitator of Adrian, he soon adopted a manner of his own. A frozen canal covered with sledges and skaters, and the yard of a country inn bustling with huntsmen, waggoners, and travellers, were his favourite subjects. He painted these with a knowledge of the principles of art which would probably have gained for him a reputation equal to that of his brother, had not death prematurely closed his career at the age of thirty-seven.

OSTASHKOV, a town of European Russia, in the government of Tver, on a small promontory in Lake Seliger, 110 miles W. of the town of Tver. The houses are for the most part built of wood; but there is a large bazaar, containing the shops, which are all of brick. There are several churches, courts of justice, a nunnery, school, and several hospitals. Malt, leather, and tallow are made, as well as boats for the Volga. Some trade is carried on in corn, salt, meat, leather, tallow, timber, &c. Pop. (1849) 8254.

OSTEND (Fr. *Ostende*), a fortified seaport-town of Belgium, province of West Flanders, stands on a low piece of ground, nearly surrounded with water, 12 miles W. of Bruges, and 67 N.W. of Brussels. The town is clean, the streets regularly laid out, and the houses, which are neatly built, present a cheerful appearance, from being painted of various colours. The place is, however, generally considered dull and uninteresting by English travellers; and it has few public buildings of any note. The town-hall, though large and handsome, is a plain structure; and of the several churches, hospital, barracks, arsenal, and prison, none are in any way remarkable. There are several squares and public walks; the most agreeable of the latter, and at the same time the most noteworthy object in Ostend, being what is called the Digue, a breakwater 40 feet high, faced with stone, which extends for half a mile

between the sea and the fortifications. This is much frequented as a promenade, and commands an extensive view over a flat sandy expanse, entirely destitute of trees. The harbour, though difficult of access, on account of a sandbar at the mouth, is large, and forms the termination of a magnificent series of canals which intersect the country in a sort of network. Vessels of 300 tons may sail by this means as far as Bruges. The sluices by which the canal communicates with the harbour are remarkably well constructed. Ostend is much frequented by the Belgians as a watering-place, and the king and queen frequently visit it in the summer. There are numerous bathing-machines, and a good bathing-house. The manufactures are not of any importance, comprising linen, sail-cloth, lace, hats, tobacco, and other articles. The cod and herring fishery gives employment to many of the inhabitants, and oysters, brought over from the English coast, are fattened here in salt reservoirs, and sent to Paris under the name of Ostend oysters. The trade of Ostend is very considerable, consisting in the exportation of rural produce, leather, tallow, salt, &c., and the importation of colonial produce, wool, wines, manufactured goods from England, and other articles. Its prosperity has been much increased by the introduction of railways, by which it is connected with the chief places in Belgium, France, and Germany. The fortifications of the town are very strong, as it is one of the fortresses that defend the French frontier of Belgium. They consist of ramparts, a broad ditch, and a citadel, and the town is entered by four gates. In the ninth century a small village existed on this site, which 200 years after had become a busy seaport; but this town was destroyed by the sea in 1334. The present town was afterwards built, and gradually rose from a small fishing village to its present importance. It was walled in 1445, and regularly fortified by the Prince of Orange in 1583. During the war of the Dutch against Spain, Ostend sustained a memorable siege for more than three years (1601–1604). So tremendous was the bombardment that the noise of the Spanish artillery is said to have been occasionally heard at London. At last, after a loss of 50,000 men on the part of the garrison, and 80,000 on that of the Spaniards, the town surrendered on honourable terms; and the Spanish general Spinola was put in possession of Ostend, now reduced to heaps of ruins. It has since sustained several sieges, successful and unsuccessful; and in 1826 was partially destroyed by the blowing up of a magazine. Pop. 14,665.

OSTEOLOGY. See ANATOMY.

OSTERODE, a town of Hanover, in the principality of Grubenhagen, and circle of Hildesheim, stands on the Söse, at the foot of the Hartz Mountains, 10 miles S.E. of Eimbeck. It is surrounded by walls, and contains several churches, a town-hall, an infirmary, and Latin school. The castle, now used as a granary, is a large stone edifice. Osterode is the chief manufacturing town in Hanover, producing linen, woollen, and cotton stuffs; nails, wooden articles, shot, needles, &c. There are also breweries, distilleries, and tanneries. Pop. (1852) 5504.

OSTERVALD, JEAN FRÉDÉRIC, a distinguished Protestant divine, was born at Neufchâtel on the 25th November 1663. He gave early marks of great intellectual precocity, and reaped laurels in philosophy both at Zurich and Saumur while yet a mere lad. After obtaining his master's degree at the latter place, he studied theology successively at Orleans, Paris, and Geneva. He was afterwards appointed pastor of the Reformed church of his native town, a position which he continued to adorn by his learning and zeal during a long life. In the first years of his ministry the political condition of Neufchâtel was critical in the extreme, and the amicable settlement of its affairs which afterwards ensued was in a great measure owing to the sagacity, energy, and moderation of Ostervald. A close friendship was soon formed between the pastor of Neufchâtel, J. A. Turretin of Geneva, and S. Werenfels of Bâle. These eminent men went by the name of "the triumvirate of Swiss divines," and did much to revive the cause of true religion in Switzerland. In addition to the active and laborious duties of a pastor and preacher, Ostervald found leisure to extend his reputation as a man of learning and piety in various able and popular works. He wrote a *Traité des Sources de la Corruption*, Amst. et Neuf. 1699; *Catéchisme, ou Instruction dans la Religion Chrétienne*, Genève, 1702; *Traité contre l'Impureté*, Amst., 1707; *Arguments et Reflexions sur l'Ecriture Sainte*, Neuf. 1720; *Traduction de la Bible*, Neuf. 1744; *Sermons sur Divers Textes de l'Ecriture Sainte*, Genève, 1722–24. Three other works bearing his name were published from notes of his lectures, but without the author's consent. These were *Ethica Christiana*, London, 1727; *Theologiæ Compendium*, Bâle, 1739; and *Traité de l'Exercise du Minitère Sacré*, Amst. 1737. His works attained to a great popularity with the French Protestants; and he was long spoken of among them as "*le Grand Ostervald*." His writings were likewise translated into English and German; and "Ostervald's Bible" was long well known and much prized in this country. Ostervald died on the 14th of April 1747, in his eighty-fourth year. (See his Life by David Durand, London, 1778.)

OSTIA, a seaport-town of Latium, was, as its name implies, at the mouth of the Tiber, at the distance of 16 miles from Rome by the Via Ostiensis. It was founded by Ancus Marcius, and originally derived its importance from supplying salt to the neighbouring district. Becoming in course of time the port of Rome, it began to flourish simultaneously and proportionally with that city. In the second Punic war, merchant vessels with grain from Sicily and Sardinia, and ships of war for the protection of the coast, were wont to throng its harbour. It was also about the same time the seat of a quæstor, who was called *Quæstor Ostiensis*, and whose task was to provide Rome with corn. But all the while the mud brought down by the Tiber was filling up the harbour, and rendering it incapable of receiving large vessels. That another port should be made for the capital of Italy was accordingly seen to be necessary. On the shore, about 2 miles north from Ostia, a new basin, called the Portus Augusti, and communicating with the Tiber by means of an artifical canal, was dug by the Emperor Claudius; an inner basin, called Portus Trajani, was added by Trajan; and this double harbour came to be called Portus (*Porto*), and gradually drew away all the traffic from Ostia. That ancient town had thus reached its acme of prosperity. Although handsome public edifices were reared by successive emperors, it dwindled down by degrees, until in the middle ages it fell completely into ruins. These ruins have been left by the constantly advancing shore about 3 miles from the mouth of the Tiber. About half a mile further up the river is the modern Ostia, an insignificant village.

OSTRACISM (ὀστρακισμός, from ὄστρακον, a *tile* or *shell*), a peculiar institution employed by the Athenian people for banishing from the state for a limited period such persons as were deemed dangerous to the republic either from their wealth or personal influence. (Aristotle, *Polit.* iii. 8.) It is said to have originated with Cleisthenes after the expulsion of the Pisistratidæ, and differed from the ordinary banishment (φυγή) in allowing the proscribed to enjoy their estates in a fixed residence, and to return after a term of ten years, subsequently reduced to five. (See EXILE.) Ostracism involved no dishonour, and was so far from casting any taint upon the reputation of a citizen that it was generally regarded as in reality a public compliment paid to conspicuous merit. That some other mode of acknowledging worth would have been preferred by public

men is likely enough; yet in the opinion of Mr Grote, who is ingenious in his defence of the policy of ostracism, this institution was necessary as a means of awakening in the multitude, and especially in ambitious men, "that rare and difficult sentiment which we may term a constitutional morality." (*History of Greece*, vol. iv. p. 205.) It was a general principle of the Athenian constitution that "no law shall be made against any single citizen without the same being made against all Athenian citizens, unless it shall so seem good to 6000 citizens voting secretly;" and under this general provision ostracism was a particular case. Before the vote of ostracism could be taken, the senate and the public assembly had to meet in the sixth prytany of the year, and deliberate upon the propriety of exercising the measure at that particular time. If their decision was in the affirmative, a day was named when the Athenian people assembled in the market-place according to their ten tribes. The agora was railed round, with an entrance left for each tribe, through which the citizens passed, and cast each a shell or potsherd (ὄστρακον), containing the name of the individual designed to be banished, into a cask or vessel which stood in the centre to receive the suffrages. At the close of the day the votes were summed up under the superintendence of the nine archons and the senate; and if any one person was found to have 6000 votes against him, that person was banished; but if the hostile votes did not amount to that number the proceeding ended in nothing. When one happened to be ostracized, he required to depart from Attica in ten days for a period of ten years; this was the sum of the penalty. With respect to the number of votes necessary to banish a citizen, Plutarch alleges that it was not necessary that 6000 should be given against one individual, but simply that the sum total should not be under that number. (*Aristeid.*, c. 7.) This view is likewise supported by Böckh and Wachsmuth; but Grote, following Philochorus, Pollux, the scholiast on Aristophanes, Platner, and Heumann, maintains that the former opinion is the only one consistent with the design of Cleisthenes in instituting ostracism for the preservation of the nascent democracy.

In order the more thoroughly to render ostracism effective in protecting the constitution, and the better to hinder it from being diverted to any other purpose, whether of private revenge or of the intrigue of faction, Cleisthenes ordained that if the process of ostracizing were opened at all, every citizen of Athens, without a single exception, should be exposed to its sentence, and run the risk of its penalty. Thus the tutelary influence of this *privilegium*, as the Romans would have called it, not merely operated when it was actually employed, but the knowledge of its existence is supposed to have exercised a restraining effect upon public leaders or men of ambitious temper. "Care was taken," says Grote, "to divest the ostracism of all painful consequence except what was inseparable from exile; and this is not one of the least proofs of the wisdom with which it was devised. Most certainly it never deprived the public of candidates for political influence; and when we consider the small amount of individual evil which it inflicted,—evil, too, diminished, in the cases of Kimon and Aristeidês, by a reactionary sentiment which augmented their subsequent popularity after their return,—two remarks will be quite sufficient to offer in the way of justification. First, it completely produced its intended effect; for the democracy grew up from infancy to manhood without a single attempt to overthrow it by force; a result upon which no reflecting contemporary of Cleisthenes could have ventured to calculate. Next, through such tranquil working of the democratical forms, a constitutional morality, quite sufficiently complete, was produced among the leading Athenians to enable the people after a certain time to dispense with that exceptional security which the ostracism offered. To the nascent democracy it was absolutely indispensable; to the growing yet militant democracy it was salutary; but the full-grown democracy both could and did stand without it. The ostracism passed upon Hyperbolus about ninety years after Cleisthenes, was the last occasion of its employment." (*Hist. of Greece*, vol. iv., p. 211.) This demagogue was as low in character as he was humble in birth; and the Athenians, thinking their own dignity, and that of the institution of ostracism, alike degraded by proscribing such a worthless individual, resolved to put an end to the practice. During the reign of ostracism in Athens, we read of about ten different persons as having been banished by that political measure. Among these are to be found some of the most illustrious names that that illustrious city ever knew. Witness Themistocles, Aristeides, Cimon, and Alcibiades. The story of Aristeides, "at all times just but when he signed the shell," recording his own name upon the tablet at the request of the illiterate peasant, is told by Plutarch (*Arist.* c. 7), and is well known.

With the exception of the statement of Aristotle in his *Politics* (iii. 8), respecting the abuse of ostracism for party purposes, we have no means of judging of its administration at Argos, Miletus, and Megara, the other democratical states in which the system of the shell prevailed. The *Petalism* (πέταλον, *a leaf*) of the Syracusans was borrowed from the ostracism of the Athenians, which it closely resembled, except that the names were written on *olive leaves* instead of potsherds, and the term of banishment was only for five years. It should not be omitted, however, especially in connection with the views of Mr Grote, that petalism seems to have proved self-destructive in Syracuse. The fear of this "humbling of the pride and hopes of the exile" deterred the best men among the citizens from taking any part in public affairs, and, as a necessary consequence, elevated the unscrupulous and incompetent to power. Misgovernment and political degeneracy was the obvious result; and petalism had to be repealed, B.C. 452. (See Diodorus, xi. 87.) In reference to this significant fact Grote offers the reflection, that "we cannot safely infer, that because the ostracism worked on the whole well at Athens, it must necessarily have worked well in other states;" a remark quite just in itself, but nevertheless laying bare the weakness of the system; and by no means calculated either to recommend the policy of its adoption or to vindicate the superior wisdom of its institution. Plutarch affirms that ostracism arose from the inherent envy and jealousy of a democracy (*Themist.* 22, and *Arist.* 7); and the majority of critics, both in ancient and modern times, have been all but unanimous in denouncing it. And if Grote is chargeable with carrying his vindication of ostracism too far, he has at least the merit of placing in a full and clear light the peculiar excellences in the system which doubtless recommended its adoption to the enthusiastic republicans of Athens.

OSTROG, a town of European Russia, capital of a district of the same name, in the government of Volhynia, stands on the Vilia, 103 miles W. of Jitomir. It has an old castle, several Greek and Roman Catholic churches, a convent, and school. Several markets are held here; and an active trade is carried on. Pop. (1850) 9353, many of whom are Jews.

OSTROGOSHSK, a town of European Russia, government of Voronesh, on the left bank of the Tosna, about 60 miles S. of Voronesh. It is a thriving town, and contains several churches. Commerce is actively carried on; and several fairs are held. About 10 miles off is a colony of German Protestants, who live chiefly by agriculture. Pop. (1851) 5622.

OSTROWO, a town of Prussia, government of Posen, and 67 miles S.E. of that town. It has Roman Catholic and Protestant churches, a synagogue, and a grammar

school. The manufacture of woollen cloth is busily carried on. Pop. 5839.

OSTUNI, a town of Naples, province of Otranto, stands on a hill, 21 miles N.W. of Brindisi. It is the see of a bishop; and contains numerous fine churches and large convents. Pop. 6000.

OSUNA, a town of Spain, province of Seville, at the entrance of a valley, not far from the Salado, 40 miles E.S.E. of Seville. It is built in a semicircular form on the slope of a hill, and has broad regular streets, well paved, and adorned with numerous fountains, which are supplied with water brought from the distance of one mile by an underground channel. On the top of a hill stands a castle, which commands an extensive view of the fertile country in the vicinity of the town. The collegiate church is a building in the mixed Gothic and Cinquecento styles, and contains several fine pictures by Ribera. The church having been occupied as a fortress by Marshal Soult, these, as well as the sculptures over the portal, have been much defaced by his soldiery, and a large quantity of ancient plate was carried off. The vaults, which are supported by Moorish arches, contain the tombs of the Giron family, by one of whom the church was founded in 1534. The university, which formerly existed at Osuna, was suppressed in 1824; but there is still a college, which is a stately building with a large quadrangle. There are, besides, numerous elementary schools, and several hospitals. In the environs of Osuna, there are many hermitages and public walks. A great number of the inhabitants are engaged in agriculture; but there are also numerous manufactories of iron, earthenware, bricks, oil, hats, linen, &c. Many mats are also made from Spanish broom; and this sort of work employs a large number of the poorer people. Wheat, barley, and beans are exported in large quantities to Seville and Malaga. Pop. 15,508.

OSWEGO, a town of the United States of North America, state of New York, built on both sides of the Oswego River, where it enters Lake Ontario, 35 miles N.N.W. of Syracuse, and 183 N.N.W. of Albany. The river, which is here about 230 yards broad, is crossed by a bridge. The houses and public buildings are handsome; and the streets are straight, broad, and regularly laid out. Oswego has eleven churches, two of which, belonging to the Presbyterians, are remarkable for size and elegance. There are also a court-house, custom-house, two banks, an academy, and other educational institutions. Several newspapers are published in the town. The river, which has falls a short distance above the town, affords water-power for the various manufactories of the place, consisting of ten or twelve large flour-mills, and a starch factory employing about 100 hands. The commerce of Oswego is extensive, and rapidly increasing; its position gives it great advantages for intercourse with Canada, nearly half of the trade of the United States with that country passing through Oswego. The imports from Canada to this port in 1855 amounted in value to more than L.1,250,000; and the whole value of imports and exports in that year was about L.8,000,000. The harbour is one of the best on the United States side of the lake, having a pier 1200 feet in length. On the E. side of the river stands Fort Oswego, built by the government for the protection of the town and harbour. The shipping of the port, enrolled and licensed, had in 1852 a total tonnage of 26,107; and during the year ten ships were built, with a tonnage of 765. In the same year the vessels that entered were 1784, tonnage 240,253; those that cleared were 1731, tonnage 234,625. Pop. (1850) 12,205; (1855) estimated at 16,000.

OSWESTRY, a municipal borough and market-town of England, Shropshire, on the borders of Wales, 20 miles N.W. of Shrewsbury, and 171 miles N.W. by W. of London. It was formerly surrounded by walls, portions of which still remain. Some of the houses are of great antiquity; but the greater number are of modern erection, built chiefly of brick. The streets are clean and well paved. Of the public buildings, the principal are—the church with its high ivy-covered tower, the town-hall, theatre, and small jail. Another church has been recently erected; and there are several dissenting places of worship. Oswestry has several schools, a savings-bank, dispensary, &c. Flannel and coarse linen cloth are manufactured in small quantities; and in the vicinity there are coal mines, and paper and corn mills. Races are held annually in September; and there are several yearly fairs. A considerable retail trade is carried on with the surrounding country. Oswestry is supposed to derive its name (originally *Oswaldstree*) from Oswald, King of Northumbria, who was killed in battle here in 642. It was of great importance in early times, as one of the keys of Wales. On a hill to the west of the town are the remains of a castle, supposed to be as old as the Norman Conquest. Pop. (1851) 4817.

OTAGO. See New Zealand.

OTAHEITE. See Tahiti.

OTHMAN IBN AFFAN, the third of the Moslem caliphs, was a descendant of Abd-al-Menaf, one of Mohammed's ancestors. He first appears prominently in history as one of the secretaries, and the son-in-law of the prophet. The next important event in his life, his appointment to be one of the six commissioners for the election of a successor to the Caliph Omar, was the immediate cause of his elevation to power. The six agreed to choose one out of their own number; their choice fell upon him; and he began his reign in 643. It soon became evident that Othman's vice of favouritism, and his inattention to the wishes of his subjects, were checking the growing prosperity of Mohammedanism. By means of his lieutenants, indeed, he completed the subjugation of Persia, rendered the island of Cyprus tributary, and successfully maintained the Moslem cause against the Greeks. But his civil administration meanwhile was by no means successful. Efficient governors of provinces were recalled in order to give place to his worthless friends; the contents of the public treasury were lavished upon his minions; he had the misfortune to lose the prophet's silver signet-ring, which was considered the palladium of the empire; and he had the indiscretion to beat almost to death Ammar Ibn Jasir, a zealous Moslem, who had denounced his injudicious government. The consequence was, that there was excited in the hearts of his subjects a settled enmity which ultimately led to his ruin. At the end of about twelve years, Medina was invested by a strong force of rebels; delegates with lists of grievances from the misgoverned provinces fanned the flame of insurrection; and the deposition of the caliph was pertinaciously demanded. The suppression of this rebellion by means of concessions only made Othman's inveterate enemies take more insidious and more deadly measures. His treacherous secretary, at the instance of Ayesha, the prophet's wife, despatched to Egypt false letters of state commanding the death of Mohammed, the son of Abubeker. Mohammed, intercepting these letters, vowed vengeance against the caliph, and forthwith repaired to Medina at the head of a determined band of followers. The city was entered without opposition; the palace was taken by storm; and Othman, with the Koran in his bosom, fell beneath the blows of several assassins in 656.

Othman, or *Osman*, the founder of the Ottoman Empire, was born in Bithynia in 1259. He is said to have been the son of Orthogrul, the chief of a pastoral and predatory horde of Turkomans, who had permanently pitched their tents in the territory of the Sultan of Iconium. At any rate, it is certain, that on the death of Masud II., the last of the Seljukian dynasty, he was at the head of the above-

mentioned tribe, and was ready to begin the project of founding a kingdom. Part of Bithynia, a fragment of the dismembered empire of the sultans of Iconium, was immediately seized; a government was established; coins were struck in the city of Cara-Hissar; and on the 27th July 1299 he led his invading forces down through the unguarded passes of Mount Olympus into the territory of Nicæa. The conquest advanced slowly but successfully for the next twenty-seven years. The hardy robber-chief, after repeated incursions, began to gain ground upon the Greeks; captives and volunteers soon swelled the number of his troops; he was then enabled, by means of garrisons, to secure every post as soon as it was taken; the different districts of Bithynia came successively under his power; and the foundation of the Ottoman Empire was completed by the capture of Prusa in 1326. Othman had just time to hear the news before he died, leaving his sceptre to his son Orchan. (See TURKEY.)

OTHO, MARCUS SALVIUS, a Roman emperor, was descended from an ancient Etruscan family, and was born A.D. 32. He was proclaimed emperor in 69; and he stabbed himself in the same year, ninety-five days afterwards. (See ROMAN HISTORY.)

OTHO or *Otto I.*, surnamed *The Great*, Emperor of Germany, was the son of Henry the Fowler, and succeeded his father in the throne in 936. The early part of his reign was occupied in simultaneously extending his power and supporting the cause of the church. In the course of a long series of civil broils his unruly vassals were subdued, and part of their wealth and influence was transferred to the abbeys and convents. He concluded a successful invasion of Denmark by compelling the Danes to become Christians; and he pardoned Boleslaus, the rebel duke of Bohemia, only on condition that all the Bohemians should receive baptism. After he had extended the limits of the kingdom of Germany on every side, Otho turned an ambitious eye towards Italy. An application from Adelaide, the widow of Lotharius, King of the Lombards, for aid against the treasonous usurper Berengarius, furnished him with an opportunity for executing his projects. He defeated Berengarius in 951, married Adelaide, and before departing to his own kingdom, was acknowledged by all the towns of Lombardy as their liege lord. His regular instalment in the sovereignty of the country took place in 961, when he returned flushed with the decisive victory which he had gained over the Hungarians at Augsburg. In that same year he was crowned at Milan with the iron crown of the Longobards; and in the following year he was crowned at Rome as emperor of the West by Pope John XII. Otho now proved that he was not unworthy to be the successor of Charlemagne. He vindicated his temporal jurisdiction over the supreme pontiffs; and, amid much resistance from the Romans, succeeded in establishing the law, that no pope could be chosen without the previous consent of the emperor. He also laid the foundation of municipal government by encouraging the growing spirit and enterprise of the citizens of the great Italian towns. The death of Otho took place in Germany in 973.

OTHO or *Otto II.*, the son of the preceding, was born in 955, and succeeded to the imperial throne on the death of his father in 973. His reign was occupied in maintaining by the sword those dominions which had been bequeathed to him. No sooner had he been crowned, than he was summoned to Germany to suppress the rival claims of his cousin Henry, Duke of Bavaria. After this rebellion had been suppressed, he involved himself in a war with the King of France touching the fief of Lorraine; and it was not until his army had been routed on the banks of the Aisne, and he had been forced to concede part of the disputed territory, that the contest was brought to a close. Then a revolt among the Romans, and the continued occupation of Calabria and Apulia by the Saracens and Greeks, recalled him to Italy, and drove him to take the most sanguinary measures. He entered Rome without opposition; overawed the malcontents; and, enticing the principal movers of the rebellion to a banquet, put them to death in cold blood. His defeat immediately afterwards by the Greeks and Saracens at Bassentello checked his success, but did not divert him from his determined course of action. He struck terror into the hearts of his disaffected subjects by surrendering the treacherous city of Benevento to the pillage of the soldiery. He was also preparing another expedition against the Saracens, when he was cut off in 983, a short time after his son Otho had been declared his successor by an assembly of the states of Italy and Germany.

OTHO or *Otto III.*, the only son of the preceding, was twelve years of age when his father died. During his minority civil broils, both in Italy and Germany, threatened the complete overthrow of good government. Yet, no sooner had he formally assumed the power, than he began to restore and maintain order with vigour and rapidity. In 996 he crossed the Alps at the head of a large army; forced his way into Milan to be crowned with the crown of the Lombards; and was invested with the imperial title by his relative Pope Gregory V. He then, in the following year, hastened northward to stem the incursions of the Slavic hordes of the Elbe and the Oder. The intelligence that a patrician named Crescentius was endeavouring to restore the old Roman republic, had expelled the pope, and had placed in the pontifical chair a Greek, with the title of John XVI., soon recalled him to Italy. Crushing the rebellion with relentless severity, he put the anti-pope to death by slow and savage tortures, and hanged Crescentius from a lofty tree. His next important action was the erection of Poland into a kingdom, on condition that it should be a fief of the empire. After this he undertook a successful campaign against the Saracens of Apulia and Calabria. He was then, in 1002, engaged in contending against a fresh revolt of the Romans, when the widow of Crescentius poisoned him. Otho left no children, and was succeeded by Henry, Duke of Bavaria.

OTHO or *Otto IV.*, the son of Henry the Lion, Duke of Bavaria, was duke of Saxony when in 1197 the Emperor Henry VI. died, leaving his crown to his infant son Frederick. Disregarding the true heir, the Guelphs conferred the imperial title upon Otho; while the Ghibelines conferred it upon Philip, Duke of Suabia. The former now commenced a series of ineffectual struggles to confirm his title. A civil war of eight years ended by placing his rival upon the throne, and by forcing himself to flee to his uncle, King John of England. Even after the assassination of the Emperor Philip had left him in possession of the empire in 1207; and after he had been formally crowned in Rome in 1209, his claims still continued unsettled. By the intrigues of Pope Innocent III., he was soon involved in a war with Frederick, King of the Two Sicilies, and the rightful heir to the imperial crown. The struggle in a short time was transferred from Italy to Germany; and in 1214 the cause of Otho was irretrievably ruined by the French king, Philip Augustus, at the celebrated battle of Bouvines. The remaining years of the degraded emperor were spent in privacy in the exercises of penitential devotion. He died at Brunswick in 1218.

OTHO, or *Otto, of Freysingen*, a celebrated chronicler of the twelfth century, was the son of Leopold, margrave of Austria, and of Agnes, daughter of the Emperor Henry IV. Although born in such a high sphere of society, he descended to the condition of an obscure scholar and a self-denying ecclesiastic. He studied at the universities of Nürnberg and Paris; entered the order of St Bernard in the abbey of Morimond; and in 1136 became abbot. His half-brother, the Emperor Conrad III., removed him to the

see of Freysingen in 1136. The rest of his life, with the exception of an interval during which he accompanied the imperial troops to Palestine, was passed in the assiduous and pious discharge of the duties of his diocese. He died in 1158, while on a visit to his old residence, the Abbey of Morimond. Otho left behind him a Latin chronicle of the world from the creation till his own time. Of the seven books into which it is divided, the first four are a mere selection of passages from Orosius, Eusebius, and others. It was published in fol., Augsburg, 1515. He was also the author of a treatise concerning the end of the world, and a history of the Emperor Frederick Barbarossa, entitled *De Gestis Frederici Ænobarbi Libri Duo*. This latter work is inserted in Muratori's *Rerum Italicarum Scriptores*.

OTLEY, a market-town of England, West Riding of Yorkshire, stands in a beautiful valley, on the right bank of the Wharfe, under Chevin Hill, 25 miles W.S.W. of York, and 205 N.N.W. of London. Though small, it is well built, and contains a large parish church, in the form of a cross, built in 1507, but retaining at present little of its original architecture. Besides this there are places of worship for several other denominations, a free grammar school, and other educational institutions. The chief manufactures of Otley are worsted, paper, and flour. There was formerly a considerable trade in woollen fabrics here, but that has disappeared; and cattle and corn are now the only articles brought to the market. Pop. (1851) 4522.

OTRANTO. See HYDRUNTUM; and SICILIES, *Two*.

OTTAJANO, a town of the kingdom of the Two Sicilies, province of Naples, stands at the N.E. base of Mount Vesuvius, 12 miles E. of Naples. It has a castle standing on an eminence, and three churches. Agriculture is the chief occupation of the inhabitants. Pop. 14,000.

OTTAWA, the recently-constituted capital of Canada, is situated on the right bank of the Ottawa River, 87 miles above its confluence with the St Lawrence, 95 miles N.E. of Kingston, and 126 W. of Montreal. It is divided into two parts by the Rideau Canal, which connects the Ottawa with Lake Ontario. These parts are called the Upper and Lower Town respectively. The canal joins the river by a series of good stone locks, and is crossed by a handsome bridge; but this mode of communication has now become quite insufficient for the increasing traffic. The streets are straight, broad, and regular, and the buildings handsome and uniform. There are six churches, belonging respectively to the Church of Rome, the Church of England, the Established and the Free Church of Scotland, the Wesleyans, and the Episcopal Methodists. There are also several educational, literary, and benevolent institutions. The principal source of the town's importance is the trade in timber, larger quantities of which are exported to Europe and the United States, through Ottawa, from the surrounding country, than from any other part of Canada. The vicinity of the town is remarkable for its grand and beautiful scenery; the falls of Chaudière on the Ottawa being second only, among American cataracts, to those of Niagara. This place was formerly called *Bytown*, but the name was changed in 1854. Pop. about 10,000.

The River Ottawa takes its origin in the interior of Lower Canada, in a series of lakes, which may be considered as mere expansions of the river. About 100 miles from its source it leaves Lake Temiscaming, the last of these; and separating Upper from Lower Canada, flows S.E. and E. until it falls into the St Lawrence at the island of Montreal. Its whole length is about 400 miles; and it is navigable as far as the town of Ottawa. It receives the Rideau from the right, and the Gratineau and Lièvre from the left. The scenery on its banks is of the finest description; but the land is not fertile.

OTTLEY, WILLIAM YOUNG, a critic and collector of paintings and engravings, was born in 1772. The unwearied enthusiasm for the fine arts by which he was distinguished through life soon began to appear. About his twentieth year he proceeded to Italy, and devoted both his time and means to the study of the great painters. Famous pictures were copied, fine engravings were collected, and numerous works of the early masters were purchased. Nor did his industry flag when he had returned to England, at the end of ten years, to turn his collections to some account. Among other splendid and costly works, he published *The Italian School of Design*, in 3 parts, 1808–12–23; and *A Series of Plates engraved after the Paintings of the most Eminent Masters of the Early Florentine School*, fol., 1826. As keeper of the prints in the British Museum he also laboured hard to arrange and classify the engravings in that institution. His death took place in 1836.

OTWAY, THOMAS, one of the foremost names in the English drama, was the only child of the Rev. Humphrey Otway, rector of Wolbeding in Sussex, and was born at Trottin, in the same county, on the 3d of March 1651. Passing from Winchester school, where he received his early education, he entered Christ Church, Oxford, as a commoner, in 1669. Little is known respecting his university career. He was not remarkable, however, for diligence in study, and seems to have cultivated society more than letters. He was intended for the church; but the death of his father, who left him no other inheritance, he tells us, but that of "faith and loyalty," compelled him to leave college without taking his degree. In these circumstances, he set out for London to push his fortune, without any more definite aim before him. For a needy youth of twenty, fond of pleasure and full of poetry, the metropolis was at that time anything but a paradise. Inclination drew him to the theatre, and necessity induced him to turn actor. He appeared on the stage for the first and last time in 1672, in the character of the "King" in Mrs Behn's drama of the *Forced Marriage*, at Sir William Davenant's theatre in Dorset Garden, Salisbury Court. "But he being not used to the stage," says Downes, "the full house put him to such a sweat and tremendous agony, being dash't, spoilt him for an actor." (*Roscius Anglicanus*, p. 43, 1789.) This was not encouraging for young Otway; but had not Shakspeare and Ben Jonson failed before him in the player's art? and why should not he succeed, like them, in writing dramas, if he could not act them? It took Otway three years to give a practical solution to this problem. Meanwhile he ran after rank and courted fashion, his gay wit and jovial disposition gaining him ready access to the society of the great. The witty and profligate John Wilmot, Earl of Rochester, the chosen patron of nearly all the vices, was likewise the patron of "Tom Otway;" and the ardent adventurer followed his chief into the wildest of his excesses. Sated for a time with the dissipation into which he was led, and perhaps tired of hanging by the skirts of dissolute men of fashion, he directed his attention to dramatic composition. His tragedy of *Alcibiades*, the first and the poorest of his productions, appeared in 1675, when Otway was in his twenty-fourth year, and met with some success. It was not borrowed from the French, as Johnson surmises (*Lives of the British Poets*); but it was written in rhyme, according to the absurd custom then much in vogue; and neither in sentiment nor in language did it give any promise of future eminence. His *Don Carlos* of the next year was a decided advance on his first attempt; but the extraordinary popularity to which it attained was owing more to adventitious circumstances than to the inherent excellence of the performance. Rochester was fond of playing the tyrant in literature; and having quarrelled with Dryden, who was too strong a man to submit to such despotism, his lordship, after various despicable attempts to ruin the fame of his rival, selected Otway as the most respectable antagonist he could find to pit against

Otway.

the sturdy laureate. Heralded by so great a name, *Don Carlos* became "the first heroic play of the age;" and, as the honest prompter tells us, "being admirably acted, it lasted successively ten days: it got more money than any preceding modern tragedy." (*Roscius Anglic.*, p. 46.) Dryden, as might be expected, had not the greatest reverence for the Prince of Spain; yet it says much for his candour, that, despite his animosity towards his young antagonist, he confessed that Otway had a power of "moving the passions" which he himself did not possess. Otway, meanwhile, in the flush of his sudden triumph, turned a satirical shaft against the laureate, and allied himself with Shadwell, the well-known "MacFlecknoe" of Dryden's famous satire. Otway's next contribution to the stage consisted of a tragedy and a farce, both translated from the French,—*Titus and Berenice* from Racine, and *The Cheats of Scapin* from Molière. These pieces were performed together at Sir William Davenant's theatre in 1677, and had good success. During the same year Otway made bold to pay court to the comic muse in his *Friendship in Fashion.* Apart from other defects, it was a very immoral play; considered "very diverting" by the play-goers of the time; but hissed off the stage in 1749 for its indecency. (See Langbaine's *English Dram. Poets.*) It was obvious enough that the author was not qualified to shine in the comic drama.

In 1677 Otway exchanged the pen for the sword, having received a cornet's commission, through the Earl of Plymouth, the king's natural son, in a new regiment of horse destined for Flanders. Here again fortune played him false. The troops to which he belonged were soon after disbanded: the money designed for their pay was diverted to other purposes; and the unfortunate soldier had to be content with debentures at a very low credit. Otway returned, therefore, to his muse again, in a state of deplorable indigence and distress. Rochester was no longer his friend. That brilliant libertine made the unfortunate poet the butt of his malicious wit in a lampoon called *A Session of the Poets.* Otway had committed the mortal offence of presuming to rival his lordship in an attachment to Mrs Barry, a famous actress of the day, who never failed to draw tears from her audience in her representations of Otway's "Monimia" and "Belvidera." The poor poet's affection for this woman was tender, passionate, and enduring; and although unrequited, his letters to her display a pathos and eloquence not inferior to the finest passages in his tragedies. In 1680 he produced his tragedy of *Caius Marius*, in great part avowedly transferred from Shakspeare's *Romeo and Juliet.* The author had now ranged himself on the side of Dryden and the Tories; and he contrived in this play, as well as in *The Poet's Complaint to his Muse*, published the same year, to expose the violences of the opposite party. The promise which Otway had early given of rare pathetic power was fully confirmed in his *Orphan*, founded on a popular novel of the day, and represented in 1680. It is a domestic tragedy, drawn from middle life, not possessing great elegance or splendour of diction, but with a power of moving the heart unknown to any tragedy of that time. "This is one of the few plays," says Johnson, "that keep possession of the stage." Passing over his comedy of *The Soldier's Fortune*, acted in 1681, and its second part, called *The Atheist*, printed in 1684, both as poor as they were popular, we come to Otway's greatest performance. He was constrained to keep toiling for his daily bread; and this necessity tended to expand his genius and mature his powers. In *Venice Preserved* he had larger scope for variety and contrast of character, and a more elevated sphere for the display of his peculiar genius, than he had found in his *Orphan.* In strength of imagery and force of expression he had made a decided advance, but his former faults were still observable. As before, this play is deficient in fire and high imaginative power; it is sometimes false in sentiment, and often poor in poetry; but it possesses a power of melting quite unsurpassed in the English drama. "Nature is there," said Dryden, "which is the greatest beauty;" and Johnson has re-echoed the judgment. Addison says of him (*Spectator*, vol. i., No. 39) that he "shines in the passionate parts more than any of our English poets;" and Goldsmith, a little forgetful, perhaps, of the merits of some of our earlier dramatists, says that Otway was, "next to Shakspeare, the greatest genius England ever produced in tragedy" (*The Bee*, No. 7). "Gentlest Otway," as Collins sings of him, is certainly, with all his faults, the most pathetic of our dramatists. Time was gradually maturing his genius; and he was just emerging from the bewildering fevers of youth into clear poetic activity, when his unhappy career was brought to a close. Having retired from the importunate demands of his creditors to an obscure ale-house on Tower Hill, he was seized with a fever, occasioned by the violent pursuit of an assassin who had murdered one of his friends in the streets of London. This cut him off on the 14th of April 1685, at the premature age of thirty-four. The current story of Otway's having been choked by a crust of bread, which he eagerly swallowed when suffering from hunger, does not seem to be well founded (For further details respecting Otway's life, see the biography, prefixed to the best edition of his works, by Thomas Thornton, 3 vols., London, 1813.) Otway's minor poems do not possess very great merit.

At the time of his death Otway had completed four acts of a new tragedy, said to have been purchased by Bentley, his publisher. An advertisement for the recovery of the missing MS. appeared in L'Estrange's *Observator* for 27th November and 4th December 1686, but to no purpose. (J. D—S.)

Oude.

Extent and boundaries.

OUDE, or more properly OUDH, a compact and important province of Hindustan, lies between N. Lat. 25. 34. and 29. 6., and E. Long. 79. 45. and 83. 11., and is now about 270 miles in length from N.W. to S.E., and 160 in breadth. The area is computed at 23,738 square miles, by Thornton; but Butter makes it 23,923, and by some it is raised to 25,000. Exact statistics, however, of the province in this or other particulars are not yet procurable. It is bounded on the N. and N.E. by Nepaul, on the N.W. by Rohilkhand (Rohilcund), on all other quarters by provinces which have at various times been wrested from it by the English,—viz., on the E. by Gorakhpúr (Goruckpore), on the S.E. by 'Azímgarh (Azimgurh) and Jaunpúr, on the S. by Allahabad, and on the S.W. by Fathpúr (Futtehpoor), Kánhpúr (Cawnpoor), and Farrukhábád (Furrukhabad), districts of the Doab.

General aspect of the country.

The general aspect of the country is that of a fertile plain, being, in fact, a continuation of that immense level valley which extends in a curved line from the sources of the Western Banás River, in E. Long. 73. 28., to the junction of the Ganges and the Brahmapootra, in E. Long. 90., a distance of 1100 miles. Along the eastern frontier, from a few miles north[1] of Bahraich, begins the great Taráí Forest—marshy, and in some places almost impassable, but nevertheless studded with the strongholds of the great baronial landholders, as the Raja of Tulsípúr. The plain of Oudh slopes gently at the rate of about 7 inches in the mile to the E.S.E. The only irregularities on its surface are caused by the greater or less resistance of its soil to the rivers which traverse the province, and of which the five principal are the Ganges, Saí, Ghúmtí, Deohá, and Raptí. The courses of these streams are almost parallel, and the order in which they are here named is the order of their succession from W. to E. The Ganges then forms the

[1] Sleeman's *Journey*, vol. i., p. 36.

Oude. western boundary of Oudh; the Saí, which comes next, unites with a western branch called the Lon, a little above Râe Barelí, and falls itself into the Ghúmtí in about N. Lat. 25. 30. The Ghúmtí is the river which washes Lucknow (Lakhnau), and passes through the centre of the province of Oudh. Faizábád, the ancient capital of Oudh, is situated on the Deohâ, which has two other names, the Sarjú and the Ghágrâ; and to the E. of this, and on the extreme E. of the province, is the Raptí, also called the Airavatí. These rivers are the principal cause of the great fertility of Oudh; but it is remarkable that they are decreasing in volume in a way which may well lead to grave apprehensions. Everywhere the wave-worn marks on the banks, much above the highest level to which the waters now attain, attest the decrease which is going on. It is a historical fact, that in 1773 Sir Robert Barker's brigade sailed *over* the famous stone bridge at Jaunpúr; and within the last fifty years the Ghúmtí has fallen 5 or 6 feet. Were the great tracts of jungle, which with provident care have been fostered by the Oudh government, to disappear, it cannot be doubted that the rivers would be still farther diminished by the cutting off of all the small streamlets, which are at present nourished by the moisture collected on the leaves of the forests, and which serve as feeders to the principal streams. The vast quantity, also, of sand and dust which during the hot season is brought by the westerly winds, would, but for the jungles, gradually overlay the country, and turn what are now expanses of verdure into dry deserts. Even now the old inhabitants of the country assert that the deposit brought by the *lúk* or hot wind is greater, and the heat of the wind itself fiercer, than in former times; and this may well be the case, from the extensive clearance of jungle which has everywhere taken place in the adjacent British districts. European observers record the fact, that it is now requisite to dig wells deeper than in times within the memory of man; and that the annual fall of rain, though extremely irregular, is upon the whole gradually diminishing.

Soil. The soil of Oudh is the finest in India;[1] and from the numerous rivers which flow through the country, the water is everywhere near the surface. Sleeman conjectures[2] that the whole province once formed part of the bed of a lake which contained a vast fund of soluble salts (nitrates of ammonia), which, combining with magnesia, lime, soda, potash, alumina, and oxide of iron, form double salts, become soluble in water, and are fit food for plants, to the growth and perfection of which they are all more or less conducive. According to the distribution of these salts, the soil may be divided for agricultural purposes into *matiyár*, *domatiya*, *bhúr*, and *úsar*. Of these, *matiyár*[3] is a rich clay soil, mixed with a small proportion of sand, or one-tenth of silex; the rest alluvial mould. It differs from the *domatiya* in containing a greater proportion of those elements which constitute what are called good clay soils. It is more capable of absorbing and retaining moisture, and of fixing ammonia, than the *domatiya*, of a darker colour, and forms more into clods. The *domatiya* is of a light-brown colour, soon powders into fine dust, and requires much more outlay in manure and labour. It has a considerable admixture of sand, and in some places about $\frac{1}{10}$th of lime. The *bhúr* consists of $\frac{7}{10}$ths of sand and the rest clay; and being not retentive of moisture, is far less productive than the two classes of soil above mentioned. Lastly, the *úsar* lands, having a superabundance of salts, are more or less unfit for cultivation; but in general, if flooded with rain-water for two or three seasons by means of artificial embankments, and then well watered, manured, and ploughed, will bear tolerable crops. From the worst *úsar* soils common salt or saltpetre, or both, are made by washing the earth, and removing the water by evaporation. The most important feature in the soil of Oudh is the abundance of *kankar*, nodules formed of the elements of chalk and oolite, which opposes such resistance to the rivers as to keep them in permanent banks, thereby insuring a perfect drainage of the country; and when an exit is once established from a hollow, the channel gradually deepens until the hollow is perfectly drained. In patches of ground where *kankar* largely predominates, are found the only irregularities of surface noticeable in Oudh. Ridges are thus formed 70 or 80 feet above the surrounding country, the less coherent materials of whose soil has, in the course of ages, been swept away by the agency of wind and water. Hence, too, the channels of the rivers have gradually deepened, so that the surface of the water is never less than 20 feet below the level of the bank, and in many places as much as 80. The Ghúmtí is intersected at every 4 or 6 miles by *kankar* ridges of 2 or 3 yards in width, which, in the dry season, sometimes diminish the depth of water to 2 feet. The right bank of this stream from Pálí to Sultánpúr, a direct distance of 40 miles, but nearly double as much if the windings of the river are followed, consists of solid *kankar*, and resembles in miniature the mountain ranges on the right bank of the Jumna and Ganges. The left bank is low and sandy, and these remarks apply also to the Deohâ: but in both cases the stream sets against the high bank, and has therefore no tendency to spread. Oude.

Rivers and marshes. The principal rivers have been already named in describing the configuration of the country, and the effect of the tenacious *kankar* upon their streams has been noticed. The next remarkable point regarding them is the singular multiplicity of their windings, from which feature, indeed, the Ghúmtí derives its name. The water of this latter stream becomes unfit for drinking during the rainy season, owing to the immense quantity of yellow clay with which it is loaded. When epidemics prevail at Lucknow, or generally along its banks, a putrid scum forms on the surface of this river, owing to the multitudes of dead bodies which are thrown into it. Yet it abounds in fish; and thus supplies one-fifth of the population with a considerable portion of their diet,[4] especially during the rains. The Ghúmtí has a total course of 482 miles, rising in the district of Shahjehanpore, in N. Lat. 28. 35., and falling into the Ganges in N. Lat. 25. 29. It enters the territory of Oudh about 96 miles from its source, and after a course of 250 miles, crosses the frontier into the British district of Jaunpúr. During the rainy season boats of 4 or 5 tons weight can go up to Lucknow, but all supply-boats return from that city empty. The Ganges and Derhâ are usually open at all seasons for the largest class of boats. Their annual rise is about 30 feet, their courses are comparatively straight, and their currents proportionally rapid during the freshes. The Ganges has a low bed, 4 miles in average width, within the limits of which it changes its course annually. The Deohâ or Ghágrâ has its latter name from a Sanscrit root which signifies "to gurgle," and is a considerable river, equal, indeed, in volume and rapidity to that part of the Ganges which runs parallel to it. Its total course is 606 miles from its source in Kumaon, in N. Lat. 30. 28., to N. Lat. 25. 46., where it falls into the Ganges. At 181 miles from the point where it rises it first touches the Oudh territory, which it continues to bound for a distance of 316 miles. The Saí is, in the rains, navigable for boats of a ton or a ton and a half as far as Râe Barelí, above which point there is no trade carried on. This river winds exceedingly, and the route by the Ganges or Ghúmtí is therefore preferable. At Râe Barelí the Saí is as broad as the Ghúmtí, but only half the depth. It abounds in fish,

[1] Sleeman's *Journey*, vol. i., p. 64.
[2] Ibid., vol. i., pp. 224, 225.
[3] Wilson's *Glossary*, p. 335; Sleeman's *Journey*, vol. i., p. 226.
[4] Butter's *Topography of the Southern Districts of Oudh*, p. 12.

Oude. of which all classes partake, even the Brahmins, except those that are pundits. The Tons, Teons, Marhá, or Bisohí, is a branch of the Deohá, which it leaves 5 miles above Faizábád; and after uniting with the Little Tarjú, runs into the Ganges 10 miles below Buxar. A cross branch, the Khajuhá Tál, 15 miles below Faizábád, again unites the Tons with the Deohá; and during the dry season is embanked at different points for irrigatory purposes. This has a most prejudicial effect on the climate, however beneficial it may be in another point of view. The Tons is not navigated above 'Azímgarh. The Son rises near Sháhábád, and running midway between the Ganges and the Saí, falls into the latter about 3 miles above Ráe Barelí. During the rains it is a considerable torrent, but at no time navigable.

There are no large permanent lakes in Oudh, but in the rains large *jhils* or collections of water, shallow but extensive, are formed, and, in the hot weather, dry up or are drained off by the water-courses. The largest of these is situated 8 miles N.W. of Mánikpúr, in the deserted bed of the Ganges, and is 16 miles long and 8 broad. The town of Betáganw, at its N.W. extremity, is the most unhealthy spot in Oudh, owing to this vast marsh, and the neighbourhood is infested with mosquitoes to an intolerable degree. It always contains water, and much rice is planted along it towards the end of March.

Climate. The climate of Oudh, more especially of the southern portion, is chiefly characterized by its dryness. Being beyond the equalizing influences of the sea-breeze, it is marked by extremes of heat and cold, the temperature at one time rising to 112°, and at another sinking to 28°. The mean daily range is 30°, and the mean temperature 74°. The annual fall of rain is very irregular, varying from 70 to 30 inches, and extending over a period of from four to two months. The gradual diminution in the quantity of rain is remarked by all the inhabitants of Oudh, and in places where grass formerly grew tall enough for thatch, it now scarce supplies pasturage for animals. Hoar-frost used to happen once in every ten or fifteen years; but within the last half century the recurrence of it has become much more frequent, and is now almost annual. West winds blow about 200 days in the year, and east winds during the remainder. The former winds are dry, and cold, or intensely hot, according to the season of the year, and loaded with fine sand. The easterly winds are damp, and bring with them the malaria of Bengal and Assam. During the hot weather the air is so loaded with particles of dust or sand as to curtail the view, and give a grayish aspect to the sky. But towards the end of the rains the atmosphere becomes highly transparent, and the Himálaya Mountains are seen at a distance of 200 miles. The sky is then of the brightest blue, and the phenomenon of converging rays in the quarter opposite to the rising or setting sun is not unfrequently seen in great perfection. The cold season extends over November, December, January, and February, and few climates then equal that of Oudh. Throughout these four months the nights are cold; and in January the cold is sometimes so great that thin ice is formed on shallow pools of water. By filling shallow vessels with water, and protecting them from the heat of the earth, and the warmer strata of air, ice is easily obtained during this and the following month. Fires are required during part of December, and in January and February, and during this period the fruits and vegetables of Europe are produced in great perfection. The hot weather begins with March, but the mornings are pleasantly cool till the middle of May. The hot winds usually commence in April, but in general abate towards sunset, so as to admit of riding or driving without discomfort. Sometimes sudden storms occur at this season from the north-west, which are attended with phenomena terrifically grand. An immense gloomy arch of clouds is formed, which assumes the appearance of a gigantic wave about to break over the earth. The sun gives to the summit of this wave a reddish-brown colour, and a rolling motion is observed in it like the smoke of artillery. When the storm is about a mile distant, a dead stillness prevails. As it approaches, eddies of wind toss leaves and branches on high, and the temperature falls twenty or thirty degrees. A continued roll of thunder has been heard from the commencement of the storm. This is now suddenly mixed with the rushing sound of the tempest, and so thick is the dust that all nature is shrouded in pitchy darkness. The fury of the wind is so great that trees are torn up, buildings demolished, and in spring-harvest the produce of whole fields is swept away. Occasionally hail falls in globules an inch in diameter, destroying tiled roofs, and stripping the trees of their leaves and branches. Sometimes neither rain nor hail falls, but in all cases the air is cooled and purified. The lightning is terrific, and but too often fatal to life. At the height of the hot season, and during the hot winds, which are called by the natives *lúh*, travellers fall dead from the heat.

The rainy season commences generally about the 15th of June, and lasts till the middle of October. The first fall is very violent, often from 8 to 10 inches in forty-eight hours, and is accompanied by strong winds which bring down the frail tenements of the natives in every direction. As the rains become sparse and uncertain in September, there is considerable insalubrity owing to the rapid exsiccation of the water-courses and marshes. October is hot and unhealthy, and the sun is not to be encountered with impunity till the beginning of November, when, as has been said, the temperature cools, and the climate becomes one of the most delightful known to man.

Zoology. In the great forests of the Taráí, elephants, tigers, and rhinoceroses are very numerous, and very destructive to human life. The tiger is also found in different jungles throughout Oudh; and the kings of Oudh have in general taken great interest in hunting that animal. Wolves are beyond measure numerous and daring, and destroy scores of children every year. A full-grown wolf stands ten hands in height, and will singly attack and kill a strong man. The natives have a superstition against spilling the blood of these animals, and say that the family of the wolf-slayer is certain to become childless; "a village community within the boundary of whose lands a drop of wolf's blood has fallen believes itself doomed to destruction." The lowest class of natives, who correspond to the gipsies of the West, seldom catch wolves, though they know their dens, and could easily dig them out, as they do other animals. It is supposed that they abstain from destroying wolves on account of the profit they make from the gold and silver bracelets, and other ornaments, worn by children who are devoured by these animals. The ornaments are frequently found at the entrance of the dens, and the people referred to are in the habit of searching for them. Sir W. Sleeman[1] records some surprising but well-authenticated stories of infants carried off and nurtured by the wolves. In particular, he mentions the case of a boy who was captured in the den of a wolf near Chandúr, and whose habits were entirely those of a wild beast. He lived three years after his capture, and was in the charge of Captain Nicholetts, the European officer commanding the 1st regiment of Oudh local infantry at Latampúr. He died in August 1850; was never known to laugh or smile; and only spoke once, when he asked for water a few minutes before his death.

Other wild animals are—the hyæna, jackal, wild hog,

[1] Vol. i., pp. 208, 211, 214, 215; ii., p. 60.

Oude.

nilgae, antelope, wild cat, porcupine, fox, hare, otter, mongoose, squirrel, rat, musk-rat, mouse, and flying-fox. The wild buffalo is found in the high j'hau jungle which clothes the banks of the Ganges in Bainswârá, and in a few of the large forests in the interior. The birds are—the adjutant, crane, partridge, quail, vulture, hawk, kite, crow, raven, jay, parrot (excessively numerous and destructive to crops), paddy-bird, maina, swallow, sparrow, dove, cuckoo, lark, kingfisher (many splendid species), wild goose, wild duck, woodpecker, and a species of Cinnyris, similar to the humming-bird of America. There is a great variety of fish. Porpoises are seen in the Ghúmtí only during the rains. Two species of crocodiles are found in the Ganges and Deohá at all seasons, but venture into the smaller rivers only in the rains. Snakes and lizards abound; the most venomous are the cobra and *karait*. Scorpions, centipedes, locusts, the sand-fly, eye-fly, and white ants, are among the most troublesome of the crustaceous and insect classes. The cochineal insect is sometimes seen on the prickly pear bush.

Domestic animals are numerous. Large flocks of sheep and goats are bred for the supply of the surrounding provinces. The price of a sheep is from 9d. to 1s. A milch goat sells for 2s., and one out of milk at from 10d. to 1s. Bullocks are exported at from L.1 to L.2 the pair, which is the common price in Oudh. A she-buffalo or two, or a cow or two, are kept by almost every person of substance, whether villager or townsman.

Natural produce.

The chief crops are,—the *Sinapis dichotoma*, *Cicer arietinum*, wheat, barley, beans, linseed, safflower, *Paspalum frumentaceum*, *Cynosurus corocanus*, millet, cotton, maize, *Holcus sorgum*, *Holcus spicatus*, *Phaseolus maximus*, *Cytisus cajan*, sesamum, and rice; which are reaped in the order in which they are now mentioned, beginning with the end of February. Sugar-cane is grown in small patches here and there, particularly between the Saí and Ganges, but there is but little sugar made. The same is the case with indigo; and though many districts, particularly about Faizábád, are most favourable to the poppy, the production of opium is comparatively small. Dr Butter, however, expresses an opinion, that the time is not far distant when the growth of opium will constitute one of the principal sources of the revenues of Oudh. The cotton produced in Oudh is nearly the same in quality as that of Bandalkhand, but is not so long in the staple, nor so soft. The rice of Oudh is described in the Institutes of Akbar as incomparable for whiteness, delicacy, perfume, and digestiveness.

Oudh has long been renowned for its groves of fruit trees, in the vicinity of which is excellent pasturage. The principal trees are—the mango, tamarind, banyan, *pípal* or *Ficus religiosa*, and the *mahúá* or *Bassia latifolia*, the flowers of which are sweet, and yield by distillation a spirituous liquor. The nuts also of this tree are valuable, as producing an oil which is used instead of butter. In the district of Bainswârá, and near Faizábád, forming a marked exception to the rest of Oudh with respect to the decay of arboriculture, extensive plantations have been lately made, chiefly of the *mahúá*, but in less proportion of the mango, the *Ficus glomerata*, the *Eugenia jambolana*, the *Melia Azadirachta*, the jack-tree, the *Artocarpus lacucha*, and *Phyllanthus emblica*. The *mahúá*, the *Eugenia jambolana*, mango, and *Melia Azadirachta* are the only trees fit for building. The *Cedrela Toona*, which furnishes a yellow dye, the *Ficus venosa*, and the bamboo, are also common in many parts of Oudh. The bamboo, however, will not grow in high *kankar* soils.

Territorial divisions.

The territory of Oudh, which in 1775 was among the largest and wealthiest provinces in India, extending from Mirzapúr, in 25. N. Lat., on the S., to Haridwár, in 30. N. Lat., on the N., and from Kánhpúr (Cawnpore) on the W. to Nepal on the E., now comprises but twelve *chaklás* or counties, and is shrunk to one-third of its former size. The *chaklás* are, beginning from the S.W. and S., and proceeding to the N.E. and N.,—1. Ahládganj; 2. Pratápgarh; 3. Sultánpúr; 4. Aldemau; 5. Salon; 6. Bainswárá; 7. Pachhamrát; 8. Lakhnau; 9. Rasúlábád; 10. Khairábád; 11. Gondá-Bahráich; 12. Sándí. The *chaklás* are again subdivided into *parganahs* or districts, sometimes compared to our baronies.

Chief towns.

The principal cities in the twelve *chaklás* are the following:—Mánikpúr, in Ahládganj, is a decayed city, once the capital of a principality, which extended over a large portion of Southern Oudh. It is situated on the left bank of the Ganges, along which it extends for upwards of a mile. The population is now about 10,000, of whom one-half are Muslims. The fort on the bank of the river, now in ruins, but once strong, extensive, and built of brick hardened by fire, resembles that of Allâhábád. Pratápgarh, or Belhághát, 2 miles W. of the Saí River, is the chief city in the *chaklá* of Pratápgarh. The population is about the same as that of Mánikpúr. It is surrounded with a decayed wall of sun-dried bricks, and on its western side is a ruinous citadel of the same material. Until 1834 there was a cantonment for a Company's regiment, with two guns, 3 miles to the N.E. of the town, in an extremely healthy spot. Sultánpúr, the capital of the *chaklá* so called, in N. Lat. 26. 16., E. Long. 82. 8., is a ruined city, about a mile from the eastern bank of the Ghúmtí River, 92 miles S.E. of Lakhnau. The inhabitants do not number 2000, and are nearly all Muslims. The town is built on the site of the capital of an aboriginal people called Bhars, now extinct, but whose possessions once extended to Allâhábád, Banáras, Faizábád, and almost to Lakhnau. Their capital, called Kasbháwanpúr, was 8 miles in circumference; and having been taken through a stratagem by Sultán Bádsháh Kaikubád, of the dynasty of Ghaur, between the years 1286 and 1289 A.D., he razed it to the ground, and built a new city,[1] which he named after himself. Some remains of the Bhar city are said to exist in the mound called Majhárgánw, in the middle of the city, and two wells at its southern verge. On the summit of the mound, which is formed of the debris of the palace of the Bhars, is a fort built by Kaikubád. Tándá is the most thriving town in the *chaklá* of Aldemau, being the seat of the chief cloth manufactories in Oudh. The population is about 6000, of whom the greater portion are weavers. The town stands about a mile from the western bank of the Ghágrá River. Ranjítpúruá is the capital of Bainswárá, and has a population of nearly 60,000, of whom one-third are Muslims. There is a fort of unburnt bricks, and two or three of the King of Oudh's regiments were always quartered in this city. Cutlery is the chief manufacture. Ráe Barelí, in Bainswárá, one of the most healthy spots in Oudh, was once a city of upwards of 50,000 inhabitants, but this population has now dwindled to 8000. Extensive manufactories of cloth once existed here. The fort is of solid masonry, a mile in circumference, with a dry ditch 50 feet wide and 25 feet deep. The walls are 8 feet thick, 50 feet high on the outside, and 25 feet inside, and have 24 bastions. The description just given applies also to the fort of Dalamau, which is an ancient city of Bainswárá, having a population of 10,000, on the eastern bank of the Ganges, about 40 miles to the N.W. of Mánikpúr. Salon, which gives its name to the *chaklá* so called, is a town with 2000 inhabitants, 3 miles to the W. of the Saí River. It originally belonged to Kánhpúríya (or, according to Sleeman, Kumpureya[2]) rájpúts; but they were dislodged for rebellion, by the núwáb Asifu'd-daulah, who granted the town and its attached lands to a fakir named Miyán Pír 'Atá, for the perpetual support of a religious eleemosynary establishment.

[1] Sleeman's account differs, see below, under "Inhabitants."

[2] Sleeman's *Journal*, vol. i., p. 247.

Oude.

The revenue is about 42,000 rupees a year, of which 30,000 are expended by Sháh-panáh 'Atá, the descendant of Pír 'Atá, in alms to Hindú and Muslim itinerant mendicants. Tiloí, in the same *chaklá*, is a town 55 miles S.E. of Lakhnau, with a population of 10,000. It is remarkable as the residence of a chief who is the lineal representative of the ancient kings of Oudh, a family which dates perhaps thirty centuries back. In the *chaklá* of Lakhnau (Lucknow), besides the capital of Oudh, which, before the late troubles, contained a population of perhaps half a million (stated by Heber[1] at 300,000), there are no towns of great note. In Pachhamrát is the city of Faizábád; and adjoining it, on the east side, the remains of the renowned and world-old city of Awadh, or Ayodhya (from *a*, "not," and *yudh*, "to make war,"—"the inexpugnable" in Sanskrit), the capital of the divine Rámah. There are still 8000 inhabitants in this most ancient city; and houses extending along the River Ghágrá or Sarjú, connect it with Faizábád. Sa'ádat'Alí, the first núwáb of Oudh, made Faizábád his residence, and built a palace there in the year A.D. 1730. His successors, Saffdar Jang and Shujá'u'd-Daulah, further embellished the city; but when the latter acquired Rohilkhand, he removed the seat of his government to Lakhnau. This was in 1775, and the population of Faizábád from that time began to decrease, but is still 100,000, of whom about one-tenth are Muslims. The chief manufactures are cloth, metal vessels, and arms. The Hindús call the city *Banglá*, which signifies "residence," and *Ayodhya*, which latter appellation properly belongs to the ruined city adjoining Faizábád on the E., as above mentioned. Rasulábád and Miyánganj, the two chief towns of the *chaklá* called after them, are situated 3 miles from each other, and about 30 miles to the W. of Lakhnau. Miyánganj was built by the famous eunuch Miyán Almás 'Alí Khán, minister of Sa'ádat 'Alí II., and, according to Sleeman, "the greatest and best man of any note that Oudh has produced."[2] On being visited by Sa'ádat Alí at this place, he built up a throne of a million of rupees, and after the núwáb had taken his seat upon it presented it to his highness. Almás built here a large fort with eight circular bastions, surrounded at 500 feet distance by a mud fortification with great Gothic gateways. The whole intervening space was planted with mango trees, of which there were magnificent avenues in Heber's time. The *chaklá* of Khairábád contains several large and populous towns. Of these, Khairábád, from which the *chaklá* has its name, is distant from Lakhnau 62 miles N.W., and lies in N. Lat. 27. 32., E. Long. 80. 49. Tieffenthaler speaks of it eighty years ago as populous, and situated in a plain abounding in fruit trees, the cultivation of which yielded L.120,000 annually. Six miles to the N.W. of this stands Sítápúr, where the 41st Bengal Native Infantry mutinied and murdered all Christian and other Europeans. Sandílá is a large and populous town,[3] 30 miles N.W. of Lakhnau, with many good houses of burnt brick and cement. Thirteen miles N.W. of this is Hatyá Haran, which is held sacred as the spot where Rámah purified himself from the sin of having killed a Bráhman in the person of Rávan, King of Ceylon. Misrik, a few miles from Hatyá Haran, is another very holy place, and celebrated as the residence of the sage Dadhích, with the bone of whose leg the gods defeated the Titans. Bilgirám is a place once considerable, and remarkable as the spot first fixed upon as the British advanced post, which was subsequently withdrawn to Kánhpúr (Cawnpore). Heber saw here the ruins of officers' houses, and what were once bells of arms.[4]

Bahráich, the chief town in Gonda-Bahráich, situated about 2 miles to the E. of the Sahti, an eastern branch of the Sarjú River, is celebrated as containing the shrine of Saiyid Sálár, who was killed in the beginning of the eleventh century, when fighting against the Hindús in the army of his maternal uncle, Mahmúd of Ghazní. It is remarkable that Hindús as well as Muslims make offerings at his shrine. The river here is a beautiful clear stream, winding as through a park. In many of the villages around the people are afflicted with the goitre. The Tarái Forest begins a few miles to the N. Bahráich has been a very populous town, but has greatly declined, and no part of Oudh has suffered so much from lawless violence as the districts surrounding it. Sándí, which gives its name to the *chaklá* so called, is stated by Heber to be a poor little village.[5] It is, however, remarkable for the noble mango groves that surround it, and for a fine lake on the south side, abounding in fish and covered with wild-fowl. The River Ghárá flows under the town to the north.[6] Near it is a very holy place called Brahmávast, situated on the lake to the south. The principal town in the *chaklá* is Sháhábád, which is a very large and ancient city, though Tennant in 1799 spoke of it as an expanse of ruins. But both Heber and Sleeman speak of it as populous; and the latter says it is inhabited by Patháns, who are a very turbulent race. The approach to the town is beautiful, from the rich crops which cover the ground up to the houses, and the fine groves and majestic single trees which surround it.

Inhabitants.

Though the extreme antiquity of the city of Awadh or Oudh, called in Sanskrit, Ayodhya, and the legend of the Rájpút princes, such as Rámah, who reigned there, appear to be incontrovertible evidence that the Aryan race bore sway in Oudh from a very remote period, there is proof as irrefragable that still earlier aboriginal tribes preceded the Aryan race in the possession of the country, and attained many centuries back to some degree of civilization. The following passage from Sleeman's *Journal*,[7] refers to one of the most important of these aboriginal tribes, called Bhars, and into it is compressed almost all that is known regarding them:—"Passed over some more sites of Bhar towns. The Oudh territory abounds with these sites, but nothing seems to be known of the history of the people to whom they belonged. They seem to have been systematically extirpated by the Mohammedan conquerors in the early part of the fourteenth century. All their towns seem to have been built of burnt brick, while none of the towns of the present day are so. There are numerous wells still in use, which were formed by them of the finest burnt brick and cement; and the people tell me that others of the same kind are frequently discovered in ploughing over fields. I have heard of no arms, coins, or utensils peculiar to them having been discovered, though copper *sanads*, or deeds of grant from the rajahs of Kanoj, to other people in Oudh, 600 years ago, have been found. The Bhars must have formed town and village communities in this country at a very remote period, and have been a civilized people, though they have not left a name, date, or legend, inscribed upon any monument. Brick ruins of forts, houses, and wells, are the only relics to be found of these people. Some few of the caste are still found in the humblest grade of society, as cultivators, police-officers, &c., in Oudh and other districts north of the Ganges. Up to the end of the thirteenth century their sovereignty certainly extended over what are now called the Bainswárá and Bansda districts; and Sultánpúr, under some other name, appears to have been their capital. It was taken and destroyed early in the fourteenth century by Alláhu'd-Dín, Sultán of Delhi, or by one of his generals, and named Sultánpúr. Chándúr was another great town of these Bhars. I am not aware of any temples having been found to indicate their creed."

Another aboriginal tribe are the *Pásís* (Pausies) of whom there are supposed to be about 100,000 families in Oudh. They are employed as village watchmen, but, with few exceptions, are thieves and robbers by hereditary profession, and many of them adopt poisoning as a trade. They form the worst part of the gangs of refractory chiefs, using the bow and arrow so expertly that they can send an arrow through a man at the distance of 100 yards. There is no species of theft or robbery in which they are not skilful, and they prosper as the disorders of the country increase. In the forces of any enterprising chief or bandit they serve without

[1] Vol. i., p. 228, ed. 1843.
[2] Vol. i., p. 320.
[3] Sleeman's *Journal*, vol. ii., p. 2.
[4] Heber's *Journal*, vol. i., p. 230, ed. 1843.
[5] Vol. i., p. 232.
[6] Sleeman's *Journal*, vol. ii., p. 31.
[7] Vol. ii., p. 246.

Oude.

wages, for the sake of the booty to be acquired. But low as the caste of these miscreants is, they assume the name of rájpúts, when by murder and robbery they have acquired wealth and landed property. Then, by giving their daughters to rajpúts, they often get their pretensions to that proud name admitted. Thus Sleeman mentions that Gangá Baksh of Kásimganj is a Pásí, and his family, after acquiring landed possessions by the murder of the old proprietors, called themselves ráwats, and had their claims allowed.

Bráhmans and rájpúts are exceedingly numerous in Oudh; and, according to Butter, the former out-number the latter throughout the province, though their arrival in it was of later date. Thus, it is said, that about the Christian era Trilok Chand, a chief of the Bais rájpúts, came into Oudh from Ujjain, and that it was after his tribe had become settled that some Bráhmans immigrated from Kanauj. The Oudh Bráhmans have 22 sub-castes, of which the Misr, the Shukl, the Tiwárí, the Dúbe, the Pháthak, the Upádhya, and the Chaube are the principal. The Misr has 28 sub-divisions,[1] the Shukl 14, the Tiwárí 23, the Dúbe 14, the Pháthak 15, the Upádhya 5, and the Chaube 3. Sleeman[2] informs us that the Kanauj Bráhmans *condescend* to hold and drive their own ploughs, a thing which cannot be affirmed of any other family of Bráhmans in Oudh.

Of rájpúts, 29 tribes are enumerated, of which the most renowned are the Bais, Ráthúr, Hárá, Kachwá, Sombansí, Bisen, Solankhí, Bachgotí, Dichhit, Rájkumár, Chauhán, Janwár, and Sengar, or Sanger. Butter affirms that these tribes differ in name only, and all intermarry without restriction of family. There is no doubt, however, that this is a mistake, and that it is owing in part to the excessive restrictions upon contracting marriages with inferior tribes that the dreadful and almost universal practice of female infanticide is perpetuated. Sleeman was informed by the rájpúts themselves that this unnatural custom arose from the Muhammadan princes of Delhi, and other Muslim chiefs, demanding the daughters of rájpúts in marriage, and they, being too proud to comply and too weak to resist,[3] determined upon putting all their female infants to death. The same authority states that the Dhánkarís[4] and Sengars are the only exceptions to the rule which stigmatizes all rájpúts as murderers of their daughters; and that no rájpút can give his daughter to a rájpút whose tribe is a shade lower, though he can take a daughter from him. Thus the Sombansí cannot betroth their daughters to any but Ráthurs and Chauháns, and must give their whole property with them. The custom of destroying female infants has prevailed everywhere from the time of the first founders of their race, according to their own account, but this is extremely improbable. It is remarkable that the greater portion of the Ahban rájpúts have become Muslims. They still eat together with those who have not changed their creed, but from different dishes; and no member of the tribe ever forfeited his inheritance by changing his religion. They are very numerous in the northern part of Oudh, where, in Bharwárá alone they once possessed 989 villages, of which about one-tenth are now occupied. Loní Singh of Mithaulí, who sent in the English fugitives from Sítápúr to Lakhnau, is of this tribe.

Of the cultivating classes, the principal are the Kurmís, Lodhís, and Kachís. Muhammadans probably do not exceed one-eighth of the whole population of Oudh.

History and government.

As has been already stated, Oudh was one of the first provinces of India colonized from the West, and, according to Buchanan, this settlement took place 1366 years B.C. The same authority places the reign of Ramachandra, the son of Dasharathah, about 775 B.C. The Hindú legends, however, assign as the epoch of this prince, the conqueror of Ceylon, the conclusion of the Treta Yug, or Second Age. The kingdom of Oudh was then called Koshalah, and its capital Ayodhyah; and it is remarkable that Kausham, a word of kindred etymology to Kushalah, was the name of the great and ancient city of Kanyakubja, or Kanauj, situated close to the junction of the Kálí Nadí with the Ganges, and the rájás of which, there is little doubt, at times bore sway over Oudh. This is the conjecture of Mr Elphinstone,[5] and it is confirmed partly by the etymological coincidence of the names, partly by the actual immigration of a numerous tribe of Bráhmans from Kanauj, who are still called by the name of their original country. After Rámah, the legendary conqueror of Ceylon, sixty princes reigned in Ayodhyah, but nothing is recorded of them. The Rámáyanah, or epic poem which relates the exploits of Rámah, is now assigned by Professor Wilson to 300 B.C. Ayodhyah is not mentioned in the Mahábháratah, the next epic poem of the Hindús, which dates 240 B.C.[6] With the exception of the immigration of Trilok Chand, the Rájpút prince, from Malwah into Oudh, about the commencement of the Christian era, there is little to be collected regarding Oudh until the Muhammadan invasion. It must be remembered, however, that hundreds of works exist in Hindú, Persian, and Urdú, on the history and antiquities of India, which have not only not been translated by Europeans, but have never even been read by them; and in these much that will throw light on the ancient annals of Oudh may yet be discovered.

Oude.

In his eighth invasion of India, Mahmúd of Ghazní, in 1018 A.D., marched through North India, and captured the city of Kanauj. There is good reason to think that a division of his army then invaded Oudh, for the shrine of Saiyid Sálár, his reputed nephew, who is said to have been killed fighting against the Hindús, is still the object of pilgrimage at Bahráich. However this may be, it is certain that in 1195 A.D., Muhammad Bakhtiyár Khilji, the general of Kutbu'd-Dín Aibak, Emperor of Delhi, conquered Oudh.[7] In 1279, Tigi, who was governor of Oudh for Ghiyásu'd-Dín Bulbun, was defeated by the rebellious governor of Bengal, and hanged by the enraged emperor over the gates of Awadh, as Ayodhyah began to be called. About 1304 A.D., Alláhu'd-Dín, Emperor of Delhi, took the capital of the Bhars in Southern Oudh, and having razed it, built on its site the present city of Sultánpúr. From 1400 to 1478, there was an independent kingdom of Júanpúr or Jaunpúr, the ruler of which had possession of Kanauj, and in 1452 even laid siege to Delhi, but was finally overthrown by the Emperor Bihlol. In 1528, Bábar's army, which he had sent to reduce Oudh, was there defeated by an Afghan chief named Bábán, whereupon Bábar threw a bridge over the Ganges, under the fire of his artillery, crossed into Oudh, and drove his opponents out of the province. He was compelled, however, to make a second campaign against Bábán who, when Bábar was retiring to Agra, made a fresh inroad into Oudh, and captured Lakhnau (Lucknow). After the death of Bábar, Bábán raised a fresh insurrection in Oudh against Humáyún, but was finally crushed by that prince. At the accession of Akbar in 1556, Jaunpúr, with its adjoining districts of Oudh and the Doáb, had again been erected into an independent kingdom, but in 1559 Akbar re-conquered it. From this time till the reign of Muhammad Sháh, and the commencement of the government of Sa'ádat 'Alí Khán, and the dynasty of which he was the founder, the princes of this dynasty, and the dates of their accession, are as follows:—

1. Sa'ádat 'Alí Khán 1720
2. Saffdar Jang, nephew and son-in-law of Sa'ádat 'Alí.. 1739
3. Shujá'u'd-Daulah, son of Saffdar Jang. 1756
4. Asafu'd-Daulah, son of Shujá'u'd-Daulah.... 1775
5. Vazír 'Alí, son of Asaf 1797
6. Sa'ádat 'Alí, the second brother of Shujá'u'd-Daulah. 1798
7. Gházíu'd-Dín Haidar, son of Sa'ádat 'Alí.... 1814
8. Nasíru'd-Dín Haidar, son of Gházíu'd-Dín 1827
9. Muhammad 'Alí Sháh, brother of Gházíu'd-Dín.... 1837
10. Amjad 'Alí Sháh, son of Muhammad 'Alí.. 1842
11. Wajíd 'Alí Sháh, son of Amjad 'Alí 1847

The origin of the Oudh family, and the character of the first three princes, have been grossly misrepresented by the historian Alexander Dow, who, having been refused the saltpetre farm of the Alláhábád districts by Shujá'u'd-Daulah, took this base method of gratifying his resentment.[8] His slanders, however, are completely refuted by the unanimous voice of all the contemporary native[9] authors, by the evidence of Mr George Forster of the Bengal civil service, a contemporary of Dow, and by the plain statement of facts to be found in Mill, Grant Duff, and other English writers. Dow imputes to Sa'ádat 'Ali, throughout his account of that chief's career, the vilest treachery to his emperor and his country; asserts that Nádir Sháh was invited to invade India by him and the Nizám; and introduces the conqueror upbraiding these two nobles as "ungrateful villains to their king and country," and spitting upon their beards.[10] He also speaks of Shujá'u'd-Daulah as "the infamous son of a still more infamous Persian pedlar enjoying the extensive province of Oudh as a reward for a series of uncommon villanies."[11]

These assertions have been largely credited and copied by writers of repute, but they are entirely without foundation. According to native authors of eminence, the royal family of Oudh are Saiyids, or descendants of the Prophet through the Imám Músa Kazim, and therefore of the noblest Arabian descent. Forster mentions[12] that, during his journey through Persia, he had an opportunity of conversing with some of the inhabitants of Naishápúr, "who bore indisputable testimony to the ancient rank of the family of Shujá'u'd-Daulah." Naishápúr is one of the oldest cities in Khurásán,

[1] Butter, pp. 146, 147.
[2] Vol. ii., p. 40.
[3] Vol. ii., p. 49.
[4] Ibid.
[5] *History of India*, p. 206, 3d ed.; and cf. Elliot's *Bibliographical Index*, p. 35.
[6] Ibid., p. 207, note.
[7] *Firishtah*, vol. i., p. 198.
[8] Forster's *Travels*, vol. i., p. 132.
[9] The *Siyaru'l Mutaakhkhirín*; *Nadír Námah*, &c.
[10] Vol. ii., p. 324, ed. 1770.
[11] Ibid., p. 380.
[12] Vol. i., p. 132.

and was for a long period during the ninth and tenth centuries after Christ the capital of that province. Here the ancestors of the Oudh family have, for a very long space of time, held landed possessions and ranked among the princes of the place. Mírza Nasír, one of this family, and the father of Sa'ádat Khán, the first núwáb of Oudh, came to Hindústán in the beginning of the reign of Bahádur Sháh, the second son of Aurangzíb. The emperor appointed him to a high office at 'Azímábád, where his tomb yet remains His second son Muhammad Amín was in Persia when Nasír died, and on being apprised of his father's decease, immediately set out for Hindústán, and was made by the Emperor Farrukhsiyar colonel of his body-guard.[1] Being a man of extraordinary personal courage and prowess, he soon rose to still higher distinctions, and was made governor of the fort of Agra. It was he who was the main instrument in delivering the Emperor Muhammad Sháh from the tyranny of the two Saiyids, who had already murdered his predecessor Farrukhsiyar. During a terrible *émeute* at Delhi, when the pusillanimous emperor hid himself in the seraglio, he rushed in, forced him from his retreat, made him mount an elephant, and cut a way for him, sword-in-hand, through a multitude of rebels. At the battle of Sháhpúr, in 1720, when Saiyid 'Abd'ullah was defeated and made prisoner, he greatly distinguished himself, and received the title of Sa'ádat Khán Burhánu'l Múlk, "the felicitous lord, establisher of the realm," by which name he was ever afterwards known. He was then appointed governor of Oudh, and reduced it from a state of anarchy to complete order, for which he was promoted to the rank of dároghah khás, with the titular command of 7000 horse. In 1736, Bájí Ráo, advancing to the Jamná, 40 miles south of Agra, ravaged the country far and near. Three of his generals—Mulhár Ráo Holkár, Pillají Jádav, and Wittojí Bole—committed great depredations in the Doáb, when Sa'ádat Khán, advancing from Oudh, overthrew their forces with great slaughter, and chased them for miles. He then moved on to Agra,[2] and took a prominent part in the subsequent operations against the Maráthas. In the meantime, Muhammad Mukím, nephew of Sa'ádat, came to India, and married his cousin, the daughter of Sa'ádat. He soon distinguished himself, and was ennobled by the title of Abú'l Mansúr Saffdar Jang, by which name he is afterwards known in history. In 1737, he, with the rájá of Kotah, commanded the rearguard of the Mughul army in that year's campaign against the Maráthas. Some years after, Nádir Sháh invaded India; and the calumnies of Dow respecting the treachery of Sa'ádat Khán, and his aid of the invader, are refuted by the unanimous testimony of the *Siyaru'l Mutaakhkhirín*, the *Nádir Námah*, the *Yádgár i Bahádurí*, the *Zafar Námah*, and all the histories of the time. Sa'ádat Khán advanced with an army of 30,000 men to the assistance of his own emperor Muhammad Sháh, fought a severe action with Nádir Sháh, was made prisoner, and shortly after died of cancer in the back. That his action with Nádir "was no concerted plan," as Dow pretends, was proved by the fact, that seven principal Persian leaders, and 2500 inferior officers and men, were killed, and upwards of 5000 wounded.[3] Sa'ádat received no token of favour from the conqueror; and when Nádir retired, Muhammad Sháh promoted Saffdar Jang to the government of his deceased uncle. The character of Sa'ádat is thus given in the *Siyaru'l Mutaakhkhirín*:—"He was excessively brave, chivalrous, and valiant; a man of great parts, thirsting after glory and renown, and of singular firmness and wisdom."

Saffdar Jang, together with the government of Oudh, had the appointment of *mír átish*, or commander of the artillery. In 1746 he was one of the chief leaders of the imperial army of Delhi that defeated Ahmad Sháh Durrání, and caused him to retire to Kábul. Next year Muhammad Sháh was succeeded on the throne of Delhi by Ahmad Sháh, his eldest son, who raised Saffdar Jang to the dignity of vazír of the empire. In 1753 a powerful conspiracy was formed against him, at the head of which was the viceroy of the Dakhan, Najíbu'd-Daulah, the chief of the Rohillahs, and the favourite eunuch. Saffdar Jang was compelled to resort to arms; laid siege to Delhi; and after an investment of the capital for six months, compelled the emperor to grant to him in perpetuity the provinces of Oudh and Alláhábád. The same year he died,[4] and was succeeded by his son Tilláhu'd-Dín Haidar, known to the English by his title of Shujá'u'd-Daulah, who is thus described by his enemy Dow:—"Shujá'u'd-Daulah is extremely handsome in his person; about 5 feet 11 inches in height; and so nervous and strong, that with one stroke of the sabre he can cut off the head of a buffalo. He is active, passionate, and ambitious, but his genius is too volatile for depth of thought; and he is consequently more fit for the manly exercises of the field than for deliberation in the closet. Till of late he gave little attention to business. He was up before the sun, mounted his horse, rushed into the forest, and hunted down tigers or deer till the noon of day. He then returned, plunged into the cold bath, and spent his afternoons among his women. He now spends more time at the comptoir of his finances than in dallying with the ladies of his seraglio. His authority, therefore, is established, his revenues increased, and his army on a respectable footing. But with all his splendid qualities, he is cruel, treacherous, unprincipled, and deceitful. If we except personal courage, he possesses not one virtue more than Saffdar Jang."[5] Such was the prince who was ere long to measure swords with the English. His first achievement was in 1756, when Dattají Sindhiyá,[6] advancing with a great Marátha army to conquer Rohilkhand, was encountered by him, and effectually checked. On this occasion, a division of the Maráthas, commanded by Govind Pant, was routed with great slaughter, and driven across the Jamná, in whose waters a great part of it perished.[7] After this the Maráthas made peace with the núwáb of Oudh, and marched off to attack Ahmád Sháh Durrání, a movement which resulted in their terrible overthrow at Pánipat.

In 1759, 'Alí Gauhar, eldest son of the Emperor 'Alamgír II., formed a league with Muhammad Kulí Khán, the súbahdár of Alláhábád, to invade Bengal, which was then governed by Mír J'afar, the ally of the British. They invited Shujá'u'd-Daulah to aid them in this enterprise, which he agreed to do; but no sooner had they marched than he, by stratagem, got possession of the fortress of Alláhábád, and soon after put to death Muhammad Kulí, who strangely enough returned and gave himself up. The English historians have not understood the true cause of this cruel action, but a perusal of the native writers will explain it. Muhammad Kulí was brother's son to Saffdar Jang, and of course heir-presumptive to Shujá'a. He had been appointed by Saffdar Jang to the command of Alláhábád, and had entirely withdrawn himself from the authority of the court of Oudh. A strong faction, at the head of which was Ism'aíl Khán of Kábul, had intrigued to put him in the place of Shujá'u'd-Daulah, who several times escaped with difficulty from their designs. The policy of an eastern prince in such cases is well known; and Shujá'a preferred to sacrifice his cousin rather than himself.

In 1760, 'Alamgír, having been murdered by his vazír, 'Alí Gauhar, was proclaimed emperor by the title of Sháh 'Alam, and his first step was to make Shujá'u'd-Daulah vazír on the 6th of January 1761. Shujá'u'd-Daulah commanded a division in the battle of Pánipat, and from that time became the most powerful prince in Hindústán. The Maráthas were crushed by their tremendous defeat, Muhammad Kulí was dead, Alláhábád re-incorporated with Oudh, and everything combined to encourage the vazír to encounter the British, an opportunity for which was not long wanting. On the 24th of May 1763 the city of Patna had been seized by Mr Ellis, a violent, unprincipled man, who was determined to force Mír Kásim, the núwáb of Bengal, into a war. A struggle accordingly commenced, and after severe fighting, Mír Kásim, defeated at all points, crossed into Oudh, and threw himself on the protection of Shujá'u'd-Daulah; who, with the Emperor Sháh 'Alam, was encamp ed at Alláhábád. Shujá'a espoused the cause of the fugitive núwáb; and, crossing the Ganges in the beginning of April 1764, laid siege to Patna, but was beaten off with loss. The mutinous conduct of the English troops delayed their operations for some time; but on the 23d of October 1764 Major Hector Munro came up with the Oudh army at Baksar, and after a severe action of five hours, put it to flight. The English loss was 101 Europeans and 773 Sipáhís killed and wounded, or more than one in nine of their whole army. Shujá'a had 2000 men killed, and lost 133 guns of all sizes. In its results, this battle was a second Plassy, as it left the English without a rival to their power, and compelled the Emperor Sháh 'Alam to throw himself on their protection; thus giving to their subsequent proceedings the colour of legitimate authority. Shujá'a now entered into negotiations with the English, but as he refused to surrender Mír Kásim, Sumroo, and the European deserters, operations in the field still continued; and a treaty was concluded with Sháh 'Alam, by which he ceded to the English Gházipúr and part of the territory of Balwant Singh, rájá of Banáras, while they agreed to put him in possession of all the dominions of Shujá'u'd-Daulah; but

[1] *Siyaru'l Mutaakhkhirín.* [2] Grant Duff's *Maráthas*, vol. i., p. 532. [3] Forster, vol. i., p. 136.

[4] According to Forster and Grant Duff, in 1754. Mill gives 1753 as the year of his decease, Thornton 1756; but the authentic annals of the Oudh family, written in Persian, give 1166 A.H. = 1752–53.

[5] Dow, vol. ii., p. 394.

[6] Molesworth spells this name Shindá; the above is the Hindústání form of it, though Shakspeare makes it Sendhiyá.

[7] Grant Duff, vol. ii., p. 135. [8] Mill, vol. iii., p. 405.

the Court of Directors utterly disapproved and disallowed these terms, on the ground that extension of territory was impolitic and disadvantageous. Colonel Munro's army advanced from Banáras to the attack of Chunár, and after two unsuccessful assaults, returned to its quarters, but two battalions of natives occupied Lakhnau. Munro resigned in January 1765, and was succeeded by Major Fletcher, who, dividing his force, with one part of it reduced the Alláhábád districts; and with the other, commanded by Major Stibbert, captured the fort of Chunár.

Shujá'a now called in the Maráthas, who entered Oudh by Karha, and on the 3d of May 1765 were defeated near that place by General Carnac, and a second time near Akbarpúr, where, however, they plundered a great part of the English baggage. At the ford of Kalpí (Calpee) they again attempted to make a stand, but after a short action, were finally broken and dispersed. Shujá'a, with an appreciation of the English character which did him credit, now determined to throw himself on their generosity; and in August 1765 they concluded a peace with him, the principal conditions of which were, that he should pay L.500,000 towards the expenses of the war, surrender the fort of Chunár, not receive Kásim 'Alí or any deserters into his service, cede Karha and Alláhábád to Sháh 'Alam, levy no duties on any of the Company's merchandise throughout his dominions, pardon those of his subjects who had aided the English in the late war, and not molest Balwant Singh, their ally. He also covenanted to aid the English with his troops if their territories were invaded; and they, in return for all these advantages, agreed to furnish him assistance in case of a like necessity. It has been said that, from the battle of Baksar (Buxar), Oudh was a conquered country; and that the English having then given it to Shujá'u'd-Daulah, might be justified in resuming their gift if badly administered. But Oudh was never entirely subjugated, or even overrun; and the utmost that was ever proposed by the Bengal government was to make it over, when conquered, to Sháh 'Alam; a design that was bitterly censured by the Court of Directors. The words of Lord Clive are conclusive as to the motives of the treaty. He says[1]:—"Our restoring to Shujá'u'd-Daulah the whole of his dominions proceeds more from the desire of not extending the Company's territorial possessions, than the generous policy of attaching him for ever to our interests by gratitude, though this has been the apparent, and is by many thought to be the real, motive. Had we ambitiously attempted to retain the conquered country, experience *would soon have proved the impracticability of such a plan.*" Shujá'a, taught by his misfortunes, set to work to remedy his reverses with an energy and success which were proofs of a superior mind. In return for the districts ceded to him, the emperor granted to Shujá'a the hereditary possession of his dominions; and so well did the núwáb arrange his financial system, that in 1768 he had not only paid off all his debts, but possessed a full treasury and a flourishing revenue. He disbanded his irregulars and reduced the cavalry—which at the battle of Baksar amounted to 30,000, and had deserted him there without striking a blow—to 5000. With the help of some Frenchmen, he remodelled his army, raised ten disciplined battalions, and founded an arsenal at Faizábád. This progress aroused the jealousy of the English, who, in November 1768, imposed a new treaty on him which limited the number of his troops to 35,000 men, including irregulars. This restraint was exceedingly galling to the núwáb; and he henceforth viewed the English with distrust. However, in 1772 the Doáb and Rohilkhand were overrun by a powerful Marátha army under Sindhya, Holkar, and Hari Pant, who possessed themselves of all the territory belonging to Ahmad Khán Bangash, except the town and environs of Farrukhábád. Alarmed at this formidable invasion, the Rohillas besought Shujá'u'd-Daulah to procure the aid of an English brigade, and engaged to pay L.400,000 for its support. Shujá'a obtained the troops required, and the Maráthas were compelled to retire from their conquests; but the Rohillas then could not, or would not, make good their promise. And here occurs one of the blackest pages in the history of the núwábs of Oudh. Shujá'a was under obligations to the Rohillas, though there had been many passages of arms between them. They had sheltered his family in his misfortunes after the battle of Baksar, and had forborne to strike when he was unable to resist. It was therefore infamous to design their ruin,—a design which he now framed and accomplished with the aid of the English, who sold the liberties of this brave people to him for L.400,000. At the same time, Mr Hastings made over to Shujá'a, for L.500,000, the districts of Alláhábád and Karha, which belonged to the emperor, and had been solemnly assigned to him by the British themselves in return for an important service. The treaty was concluded in the end of 1773; and on the 17th of April 1774, Colonel Champion, with an English brigade accompanying the Oudh army, entered Rohilkhand. On the morning of the 23d a decisive battle was fought, in which the Rohillas were utterly broken, and their general, Háfiz Rahmat was slain.

After this dishonourable success, Shujá'a gave still stronger proofs of his callousness to generous sentiments in the cruel severity with which he treated the conquered Rohillas. It must be remembered, however, that, as a *Shí'ah* dealing with *Sunnís*, he had a religious incentive to rigour, similar to that which steeled the heart of the English Mary against her Protestant subjects, and made Philip II. deluge the Netherlands with blood. This fact has been wholly lost sight of by the English historians. It must be added that Sháh 'Alam had given his sanction to the conquest; that the English supported Shujá'a in all his proceedings; and that, as a mere question of policy, it was certainly for his interest to crush, and if possible extirpate, such warlike and dangerous neighbours as the Afgháns, who have given their name to Rohilkhand. He was yet busy with the arrangement of the conquered province, when a disease with which he was afflicted broke out so virulently that he was compelled to retire to Faizábád, where he died in January 1775, aged forty-six. He had received from his father a considerable principality, surrounded by implacable and powerful enemies; he left to his son an extensive and flourishing kingdom, secure from all aggression. Whatever his private character, he must be regarded as one of the ablest and most successful princes that have ruled in Hindústán. He was succeeded by Mírzá Arnání, his eldest legitimate son, who assumed the title of *Asafu'd-Daulah*, and who removed the royal residence to Lakhnau, then a mere village.[2] The Bengal Council, in opposition to the opinion of Mr Hastings, shamelessly seized this opportunity to extort immense sums from the young núwáb, and, to use the words of Mr Mill, "while they exacted all, and far more than had been covenanted by Shujá'a, from his son, declared their own engagements to be void by Shujá'a's death." They compelled Asaf, to raise the pay of the brigade which they had lent to his father, and which was no longer required in Oudh, to L.330,000 a year, and annexed territory bringing annually L.230,000. The first object of the new núwáb was to obtain from the emperor the office of vazír, which had been held by his father. This he secured in 1776, by sending at an opportune time 5000 men and some guns to the emperor's assistance. But this was the only gleam of sunshine during his reign, the history of which is that of a continual struggle with the exorbitant demands of the English. They drew from Oudh enormous sums, to supply which the wretched kingdom was parcelled out to farmers of revenue, who, as they grew powerful by draining the country of its wealth, gradually shook off their allegiance to the núwáb, and defied his authority. In addition to the brigade which, by the treaty of Faizábád, had been quartered on Shujá'a, a second, called the *temporary* brigade, was added in 1777, and several detached corps were from time to time imposed on the unfortunate Asaf, at an expense of L.120,000 a year more. Besides the Resident, who, by an agreement between Shujá'a and Mr Hastings, had been located in Oudh, another Company's agent was now added; and the expense of their establishments, and of the pensions, allowances, and gifts to various Company's officers, grew to that height, that no revenue, however elastic, could bear.[3] In 1779 the unfortunate núwáb petitioned for the removal of the troops quartered upon him, stating that they were "not only quite useless to his government, but, moreover, the cause of much loss, both in the revenues and customs, and that the detached bodies of troops, under their European officers, brought nothing but confusion into the affairs of his government, being entirely their own masters." But the exigencies of the governor-general were such that he was determined to force a supply of money from Oudh, in defiance of all reason and justice. The alleged debt to the English now amounted to L.1,400,000, and the salaries of the núwáb's own servants, and even of the members of the royal family, were deeply in arrears. Of the way in which this ruin had been caused a single specimen will suffice. Colonel Hannay,[4] a Company's officer greatly in debt, was foisted into the núwáb's service in 1778, as farmer of Bahráich and Gorakhpúr, and in 1781 had realized *a fortune of* L.300,000! On the 19th September 1781 Mr Hastings signed a new treaty with the núwáb at Chunár, by which he was relieved of the burdens which had been so unjustly imposed upon him, on condition of his plundering his grandmother, the Bahu Bígam, and his mother, of all their wealth, and sending it over to the English. This resulted in the famous spoliation of the Bígams, which formed the subject of the eloquent denunciations of Sheridan and Burke. A brief resumè of the question will be found in the pages of Mill and Wilson, the former of whom censures the conduct of Hastings in the strongest terms, while the latter inclines to defend him, but indirectly admits that the spolia-

[1] Mill, vol. iii., p. 590.
[2] Sleeman, vol. i., p. 137.
[3] Mill, vol. iv., p. 420.
[4] Ibid., vol. iv., pp. 429–459.

tion of the royal ladies was a thing wholly at variance with the "easy temper" of the núwáb, and that he was driven to it by the insatiable demands of the English. For his part in the transaction, Mr Hastings accepted—that is, extorted—a *douceur* of L.100,000. The next step was to despoil Faiz'ulláh Khán, a Rohilla chief who had been suffered to remain in Rohilkhand by Shujá'u'd-Daulah, and who had brought his territory into the most flourishing state. It would, however, be impossible to condense into a short space the financial transactions of the English government with 'Asafu'd-Daulah. Suffice it to say, that from 1777 to 1786 the núwáb was compelled to pay the Company L.840,000 per annum, instead of L.330,000, which had been forced from him by the iniquitous treaty of 1775, and L.360,000 extorted by the still more iniquitous treaty of 1781. In addition to this, his country had been plundered by the gigantic frauds, briberies, and extortions of the Company's officers, as a sample of which may be taken the expenses of Major Palmer, the agent of Hastings, which alone were L.112,950,—L.22,800 being that gentleman's moderate annual salary.[1] Sir J. Macpherson and Lord Cornwallis alleviated this frightful oppression to some extent, but they only pruned and did not extirpate the evil; and in March 1797 Sir John Shore commenced new exactions, and imposed on the wretched núwáb the expense of two additional regiments of cavalry—one European, the other native. A few months after, Asafu'd-Daulah expired, leaving an impoverished country, a bankrupt treasury, and a dissatisfied people. He was a mild, easy, and somewhat indolent and sensual prince; but no abilities or virtues could have protected him against the relentless tyranny of the English government. He himself admitted that he had been rendered reckless and desperate by its insatiable demands. Mírzá 'Alí, the reputed son of Asaf, known to English writers as Vazír 'Alí, was now raised to the throne, and was publicly acknowledged by the English government. There was, however, a powerful faction against him; and Sir J. Shore hearing that he was a youth of impracticable temper, visited Lakhnau, and received proffers of vast sums if he would set him aside. "A large pecuniary sacrifice," says the governor-general, "was promised as a compensation for my acquiescence." Accordingly, on the 21st of January 1798, the núwáb was deposed, and Sa'ádat 'Alí II., brother of Asafu d-Daulah was raised to the throne on payment of L.120,000 in ready money, and on condition of raising the annual subsidy to the English to L.760,000, and paying all the expenses of the English armies in Oudh when exceeding 13,000 men. He further ceded the fortress of Alláhábád; and agreed to employ no Europeans, except Company's officers, in his service, nor permit them to settle in his dominions; to hold no communication with any foreign state; and to settle L.15,000 a year on the deposed Vazír 'Alí. The latter having been deprived of a kingdom on evidence upon which, to use the words of the historian Mill, "a court of English law would not have decided against him a question of a few pounds,"[2] was removed to Banáras. In 1799 it was resolved, in order to prevent any intrigues in his favour, to convey him to Calcutta; an intention which he bitterly resented. On the 14th of January in that year, he called on the Resident at Banáras, Mr Cherry, to complain; and on being chidden, rose from his chair and struck at him with his sword. His attendants immediately despatched the Resident and two other gentlemen; but on the arrival of a party of horse, took to flight. Having thus made his escape, Vazír 'Alí was soon joined by several thousand men, and maintained himself in rebellion for some time. He was at last traitorously given up to the English by a Rájpút chief, and carried to Calcutta, where he died a prisoner in Fort-William in 1817.

Sa'ádat 'Alí II. is represented by Sleeman at his first accession as a careless, jovial prince, fond of the chase and the glass. He was, nevertheless, so deeply impressed with the miserable condition of Oudh, and the impossibility of satisfying the demands of the English, that he at one time contemplated the abdication of his throne. Lord Wellesley, the then governor-general, eagerly grasped at this proposal, and used every stratagem and menace to secure the whole kingdom for the Company, but finding that Sa'ádat had no intention of trafficking away the birthright of his sons, and would not resign except in their favour, he compelled him to cede the richer half of his territories, including Etáwah, Karha, Farrukhábád, and the whole of Rohilkhand, 'Azímgarh, Gorakhpúr, Alláhábád, and many other districts, producing in all L.1,334,730 annually. The núwáb was further bound to dismiss all his regular troops, save five battalions of infantry, 2000 cavalry, and 300 artillerymen; the English government undertaking to defend the kingdom against all foreign aggression, and to coerce all rebellious subjects Of foreign aggression there never was the least probability; but when called upon to reduce rebellious chiefs, the English refused, or yielded a grudging compliance,[3] and in the succeeding reigns altogether refused to observe this condition of the treaty. The treaty was signed on the 14th of November 1801, and from that hour Sa'ádat 'Alí became a changed man. He gave up all the moderate pleasures to which he had been accustomed, and devoted himself heart and soul to the management of his kingdom. For the remaining fourteen years of his life few princes in ancient or modern times have displayed such self-denial and such attention to the business of their government as Sa'ádat. During his "salutary rule"[4] a great part of Oudh is described as "a magnificent garden."[5] By his prudence and economy he so reduced his expenditure within his income, that on his death, on the 12th of July 1824, he left fourteen millions sterling in a treasury which he found empty when he entered upon the government in 1797. He was a man of great general ability; had mixed much in the society of British officers in different parts of India; had been well trained to habits of business, understood thoroughly the character, institutions, and requirements of his people; and, above all, was a sound judge of the relative merits and capacities of the men from whom he had selected his officers, and a vigilant supervisor of their actions. He had a thorough knowledge of the rights and duties of his officers and subjects, and a strong will to secure the one and enforce the other.[6] Yet this was the man that Lord Wellesley would have put aside as worthless and incapable.

Sa'ádat 'Alí II. was succeeded by his second son, styled Ghâzíu'd-Dín Haidar. Shamsu'd-Daulah, the eldest son[7] of Sa'ádat, died before his father, and left a son; but he, according to the Muhammadan law, was excluded from the succession by his father's death in his grandfather's lifetime. Gházíu'd-Dín was young and in possession of vast wealth: he gave himself up to pleasure, and neglected the government. He was, besides, unfortunate in his selection of a minister—Aghá Mír, who was utterly dishonest, though a man of abilities. The young núwáb, immediately on his accession, gave to the minister L.500,000 to be expended in public works and charity. This Aghá Mír retained for himself, and forged letters to show that he had expended it as desired. Another million was borrowed by Lord Moira for the expenses of the Nepál war. The Resident, Major Baillie, was instructed to apply for the money, and "to make it appear as a voluntary offer on the part of the núwáb."[8] In March 1815 the Resident was instructed to apply for a second million, which he did in so disrespectful a manner that the núwáb, although he surrendered the money, insisted on his removal, and to this the governor-general assented; and on the 1st of May 1816 granted to the núwáb, in discharge for the millions just lent, an unproductive marshy forest called the Taráí, just taken from Nepál. This region became the sanctuary for all the rebels and banditti in Eastern Oudh, and there they built their strongholds. But money was not the only thing supplied by the núwáb to the English. In addition to the vast sums just mentioned, he mounted a whole regiment of English cavalry at his own expense, and supplied various necessaries towards the wars the Company were carrying on. In return for these services, and to sow jealousy between the courts of Delhi and Lakhnau, Lord Moira encouraged the núwáb to assume the title of King. Accordingly, in 1817, Gházíu'd-Dín for the first time coined money in his own name, and assumed the title of King in the year following. At the end of 1825, another "perpetual loan" of a million was borrowed from the king by the Company, the interest of which was to be paid to the minister, Aghá Mír, who, by a gross fraud, had obtained the king's consent. Next year another loan of half a million was obtained for, as it was said, two years. On the 20th of October 1827 Gházíu'd-Dín died, having expended, or rather given to the English, four millions of the fourteen bequeathed to him by his father. "He

[1] Mill, vol. v., p. 13, note.

[2] Ibid., p. 54. Wilson attempts to justify Sir J. Shore, and says many impartial witnesses were consulted; but, in the nature of things, there could have been no impartial witnesses at Lakhnau, and the judge himself, Sir J. Shore, was an interested party, for his government gained enormous sums by his decision. Moreover, the inquiry was private; and, if made at all, should have been made before the public acknowledgment by the English of Vazír 'Alí's legitimacy. There is no dispute that 'Asafu'd-Daulah acknowledged Vazír 'Alí as his son; and the troops and people were so much in his favour that there was a partial insurrection when he fled from Banáras. Wilson alleges that Sa'ádat had then become unpopular by his parsimony; but this is refuted by Sleeman, who says that Sa'ádat did not commence his economical reforms till 1801.

[3] Sleeman, vol. i., p. 65.

[4] Ibid., vol. i., p. 55.

[5] Ibid., pp. 54, 273; vol. ii., p. 79.

[6] Sleeman, vol. ii., p. 190.

[7] *Vide* Sleeman. Mill, vol. viii., p. 11, note, seems to be in error here.

[8] Mill, vol. viii., p. 111, note.

was an encourager of letters and the arts; was of a kind and conciliatory disposition, and afforded a not unfavourable specimen of an Asiatic prince[1];" but his ministers defrauded him of enormous sums,[2] and as he was prevented by treaty from keeping up sufficient troops of his own, and the British troops refused to act against refractory zamíndárs, that system of baronial aggrandizement commenced under his reign which has now made Oudh what England was during the worst period of the wars of the Roses. He was succeeded by his eldest son Sulaimán Jáh, who assumed the title of Nasíru'd-Dín Haidar. The treasury was full, and the young king "was anxious to spend his money in the manner best calculated to do good and please our government;" and Sir W. Sleeman has left it on record,[3] that had the English Resident given good advice, or even been willing to meet the king's advances, "Oudh might have been covered with useful public works." But the Residents for a long period of years made it their business to do nothing, or only interfered to extort vast sums of money, or to prefer the complaints of the Company's sipáhís, who were allowed privileges contrary to all justice and order. The object of the political officers employed in Oudh was, in plain words, to bring on such a state of affairs as should justify the annexation of the province. Nasíru'd-Dín, repelled by the Resident, gave himself over to sensual and intemperate habits, in which he had been encouraged from his early youth by his adopted mother, the Pádsháh Bígam, a woman of an ungovernable temper, but over-indulgent to her son. Among his first measures, the king attempted to make the fraudulent Aghá Mír disgorge the enormous sums of which he had robbed the state, but the British government threw their ægis over the traitor, and permitted him a safe retreat to Cawnpore, where he died in 1832. Some years before his death he set up a printing-press at Cawnpore, whence he disseminated attacks upon the Oudh government. His son took a leading part against the English in the mutiny at the above station, and held a high office under the infamous Náná Sáhib. Hakím Mahdí, who had been *ijárahdár*, or farmer, of Muhammadí (Mahomdee) and Khairábád from 1804 to 1819, and had made those districts a blooming garden, succeeded Aghá Mír[4] (after a brief interval, till February 1829, during which period Fazl 'Alí was minister), endeavoured to introduce reforms which would have restored Oudh to the condition in which it was under Sa'ádat 'Alí, but the king was immersed in sensual pleasures, and surrounded by vile courtiers and still viler Europeans, whose interest it was to prevent reform.[5] Hakím Mahdí was silenced, and even dismissed after two years' tenure of office,[6] and was succeeded by an imbecile old man, Roshanu'd-Daulah,[7] who was thwarted in everything by the king's unworthy favourites. Nasíru'd-Dín died, it is said by poison, on the night of the 7th of July 1837, and was succeeded by his uncle, Nasíru'd-Daulah, who assumed the title of Muhammad 'Alí Sháh. He was the third son of Sa'ádat 'Alí II., and, according to Muslim law, became heir to the throne, owing to the death, during his father's lifetime, of his elder brother Shamsu'd-Daulah, whose four sons were thereby excluded from the succession. Nasíru'd-Dín had left a son, Muna Ján, by a lady named Afzal Mahal, but had disowned him in order to gratify his resentment against the Pádsháh Bígam, whom, in later years, he detested, and who doted on the boy. The Bígam was not a person to suffer the rights of her favourite to be set aside without a struggle; and when Nasíru'd-Dín died, she marched to the palace with an armed multitude, and caused Muna Ján to be proclaimed king. The Resident, Colonel Low, however, suppressed the *émeute*, killing and wounding 120 of the Bígam's followers; and Muna, who was pronounced by the English government illegitimate,[8] was sent to Chunár. Muhammad 'Alí Sháh was a parsimonious and prudent old man, but in his short reign, till the 16th of May 1842, he could not restore the treasures wasted by his predecessor, who had inherited L.10,000,000, and left but L.700,000. He bequeathed, however, L.788,000 to his second son Amjad 'Alí, who succeeded to the throne, to the exclusion of Mumtázu'd-Daulah, the son of his elder brother Asghar 'Alí,—Asghar having died during his father's lifetime. Amjad 'Alí[9] died on the 13th of February 1847, and left L.1,358,400, and this, as far as can be ascertained, was expended by Wajíd 'Alí, the ex-king of Oudh, before his deposition, which took place on the 1st of January 1856. Wajíd 'Alí is a good poet and an accomplished man of letters, but not a man of business, and before his accession the great barons had become altogether too powerful to be controlled. The royal revenue declined daily during his reign; but on the whole, the condition of Oudh was not deteriorating, and the barons drew ample and increasing revenues from their estates. They maintain to this day 100,000 armed followers, and have 400 forts of such strength, that one of them (that of Rudhamau) has lately successfully defied a whole division of British troops, and repulsed their attack, with the loss of a general and 120 men. It was for the English government to have reduced and destroyed these forts, and to have restored the king's power, or to have retired from the country and left him to fight his own battles. The latter course was the one recommended by Lord Dalhousie, who felt that by the treaty of 1837, made by the governor-general, Lord Auckland, who had full powers to conclude it, and acknowledged by succeeding governors-general, though not by the Court of Directors, the kings of Oudh could not be deposed for misgovernment. That treaty provided, that in case of serious internal disorders, the English should assume the administration in trust for the king, and restore it to him, or his successors, when matters were adjusted. In an evil hour, however, in spite of the remonstrances of the ablest Residents, Sir W. Sleeman and Colonel Low, and the protests of two of the most enlightened directors, the home government resolved on the unjust and impolitic step of annexing Oudh to the dominions of the Company. The announcement was received with indignation and astonishment throughout India, and more than one Indian prince declared publicly in open court, that no native potentate could now feel himself safe. Fanatical emissaries went abroad in all directions, calling on the population to rise against the Faringís; and in little more than a year from the annexation the terrible revolt of the Bengal army broke out. In Oudh the whole population rose against the English as one man, and although Lakhnau was stormed and taken for the third time on the 19th of March 1858, the whole country remained in arms against the English up to the time at which this article concludes, in July of the same year. (See NORTH-WESTERN PROVINCES.) (E. B. E.)

OUDINOT, NICOLAS-CHARLES, Duke of Reggio and Marshal of France, was the son of a merchant, and was born in 1767. He was a soldier from his youth, and at the outbreak of the Revolution he was appointed to the command of a battalion. His skill and intrepidity speedily raised him in the scale of promotion. A successful stand which he made at the head of the regiment of Picardy against an overwhelming force of Austrians, gained for him in 1794 the rank of general of a brigade. His services under Moreau in Germany were recognised by his being created a general of division in 1799. Nor was his conduct less notable when, immediately afterwards, he was transferred to the army of Italy. Under Massena he played an important part in the victory of Zurich; in the famous defence of Genoa, under Brune, he distinguished himself at the passage of the Mincio; and his reward for these services was a sword of honour from the First Consul. The next important achievements of Oudinot were performed under the direct command of Napoleon himself. At the capture of Vienna he was the first to lead his corps into the city; on the memorable day of Friedland he elicited the commendation of Bonaparte himself; and on the field of Wagram he won a marshal's baton, a pension, and the title of Duke of Reggio. The warlike renown of Oudinot had now reached its climax. Although he conducted himself bravely in the campaigns of 1812, 1813, and 1814, his cause wanted that success which renders great exploits recognisable. On the first abdication of Napoleon he submitted to the Bourbons, and forsook for ever the fortunes of his great leader. The remaining years of his life, though occupied with the discharge of several high military offices, were spent in comparative inaction. His death took place in September 1847.

OUGHTRED, WILLIAM, an eminent mathematician, was born at Eton in 1573, and educated in the school there, whence he was elected to King's College, Cambridge, of which he afterwards became fellow. Being admitted to holy orders, he left the university about the year 1603, and was presented to the rectory of Aldbury, near Guildford in

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1 Mill, vol. ix., p. 209; and especially for some remarkable examples, Sleeman, vol. ii., p. 79.
2 Vol. ii., p. 413.
3 Vol. ii., pp. 52, 76.
4 Sleeman, vol. i., p. 272.
5 *Private Life of an Eastern King*.
6 Sleeman, vol. i., p. 162.
7 Ibid., p. 156.
8 Sleeman shows that he was legitimate, vol. ii., p. 181, &c.
9 Sleeman, vol. ii., p. 180, note.

Surrey; and about the year 1628 he was appointed by the Earl of Arundel to instruct his son in the mathematics. He kept a correspondence by letter with some of the most eminent scholars of his time on mathematical subjects; and his house was generally full of young gentlemen who came from all parts to receive his instruction. It is said that, upon hearing the news of the vote at Westminster for the restoration of Charles the II., he expired in a sudden transport of joy, at the age of eighty-eight. He wrote *Clavis Mathematica* in 1631; a Description of the Double Horizontal Dial in 1633; and *Opuscula Mathematica* in 1676. (See *Biographia Britannica.*)

OUGLITSCH, or UGLITSCH, a town of European Russia, government of Jaroslav, on both sides of the Volga, 63 miles W. of Jaroslav. The streets are narrow and irregular, and the houses ill-built. It has an ancient citadel, and is partially fortified. The churches are numerous; and there are two convents. Weaving and paper-making are the chief manufactures; and some trade in corn and Russian leather is carried on. Ouglitsch is an ancient town, and was once a place of great importance; but having been taken and burnt by the Poles, it has never regained its former prosperity. Pop. 7483.

OUNDLE, a market-town of England, county of Northampton, stands on the slope of a hill, nearly surrounded by the Nen, 24 miles N.E. of Northampton, and 78 N. by W. of London. The three principal streets are straight, well-paved, and lined with good stone houses. The town-hall and the parish church are the chief buildings; the latter being a large edifice in the early English style, with a hexagonal spire 200 feet high. There are several other churches, three schools, almshouses, and a savings-bank. In the vicinity is the site of Fotheringhay Castle, of which one large stone is all that remains. Pop. (1851) 2689.

OURG, or OORGA, a town of Mongolia, on the right bank of the Tula, 165 miles S.S.E. of Kiachta, and 720 N.W. of Pekin. The houses are generally built of wood; and the streets are so narrow as hardly to allow two men on horseback to pass. There are numerous temples, and a college for priests, who form a great part of the inhabitants. Pop. estimated at 7000.

OURO PRETO, formerly called *Villa Rica*, a town of Brazil, capital of the province of Minas Geraes, is built on a tract of uneven ground in the midst of lofty and barren mountains that abound in gold, 190 miles N.N.W. of Rio de Janeiro. Although it looks well from a distance, the streets are narrow, ill-paved, and irregular, and the houses have no appearance of uniformity. Of its six churches, one or two are fine buildings; the governor's palace is a large and well-built edifice of a square form; and there are also a town-house, barracks, treasury, and theatre. The educational establishments consist of a college, school of agriculture, and other schools; botanic garden, and public library. The town has declined very much in consequence of the gold mines becoming exhausted. These, however, are still worked by English companies; and an active trade is carried on with Rio de Janeiro. Pop. 10,000.

OUSE, a river of England, county of York, is formed by the junction of the Swale and the Ure, which unite near Borough Bridge. It flows through the great plain of Yorkshire, at first S.E. as far as the town of York, which it passes, and then pursues an irregular course S. and S.E., until it joins with the Trent to form the estuary of the Humber, by which it discharges its waters into the German Ocean. It receives the Nidd, the Wharfe, and the Don, from the left, and the Derwent from the right. Its whole length is about 60 miles; and it is navigable for large vessels up to York, 45 miles from its mouth.

OUSE, *Great*, another river of England, rises near Brackley, Northamptonshire, and flows in a very winding course, dividing for a short distance the counties of Oxford and Buckingham, and flowing in succession through Buckingham, Bedford, Huntingdon, Cambridge, and Norfolk, until it falls into the Wash, after a course of 160 miles, about two-thirds of which is navigable. It is the most meandering of English rivers, and the one that traverses the greatest extent of level country. The towns of Buckingham, Bedford, Huntingdon, and Ely, are on its banks. Its principal tributaries are the Old Nen, Cam, Little Ouse, Stoke, and Nar.

OUSE, *Little*, an affluent of the preceding river, rises in Suffolk, and flows N.W. till it joins the Great Ouse on the borders of Cambridge and Norfolk.

OUTLAW, is a term applied to one who flees from justice, or who wilfully neglects or refuses to appear and answer for a transgression in obedience to the process of a competent court. The punishment consequent on such contumacy is termed *outlawry*, and consists in an exclusion from the benefits and protection of the law, thus disqualifying the defendant from maintaining any action real or personal. From the Conquest until nearly the reign of Mary, an outlaw might be lawfully killed like a wild beast by any one who met him. This was especially the case if he resisted seizure; "but when once taken," says Bracton (iii. c. 14), "his life and death were in the king's hands; and if any man then killed him, he must answer for it, as in the case of any other homicide." Sufficient notice of the process of the court, and satisfactory evidence of his disobedience, is essential before a person can be outlawed. As a security for making the defendant aware of the process of court, three successive writs of *capias* are issued against him, and failing his appearance, a writ of *exigent*, requiring the sheriff to call him in five successive courts, is then sued out; and if he does not render himself up at the fifth call, judgment of outlawry is at once pronounced against him. At the same time that the exigent is issued, moreover, it is provided, as an additional security, that the sheriff shall make three proclamations of the defendant in notorious places in the county of his residence a month before the sentence of outlawry. In the case of contumacy on prosecutions for civil actions and inferior crimes, only one writ of *capias* is necessary before the exigent is awarded. Outlawry entails the forfeiture of the goods and chattels of the outlaw. It was formerly necessary for the outlaw to be restored to his law by the crown; but in modern times it is usual for the courts to reverse outlawries upon motion.

OVADA, a town of the kingdom of Sardinia, division of Alessandria, stands on the Orba, 9 miles S.W. of Acqui, and 20 S. of Alessandria. For the most part it is well built; and contains several churches, convents, schools, and hospitals, and a theatre. One of the churches is a handsome building. Manufactures of cloth, vermicelli, hardware, and silk, are carried on; and there is some trade in wine and silk. Pop. 6177.

OVAR, a town of Portugal, province of Beira, stands near the mouth of a river of the same name, 15 miles N. of Aveiro, and 22 S. of Oporto. It is well built, but unhealthy; and consists of one long street, well paved and clean. There is a harbour and a mole. The inhabitants are engaged in fishing, and carry on some trade. Pop. 10,500.

OVATION (*ovatio*) was a lesser triumph allowed to Roman commanders for victories won without the effusion of much blood, or for defeating a mean and inconsiderable enemy. The show generally began at the Alban Mountain, whence the general with his retinue made his entry into the city on foot, with many flutes or pipes sounding in concert as he passed along, and wearing a garland of myrtle as a token of peace. The term *ovation*, according to Servius, is derived from *ovis*, a sheep, because on this occasion the conqueror sacrificed a sheep, as in a triumph he

sacrificed a bull. Festus, however, derives it from *ovo*, "I exult," "I cry O!" while Dionysius maintains it to be a corruption of the Greek bacchanalian εὐοῖ. The senate, knights, and principal plebeians assisted at the procession, which concluded at the Capitol, where rams were sacrificed to Jupiter. The first ovation was granted to Publius Postumius Tubertus, for his victory over the Sabines in the 253d year of Rome. (Pliny, *Hist. Nat.* xv. 29.)

OVERALL, John, an English bishop of some celebrity during his day, was born in 1559. He was elected a scholar of St John's College, Cambridge, but afterwards removed to Trinity, of which he became a fellow. In 1596 he was made regius professor of divinity, when he took his degree of Doctor, and about the same time was elected master of Catherine Hall. In 1601 he was promoted to the deanery of St Paul's, London, by the recommendation of his patron, Sir Fulke Greville, and Queen Elizabeth; and in the beginning of King James's reign he was chosen prolocutor of the lower House of Convocation. In 1612 he was appointed one of the first governors of the Charter-House Hospital, then just founded by Mr Thomas Sutton. In April 1614 he was made bishop of Litchfield and Coventry; and in 1618 he was translated to Norwich, where he died in May 1619, at the age of about sixty. He was buried in that cathedral, where he lay unnoticed and forgotten till some years after the restoration of Charles II., when Cosin, Bishop of Durham, who had been his secretary, erected a monument, with a Latin inscription in which he is said to be "Vir undequaque doctissimus, et omni encomio major."

Wood observes, that he had the character of being the best scholastic divine in England; and Cosin, who perhaps may be thought to rival him in that sort of learning, calls himself his scholar, and declares that he derived all his knowledge from the good bishop. Overall cultivated a particular friendship with Gerard Vossius and Grotius, and some of his letters to those learned men are printed in the *Epistolæ Præstantium Virorum*. The bishop is known in England chiefly by his *Convocation Book*, 1606, *Concerning the Government of God's Catholic Church and the Kingdoms of the Whole World*, 4to, London, 1690; reprinted at Oxford in 1844; in which the author discusses the rights of civil and ecclesiastical governors. This work was solemnly approved by the convocations of Canterbury and York, and was afterwards published by Archbishop Sancroft, but it led to a stir he did not contemplate. (See Macaulay's *History of England*, vol. iv.)

OVERBURY, Sir Thomas, an English courtier, famous for his genius and the tragical history of his life, was the son of Nicholas Overbury of Boorton-on-the-Hill in Gloucestershire, and was born in 1581 at Compton Scorfen, the Warwickshire seat of his maternal grandfather. The early part of his career was one continued course of success. Having enrolled as a gentleman commoner of Queen's College, Oxford, he distinguished himself in philosophy and logic, took the degree of Bachelor-of-Arts in 1598, and came out into the world adorned with every scholar-like accomplishment. On his removal to London for the purpose of studying law in the Middle Temple, he found favour with the lord treasurer, Sir Robert Cecil, and a prospect of court preferment seemed to be opening up before him. The sudden disappointment of these hopes, by driving him to travel, was only the means of securing his ultimate success. He sojourned in different places both at home and abroad, acquiring foreign languages, inspecting foreign governments, liberalizing his manners and opinions, and marking those varied phases of life which he afterwards described with such fidelity and wit in his book of *Characters*. After his return to court, his polished bearing, polite attainments, and large experience, recommended him to the friendship of Robert Carr, an acquaintance to whom he had been introduced shortly before in Edinburgh, and who was now the rising favourite of James I. The travelled and accomplished scholar soon became the bosom confidant and indispensable oracle of the illiterate minion. He dictated his love epistles, supplied him with opinions and plans of action, took charge of all his secrets, and with absolute sway ruled the will that ruled the king. The result was, that those who wished to honour and propitiate the favourite, honoured and propitiated the favourite's master. James I. made him a knight in 1608; the court poets, with Ben Jonson at their head, ascribed to him every attainment and every virtue under heaven; statesmen craved his counsel; and princes sought his society.

Sir Thomas Overbury had now climbed to the pinnacle of power, and, like most other successful aspirants, he was seized with a giddiness which suddenly brought him down headlong. His imperious pride could not brook the thought that any one should be a fellow sharer with him in the affection of Carr, now Viscount Rochester. Therefore, although his conscience had not prevented him from writing the letters and sentimental ditties which had won for his friend the unlawful love of the profligate Countess of Essex, yet no sooner was it proposed to close this intrigue by marriage than he took the most decided measures of opposition. He exhorted Carr, by all his hopes of continued prosperity, not to take such a step; he wrote the famous poem called *The Wife*, for the express purpose of showing him the contrast between a chaste and an immodest spouse; and in express terms he denounced the countess as "a strumpet, and her mother and brother as bawds." It was this interference, and especially the epithets of infamy, that determined his fate. The countess planned a scheme of deadly vengeance; her infatuated lover Rochester, who feared the divulging of the secrets intrusted to his confidant, and her uncle the Earl of Northampton, who aspired to step into the doomed courtier's place, became her accomplices; and it is even said that the king, highly offended at the arrogant bearing of his minion's friend, was privy to the plot. In April 1613, accordingly, Overbury was offered a foreign ambassadorship; by the advice of Rochester he was induced to decline it; and on the 21st of the same month he was apprehended on the charge of disobeying the king's commands, and conveyed a close prisoner to the Tower. The victim was now in the clutches of his murderers, and was destined to expiate his offence by a death of aggravated and protracted pain. He was consigned to a dismal dungeon; his condition was deceitfully kept secret from his friends; not even a priest was allowed access to him; and a ruffian named Weston, who had been hired expressly on account of his knowledge of drugs, was appointed to be sole attendant. Then a process of slow poisoning was commenced. The daily food of the unconscious prisoner was tainted with deadly powders; the very water that he drank was poisoned, and inflamed the ever-burning thirst it was intended to allay; for three months and six days his strong constitution continued to be racked and wasted under the combined action of different drugs; and on the 15th September 1613, when he had become a mere skeleton, covered with a mass of sores, a clyster put an end to his life. The murderers, although successful at first in concealing their guilt, and although favoured by certain unaccountable circumstances connected with the deed, were at length, after the lapse of two years, overtaken by retribution. They were all tried and condemned. The four under-assassins, including Weston, suffered the penalty of the law; and Carr and his wife, now the Earl and Countess of Somerset, although pardoned by the king, were afterwards punished, the former by the loss of the royal favour, the latter by a most painful and loathsome death.

The tragical fate of Sir Thomas Overbury drew atten-

tion to his works, which were not published till after his death. His poem of *The Wife*, though over-elaborated and stiff both in thought and in diction, passed through sixteen editions before 1653, called forth numerous imitators, and is still valuable on account of its discriminating knowledge of human life, and its profound and high-toned moral sentiments. His other principal work, the *Characters*, was also admired for the happy and ingenious conceits, and the graphic delineations, which it occasionally displays amid its crowd of over-strained witticisms and unnecessary details. An incomplete edition of Overbury's productions, under the title of his *Miscellaneous Works*, was published in London in 1632, and was frequently reprinted. The latest and best edition is that published in the *Library of Old Authors*, accompanied with a Life of Overbury by Rimbault, London, 1856.

OVERFLAKKEE, an island of Holland, in the province of South Holland, formed by two branches of the Meuse,—the Haringvliet on the N., and the Volkerak on the S.,—and is bounded on the W. by the North Sea. A part of the island, called Goedereede, was formerly separated from Overflakkee by a branch of the river, but this has been dammed up, and the two islands united. The soil is fertile, producing wheat, barley, potatoes, &c. Length, 25 miles; greatest breadth, 7 miles. Pop. 17,000.

OVERTON, a parliamentary borough of N. Wales, county of Flint, stands in the midst of beautiful scenery on the left bank of the Dee, here crossed by a fine stone bridge, 14 miles S. of Chester, and 21 S.S.E. of Flint. It is a neat and generally well-built place; and has a fine old church, with some yews of great size and beauty in the churchyard. The people live by agriculture, and no manufacture or trade is carried on. Overton unites with Flint and other boroughs in returning a member to Parliament. Pop. (1851) 1479.

OVERTURE (Fr. *Ouverture*), a piece of instrumental music which precedes the opera, the pantomime, the cantata, &c.; and named *Sinfonia* by the Italians. The overture originated in France, and received a settled form from Lulli in particular. The opera overture has now no settled form, but is moulded according to the fancy of the composer. In the latter part of the last century overtures for concert-rooms and theatres were introduced. Among the composers of these were Stamitz, Abel, Lord Kelly (a Scotchman), Vanhall, Haydn, Pleyel. This kind of overture was, in fact, the early form of the symphony, afterwards developed by Haydn, Mozart, and Beethoven. Some writers think that the overture to an opera ought to consist of a sort of analysis of the opera itself; but the Spaniard Don Tomas de Yriarte, in his poem *La Musica*, very properly dissents from that opinion, and considers opera overtures so constructed as

"Diligencia pueril que en vano ostentan;
Porque la imitacion no causa agrado,
Si antes non se conoce lo imitado." (Canto iv., § 6.)

(G. F. G.)

OVERYSSEL, a province of Holland, bounded on the N. by those of Friesland and Drenthe, E. by Hanover and Rhenish Prussia, S. by the province of Gelderland, and W. by Gelderland and the Zuider Zee. Length, from N.W. to S.E., about 60 miles; breadth, 27 miles; area, 1282 square miles. It is entirely low and flat, with few hills and no mountains. The principal river is the Yssel, which separates it from Gelderland, and falls into the Zuider Zee below Kampen. The province is also watered by the Vecht and its tributaries; but none of these is of any importance. With the exception of a tract of rich clayey soil along the Yssel, the surface consists of wet and marshy ground, or of sandy and barren heaths. There are several lakes, but not of any size. The climate is damp, and not very salubrious. Wheat, barley, rye, buckwheat, pulse, potatoes, and fruits, are raised in the more fertile regions; but the inhabitants depend for their subsistence mainly on the rearing of cattle and digging of peat. The pastures are good, especially in the west; and horses, oxen, and sheep are bred. Bees are likewise a source of much profit, and fishing forms a lucrative employment. The chief manufactures are linen, woollen, and cotton fabrics; calico, damask, paper, &c. Spinning, bleaching, dyeing, and boat-building are also carried on. The capital is Zwolle; and among the other towns the chief are Deventer and Kampen. Pop. (1856) 233,723. (See HOLLAND.)

OVIDIUS NASO, PUBLIUS, in some respects the greatest poetical genius of Rome, was born at Sulmo, in the country of the Peligni, on the 20th of March B.C. 43. In that year Cicero was murdered, and on the very day of the poet's birth the consuls Hirtius and Pansa died in the campaign of Mutina. His father, a member of an old equestrian family, was only moderately wealthy. At an early age the poet and his brother Lucius, who was exactly a year older than he, were sent to Rome to be educated for the bar. Though placed under the first teachers of eloquence of that age, Arellius Fuscus and Portius Latro, the poet never took kindly to the study of oratory. His tendencies were all to literature, and especially to poetry. His father, with whom poetry was only a synonyme for poverty, warned him, but in vain, against his favourite pursuit. The death of his elder brother Lucius placed him in circumstances of moderate affluence, and from that time he was allowed to follow out his tastes pretty much as he chose. After completing his education, and mastering the Greek tongue at Athens, he travelled with the poet Macer in Asia and Sicily. After spending nearly a year in the latter country, he returned to Rome. His delicate health and indolent temper disqualified him for active life. It does not appear that he ever practised at the bar. He sat for a short time as a judge in the court of the Triumviri Capitales, and afterwards of the Centumviri, besides acting occasionally as a judge. His chief pleasure, however, was in the literary society of the capital. Among his friends he counted such men as Bassus, Ponticus, Propertius, and Macer. Virgil he only saw once. Horace, who was twenty-two years his senior, he often met. His intimacy with Tibullus was fast ripening into friendship when that poet was prematurely cut off. Unlike most of these literary friends, he owed nothing to the favour of Mæcenas. It is a significant fact that the name of that patron of letters does not occur once in all the poet's works. Ovid was three times married. His first wife proved unworthy of his choice, and was soon put away. His second was in like manner speedily divorced, though her chastity was, on the poet's own admission, beyond dispute. The real culprit in this case was the poet himself. Falling in with the fashion of the day,—a fashion which accorded only too well with his inclinations,—Ovid devoted himself to his mistress Corinna, and probably to other women. When about thirty years of age, he espoused his third wife, a member of the Fabian family. With her he lived happily till his exile, and by her he had his only child, his daughter Perilla. This daughter was twice married, and had a child by each husband. Not long after the birth of the first of these children, Ovid's father died, at the age of ninety. His mother survived her husband only a few months. They had lived to witness their son's rise and growing fame. They were spared the sight of his fall and banishment.

Ovid's life at Rome was on the whole a singularly fortunate and happy one. He had competent means, a house near the Capitol, a pleasant garden between the Flaminian and Clodian ways, a farm of some value in the country of the Peligni, access to the best literary society of Rome, and the favour of Augustus himself. His growing fame as a poet was justified by his three books of *Amores*, his

Epistolæ Heroidum, and his *Ars Amatoria*. The last of these works was published in B.C. 2, the year in which the elder Julia was sent into exile by her father. He had also completed, though he had not published, his *Metamorphoses* and his *Fasti*. He had submitted these, the most valuable and important of his works, to his literary friends, and was engaged in giving them the finishing touches, when he was overtaken by the great calamity of his life. In the year A.D. 8, he was banished from Rome. The place of his exile was Tomi, or, as he himself calls it, Tomis, an old Milesian colony on the shores of the Black Sea, near one of the mouths of the Danube. His sentence was a simple *relegatio*, and did not involve the loss of citizenship or the confiscation of his property. He has himself described with the most touching pathos (*Trist.* i. 3) the last night he was allowed to spend in Rome, and the pangs with which he tore himself for ever from his friends and family. The voyage to Tomi occupied the greater part of a year, and more than once the poet was in danger of his life from shipwreck. When at last he reached his destination, it almost seemed as if death would have been preferable. Tomi could hardly be said to be within the pale of civilization. The inhabitants were barbarous and ignorant, the soil barren, and the climate so cold that in winter even the wine froze. Savage hordes of Getæ from the northern banks of the river sometimes attacked the place, and rendered life itself insecure. It is hardly to be wondered at that in his petitions to be recalled, or at least transferred to some less utterly miserable place of exile, the poet should use the language of fulsome and even abject flattery to Augustus. But the emperor was inexorable; and neither the poet's own urgent prayers, nor the interest of his friends, availed to procure any mitigation of his sentence. He was left to drag out his remaining years, a prey to anxiety and despair, perhaps also to remorse. With his new townsmen he ingratiated himself by learning their language, and versifying their local legends and traditions. So popular did he make himself among them by these arts, that they passed a decree exempting him from all taxes. While his health allowed, he spent his time in putting the finishing touches to his *Fasti*, and in writing those letters to his wife and friends at Rome which we now possess in four books, under the title of *Letters from Pontus*. To this period of his life we also owe his *Ibis*, and the five books of the *Tristia*. It is from this last-named work that the events of the poet's life are chiefly known. Ovid died at Tomi A.D. 18, in the sixtieth year of his age and tenth of his exile.

Much has been written, and to little purpose, on the cause or causes of Ovid's banishment. The ostensible ground was the immoral tendency of many of his writings, especially his *Ars Amatoria*. But he confesses that this was a mere pretext, and hints obscurely at some "error" as the real cause of his punishment. What this "error" was, it is useless to conjecture; but we may conclude that it partook of the nature of a grave moral offence, as, on the poet's own admission, it deserved a severer punishment than even the very severe punishment it received. It was long a favourite theory with some scholars that the crime in question was an intrigue with the emperor's daughter Julia, the Corinna, as they maintain, of the *Amores*. A refutation of this view, however, is contained in the fact, that Julia was exiled ten years before her supposed paramour. A more plausible theory is that which alleges an intrigue between the poet and the younger Julia, the emperor's grand-daughter. It is a strong objection to this view that Ovid was old enough to be the younger Julia's father; but it receives a curious confirmation from the circumstance that they were both banished in the same year. The idea that he fell under the displeasure of the imperial family for his political views, is both at variance with his own statements, and is not sufficiently supported by historical evidence. The real cause was no doubt the "error" to which he himself alludes. What that "error" was, is, and is likely ever to be, a mystery.

The longest and most ambitious of Ovid's works is his *Metamorphoses*, in fifteen books. It is the only one of all his writings in which he does not use the elegiac metre. The mythologies of Greece and Rome furnished Ovid with the materials for this work, which comprises every, or nearly every legend and tradition involving, as the name implies, a transformation. The component parts are worked into a harmonious whole with rare skill; while many of the episodes are unrivalled in Latin literature for vigour of fancy, warmth of colouring, and simplicity and variety of diction. Next in importance to the *Metamorphoses* come the *Fasti*, in twelve books, six of which only have survived. This work is a kind of poetical Roman calendar, in which, beginning with January, he describes the rites and festivals peculiar to every day of every month, preserving every old story or interesting legend attached to each. As much of this work was drawn from the oral traditions current among the common people, and from ancient chronicles extant in his day, but long since lost, the *Fasti* form a valuable historical monument. It is inferior in general effect to the *Metamorphoses*, but is read with interest for the events it relates, and with pleasure for the real poetry with which these are set off. Of his minor works, the *Amores* and the *Ars Amandi* are notable for the deep knowledge of human nature, and especially of the female heart, which they display. The general tone of both is indefensibly immoral, and in many passages they breathe a warmth and even grossness of passion which nothing can excuse. The effect of such writings could not but have been dangerous to the morals of the people, and the danger is enhanced rather than diminished by the transparent veil under which the author affected to hide his voluptuous pictures. Even his *Epistolæ Heroidum*, a work still highly popular as a text-book for schools, is far from being quite free of these vices. In addition to the works already mentioned, Ovid wrote a tragedy entitled *Medea*, which is mentioned in terms of praise by Tacitus and Quinctilian. It has long since perished.

The memoirs of Ovid are numerous. The most careful and elaborate, though not the most correct, is that of Masson, originally published at Amsterdam in 1708, and frequently reprinted since that date. The most accurate and reliable, besides the most interesting, is the Life of the poet in Italian by Rosmini, Milan, 1821. Besides these there are numerous shorter sketches, of which may be specified the two old Latin biographies generally prefixed to the larger editions of Ovid's works, and those by Manutius, Paulus Marsius, and others, which are given collectively in Burman's edition.

The *editio princeps* of Ovid appeared at Bologna in 1471, and at Rome in the same year. The first Aldine edition was published in 1502. The Elzevir edition of Heinsius appeared at Leyden in 1629; and that *In usum Delphini* at Lyon in 1689. The best is that of Burman (see BURMAN, *Peter*), Amsterdam, 1727, which has not been superseded by the later French edition of J. A. Amar in Le Maire's *Bibliotheca Latina*, or by the German one of J. C. Jahn, Leipsic, 1828. The editions of the separate works are numerous, and some of them excellent. The translations of Ovid into the languages of modern Europe are very numerous. Of these we can only indicate here a few of the best that have appeared in English. The most admired is "Ovid's *Metamorphoses*, in fifteen books, translated by the most eminent hands," London, 1717. The "eminent hands" in question were Dryden, Addison, Congreve, Rowe, Gay, Phillips, Croxall, Sewell, and, Garth; the last of whom wrote the preface and saw the work through the press. This version has been frequently reprinted. The earliest English verse translation of the *Meta-*

morphoses is that of Arthur Golding, London, 1567. The first five books of the same work were "Englished in verse, mythologized, and represented in figures" by G. Sandys, Oxford, 1626. A blank-verse translation of the whole poem was published by Howard in London, 1807. The *Epistles* were rendered into English verse by several hands,—viz., Dryden, Otway, Settle, and others. This translation, which has been several times reprinted, appeared first in London in 1680, with a preface by Dryden. Of the literal prose translations may be mentioned that by Clarke, London, 1735; another which appeared in 1748; and that by H. T. Riley, published in 1851–2, forming 3 vols. of Bohn's Classical Library.

Ovid has always been highly popular in France; and the French translations of his various works are very numerous. A very complete list of these is appended to the article on Ovid in the *Biographie Universelle*, by M. Villenave. (J. C—L.)

OVIEDO, a province at the northern extremity of Spain, constituting the greater part of the principality of the Asturias, lying between 42. 57. and 43. 38. N. Lat., 4. 35. and 7. 4. W. Long. Its natural limits are so marked as not to have been much disturbed in the various governmental divisions; and its actual boundaries are,—N., Bay of Biscay; E., the province of Santander; S., Leon; W., Lugo. It is separated from Santander by the River Deva, and from Lugo by the River Eo. Its greatest length, from E. to W., is 147 miles; breadth, from N. to S., about 53; and its area, 3674 square miles. It has a coast-line of about 148 miles, from Rivadeo on the W., to Santiuste on the E., of extremely irregular outline, bristling with headlands, of which the most prominent are the Cabo de Peñas, de Torres, and San Lorenzo, and indented with creeks and estuaries, into which numerous streams descend, which being of little volume, and encountering a stormy sea, deposit dangerous bars. The chief of these estuaries are those of Navia, Pravia, Avilés, and Villaviciosa. Little has been done to improve the naturally bad harbours, of which the principal are those of Gijon, stretching 2 miles inland, from between Capes Torres and San Lorenzo; Ribadesella, with 10 feet of water on its bar; and Lastres. Jovellanos projected a harbour in the Bay of El Musel, near Gijon, protected by Cape Torres. There is no bar; the bottom is firm and level; and the execution of this project is most important for the development of the province. The surface of the country is extremely broken by two chains of mountains and their offshoots. A branch of the Pyrenees, formerly known as the Hervaseos, extending in an unbroken line parallel to the coast from Leitariegos to Peñamellera, forms the south rampart of the province, and sends off innumerable cordales, which form, at their junction with the main cordillera, deep and precipitous valleys, but broaden and diminish as they proceed, cultivated in terraces, or covered with oak and chestnut forest. The main chain is very lofty, rising in some parts to more than 10,000 feet, and presents a series of conical summits, covered with snow some months in the year, and generally loaded with the masses of vapour from the Atlantic which they arrest. Another chain of less elevation stretches from Pravia on the W., to Peñamellera on the E., where it joins the former; and the comparatively broad spaces between the cordales and the south declivities of this "cordillera of the coast" are the most fertile and delicious valleys of the Asturias,—traversed by numberless streams, covered with verdure, and very populous. Next the coast is an isolated group of mountains, from Buron westward, where offshoots descend into the sea. The principal rivers are the Nalon, Narcea, Navia, Piloña, Sella, and Eo. Nalon, which is the largest, rises in the pass of Tarna, flows N.W. 62 miles, and falls into the Bay of Biscay at Mures. Especially after its junction with the Narcea in Ambas Mestas, its waters abound with fish, salmon, lampreys, trout, and mullet; at its mouth are valuable salmon-fisheries. Narcea, also a good fishing stream, and for most of its course rapid, rises on the borders of Leon, receives the Nioron and the Pigueña, and joins the Nalon on its right at Pravia, after a course of 54 miles. The Navia rises in Lugo, and flows N.N.E. about 90 miles to the sea at Navia. The Piloña or Infiesto, from Peñamayor, joins the Sella at Las Arriondas, and falls into the sea at Ribadesella. The Eo, rising in Lugo, has a N.E. course of about 50 miles, and joins the sea at Rivadeo, in a beautiful bay famed for its salmon and its oysters. Communication with Galicia and Castile is possible only by the eighteen or twenty difficult passes of the south cordillera. The Camino Real along the coast from Santander to Ferrol is also extremely bad, broken, and impassable in winter, being almost quite unprovided with bridges; and the roads in the interior, with few exceptions, are proportionally wretched, seldom pretending to be anything more than rough bridle-paths.

In regard to geological structure, the province may be divided into three districts. Of the west part, between the rivers Eo, Navia, and Narcea, the base is transition or Cambrian rocks. The principal rocks are slate, trap, and quartz; among which are some thin beds of limestone which bear traces of very ancient exploration, and various groups of igneous formation—more frequently veins of oxide and carbonate of iron, and magnetic pyrites, to which class of Cambrian belongs also the Cabo de Peñas. The eastern part of the province, with the chain of hills from Leitariegos to Peñamellera, and its cordales, is of Silurian formation, limestone predominating, with occurrence of slate and quartzy rocks, over which the soil is thin and poor. This part presents the strikingly picturesque scenery peculiar to its formation, among the aspects of which may be mentioned the singular gulfs or subterranean passages of the mountain streams, and many caves of great extent, as that of Sequeros in the concejo of Tineo, adorned with beautiful stalactites. Among the valuable mineral products of this tract are building-stones, marbles, lithographic stones, and coloured marls; with veins of copper, cobalt, iron, calamine, antimony, argentiferous galena, and coal of an inferior quality. The centre of the province is carboniferous, abounding with organic remains; and its mineral products are coal, gypsum, salt from various springs, as of Sariego Muerto, and Sariego de Siero. There are extensive chalk deposits in the coasts of Gijon, Villaviciosa, and Colunga, and in the central concejos of Llanera, Siero, &c. Deposits of turf in Cudillero, Artedo, and other points, supply their population with fuel.

Agriculture is very backward, although, in spite of the unequal surface, the humidity, and the much ground occupied with sterile rock and sand, this province enjoys a climate and soil of rare excellence, as is proved by the variety and abundance of its products even in its neglected state. Wheat is not much grown, and the little is partly exported. An early indigenous variety, called *escanda*, is used. The staff of life is maize, made into a kind of bread called *borona*. Beans, pease, and potatoes are grown everywhere. Great quantities of rye and hay are grown in the poorer tracts. The fruits and legumes are excellent, especially the stone fruit of Candamo and the limestone tracts. From Llanes to Avilés, in the coast *concejos*, and in many districts of the interior, large quantities of apples are grown, from which cider is made,—the favourite beverage of the province. It is also exported to the neighbouring provinces and to Spanish America. The oak and chestnut forests supply bark for tanning, charcoal for the iron-works, and wood for construction. The hazel grows wild plentifully along the streams, and the nuts are exported to England from Gijon and Villaviciosa. In the small towns the cherry, fig, plum, pear, walnut, and chestnut are abundant.

Oviedo.

Along the whole coast the orange and lemon were grown when there was an export trade; their occurrence is now limited to the part between Llanes and Ribadesella. The growth of wine, general in the Asturias before the sixteenth century, is now confined to Candamo, Grado, Tineo, and some of the western districts. Among useful but less cared-for products, are the bilberry (used in dyeing leather), madder, kermes, hop, and saffron. In the large natural pastures are reared, by a system of migration, great quantities of horned cattle, sheep, and goats. The refuse of maize and acorns support many swine. The horses are small, but strong, sure, and active. The excessive division of property, and ignorance of good methods, combine to injure greatly the agricultural prosperity of the province; and though the cultivation, such as it is, has continued to push its way and reclaim useless ground, this has not always been done with prudence, and the effect has been in many cases, by loosening the exposed and precarious soil, to convert good though rough pasture into utter rock and barrenness. The wolf, fox, and hare are frequent; but the larger game—the bear, wild boar, deer, and mountain goat—have disappeared, and are only to be met with in the wildest parts of the S. cordillera. Partridges, quails, woodcocks, &c., are frequent.

The mineral industry of the province is the most important, but more so in prospect than in reality. Jovellanos was the first to direct public attention to the extent and value of the coal deposits, and much has been done since his time, though the want of native enterprise, of good harbours and roads, and the supineness of government, have been heavy drawbacks. Coal in great abundance and good quality is found chiefly at Langreo, Tudela, Santofirme, Mieres, Ferroñes, Lieres, Nava, and Torazo. The quantity extracted at Langreo in 1847 amounted to 5000 cwts. daily. At S. Maria del Mar, in Avilés, where are galleries under the sea-bottom, it is not so good. The whole amount extracted in 1847 was 473,000 cwts. Other minerals have been already indicated. Iron is found in many places, but is not worked to any extent, except in Castropól. Langreo, which, with iron, has all the necessary adjuncts of coal, water-power, and tolerable roads, is not taken advantage of. Copper is found at Po de Cabrales, Caldueño de Llanes, &c.; cinnabar to some extent at Mieres. The cobalt of Peñamellera, and the argentiferous lead of San Estévan de Leces, near Ribadesella, have been abandoned. The ancient tin mines at Salave are deserted. The principal manufactures are,—utensils of copper at Avilés; nails and iron instruments at Boal, La Vegiña, Coaña, Navia, Castropól, &c.; linens and damasks in Avilés (a house manufacture of coarse linens and quilts is carried on in all the rural districts); pottery at Ceceda, Faro, and Avilés; common delft at La Pola de Siero. In Oviedo and Gijon a good deal of beautiful cabinet-work is made with the walnut, cherry, yew, and other native woods. Fish are cured for export at Cudillero, Luanco, Candas, and Lastrés. Lard is made at Salas, Piloña, &c.; cheese at Cabrales. The commerce of the province has been sufficiently indicated. For internal trade there are fairs at Oviedo on Assumption Day, All Saints', and St Matthew's; at Gijon on St Ferdinand's and St Michael's; at Avilés on St Augustin's; at Villaviciosa on St John's; but they are much decayed.

The Asturian is strong, enduring, and laborious, of simple and primitive habits, and proverbial thrift. Many migrate yearly to the various provinces of Spain, particularly the wine-growing, where they become domestic servants, or engage in shop-keeping, &c., and having acquired a competence, return to their native hills. The dialect, called *bable*, is nearly identical with the ancient Castilian. Jovellanos endeavoured to enrich the literary language with ancient words, which it alone preserves, and to illustrate by it the progress of the national tongue and the changes of national manners. In this secluded region, among this hardy stock, an infinite number of primitive usages are preserved in weddings, games, funerals, and church ceremonies, of whose antiquity documentary evidence exists in the charters and municipal laws granted by the native princes, from Alonso VI. downwards. For a similar reason, the church architecture of the Asturias—the most ancient in Spain, perhaps in Europe—is interesting, giving a period of transition from the Roman to the later pointed Gothic or Tedesco. It has many points of resemblance with the early Saxon. Good specimens are the S. Maria de Naranco, the S. Miguel de Lino, and the S. Julian, at Oviedo.

The province of Oviedo (*Asturia Transmontana*) was first properly subdued by Publius Carisius under Augustus. The names of several towns, various inscriptions, and vestiges of mines, attest the Roman dominion. It was the last province in Spain to submit to the Goths. In the eighth century Pelayo took refuge there after the fatal battle of the Guadalete, and the Asturians maintained their independence under his descendants throughout the Moorish period. The Asturias was made a principality in 1388, and the title conferred by Don Juan I. on his son Enrique, in imitation of the title of Prince of Wales, when Enrique married Catharine, daughter of the Duke of Lancaster. Oviedo suffered much in the war of independence—the capital being twice plundered, once by Ney in May 1809, and afterwards by Bonnet. The Asturians are considered by Spanish writers to have done miracles in that war; but the only important step they took was to send the Conde de Toreno for assistance and money to London. There is a kind of Bœotian stigma on the Asturias; but they have produced many eminent men, of whom it will be sufficient to mention the name of Jovellanos, poet and patriot, worthy of a more grateful country. The province is divided into 15 partidos; and in 1849 had a population of 450,610.

OVIEDO, chief town of the preceding, is situated about 14 miles S. of Gijon and the coast, on a slope. About a mile to the N.W. is the Sierra de Naranco, 1070 feet above the sea, by which the town is protected from the N. winds, though the vapours collected by it in the spring and autumn render the climate extremely humid, and do not conduce to its salubrity. Most part of the town was burned in 1521, and the reconstruction, till within some years, has been irregular. The four main streets are formed by the roads connecting Gijon and Leon, N. and S., and Santander and Grado, E. and W., which cross each other in a central plaza. The streets are clean and well-lighted; the houses are built with projecting roofs. In the central plaza are the Casas Consistoriales, with a piazza,—the finest, it is said, in Spain. There are two prisons: one known as the Real Castillo—the fortress, with some changes, built by Alonso III., A.D. 913, on the west in an angle of the walls. It was partly destroyed with gunpowder by General Bonnet in 1818. The other is called the Carcel Galera. There is a theatre, capable of containing 700 spectators. The university, founded by Philip III. in 1604, after the project of Valdés, Archbishop of Seville, is a square building, 180 feet every way; the N. gate has two lofty Doric pillars on each side; the E. gate is more handsome. These entrances open on a central court with pillared galleries. The university has a library, founded in 1764, of 12,000 volumes; a museum of natural science, particularly mechanics and chemistry; and various theological and philosophical chairs. There is a normal school, three other public schools, and 17 private. The poor-house (*Hospicio Provincial*) is a large and handsome edifice, of date 1752. In 1837 the three hospitals of the town were consolidated into a general hospital in the ex-convent of San Francisco. The present cathedral was commenced in the fourteenth century, the previous church, erected in the ninth century, being taken down, and nothing is now left of it save the Camara Santa. The west front

has a fine portico of ornamented arches, with two lateral towers, of which the completed one rises 200 feet; the uncompleted tower was surmounted in 1575 with a pyramidal top. Of the lateral chapels, the most remarkable are the Capilla del Rey Casto (Alonso II.), where are the remains of many successive princes of the House of Pelayo; and the Camara Santa, containing in an arca the relics saved by Don Pelayo when he fled to the Asturias. Besides the cathedral, there are four parish churches and six convents in Oviedo. The churches remarkable for their early architectural style have been already mentioned. Outside the town, on the Gijon road, is a black marble monument to Jovellanos, re-erected in 1835. The industry of the town, and productions of the neighbouring country, have been indicated in the preceding article. Pop. (1847) 9384.

OVIEDO Y VALDEZ, Gonzalo Fernandez de, an early historian of the New World, was born at Madrid, of noble descent, in 1478. He was attached in his boyish years to the court of Ferdinand and Isabella as one of the pages of Prince John, where he received an excellent education. The discoveries of Columbus had just opened up the New World to Spanish enterprise; and in 1513 Oviedo was sent out to San Domingo as a supervisor of gold smeltings, where, except occasional visits to Spain and Spanish America, he remained during the rest of his life. In this position he is said to have treated the natives of the island with great cruelty, so that their gentle and feeble race rapidly melted away under the harsh servitude of the gold mines. In addition to his original appointment, Oviedo held several important offices under the Spanish government in Hayti. He had always exhibited a passion for writing; and the post of historiographer of the Indies to Charles V. was quite to his liking. Besides some inconsiderable chronicles of Ferdinand and Isabella, and of Charles V., and a Life of Cardinal Ximenes, he wrote two works of abiding interest and value: one was *La General y Natural Historia de las Indias Occidentales*, consisting of fifty books, of which twenty-one were published at Seville in 1535, while the rest remain still in manuscript. Several editions of this History have been published, of which the latest is that begun in 1851 by the Real Academia de la Historia, Madrid. It was translated into French by Poleur in 1556, and into English by Eden in 1555. This work contains a great mass of valuable information, thrown together in a crude, indigested state, and written in a loose, rambling, moralizing style, sadly provoking to the reader's patience. It is worthy of notice also, that his contemporary, the brave and philanthropic Las Casas, the defender of the American Indians, a man who had ample means of knowing about the affairs of the New World, denounces the History of Oviedo as "as full of lies almost as pages." The benevolent churchman and the courtly historian had separate interests, however, which kept up a constant hostility between them. Las Casas was doubtless much the nobler man of the two, but Oviedo was not therefore necessarily a wholesale fabricator. The other work for which Oviedo is still esteemed among scholars is *Las Quinquagenas*, written during the latter years of the author's life, and devoted to fond recollections of his native land, and of the principal characters who had figured there during his time. It consists of a series of immethodical dialogues, full of gossip and curious anecdote, drawn from the memory of a long life. It occupies three folios of MS. in the National Library of Madrid, but has never been printed. The author concludes by saying that it was finished on the 23d May 1556, when he was seventy-nine years old. He died at Valladolid during the following year. (See Ticknor's *Hist. of Spanish Literature*, vol. i., p. 514; and Prescott's *Ferdinand and Isabella*, vol. i., p. 187.)

OWEN, John, the eminent Puritan divine, was the son of Henry Owen, vicar of Stadham in Oxfordshire, where he was born some time in the year 1616. His biographers have traced his lineage backward to one of the five regal tribes in Wales; but we shall not here attempt to untwist the tangled knot of Welsh genealogies. He received his earlier education in the private academy of Edward Sylvester at Oxford, where the immortal Chillingworth had also been a pupil; and at the strangely precocious age of twelve entered as a student at Queen's College, having for his tutor Thomas Barlow, who was even then distinguished, and who subsequently rose to the see of Lincoln. He pursued his studies with an excess of application which would have destroyed most constitutions, and which left some seeds of future suffering even in his iron frame; for he allowed himself during many years only four hours for sleep, though the evils of this course were so far counteracted by his indulging in some of the most robust amusements of his college, and by the daily practice of music, in which he received lessons from Dr Thomas Wilson, the preceptor in the same delightful art of Charles I. Many years before the completion of his studies, Laud had been raised to the chancellorship of Oxford, and had begun to impose upon the students many of those rites and ceremonials which the Reformers had most severely condemned, the penalty of resistance to his demands being nothing less than expulsion from the university. All the worldly interests of Owen pointed to compliance with the innovations of this bigoted ecclesiastic; but convinced that very much of what Laud imposed was in itself wrong, and that what was in itself indifferent ought not to be complied with when sought to be bound upon the conscience as of Divine authority, and thus finding his way to the true standing-ground of the Puritans, he refused subjection to the innovations; and at the early age of twenty-one left Oxford, self-exiled for conscience sake. He found a home as chaplain and tutor, first in the family of Sir Robert Dormer, and subsequently in that of Lord Lovelace in Berkshire; but meanwhile the unconstitutional measures of Charles had driven the Parliament to arms, and placed the country in a state in which it was impossible for any honest man to remain neutral. It found the nobleman and his tutor on opposite sides; the former taking part with Charles and royal prerogative, the latter with the Parliament and popular rights. The loss of an honourable and lucrative post was not the only sacrifice which Owen had now to make at the call of duty; for about the same time he was disinherited, because of his opinions, of large estates, by a royalist uncle in Wales. Dispirited by these losses, he came to London, where sorrows of a deeper source, and having their origin in religious anxieties, greatly aggravated his sadness. Under the burden of these heavier griefs, he is described by his biographers as going on a certain Sabbath to hear the famous Presbyterian minister, Edmund Calamy, preach, when a rustic preacher, whose name he could never afterwards discover, to his great disappointment, entered the pulpit, and so met his difficulties in his discourse as to introduce him into a state of settled mental peace.

In 1642, Owen gave to the world his first literary production, *The Display of Arminianism*, which was intended to stem the current of theology that had become fashionable under the influence of Laud, and which, like all his other great compositions, holds its place, after the lapse of two centuries, as a standard work on the subject on which it treats. One incidental effect of its publication was to attract towards him the favourable notice of the committee for purging the church of scandalous ministers, who, in consequence, invited him to accept the pastorate of Fordham, a village overhanging the pleasant valley of the Stour between Suffolk and Essex. Not long after, he was transferred to the pastoral care of Coggeshall, an important market-town in Essex, where he soon found himself surrounded by a

congregation of 2000 people, numbers of whom were attracted by his weighty words from the neighbouring parishes; and while in this place he adopted views on the subject of church government which approximated to, though they never became identical with, the modern Congregational platform. From the same place emanated one of his greatest works, on which he owns himself to have expended much of the thought and toil of seven years, *The Death of Death in the Death of Christ.* During Owen's incumbency in this town, the neighbouring town of Colchester was besieged by the parliamentary army under General Fairfax; and Coggeshall having been the head-quarters of the general during the ten weeks of the siege, a friendship was formed between him and Owen which proved one of the links in the chain that drew him forth soon after into public life. His solid and enlarging reputation had already led to his preaching before Parliament; but at length he was unexpectedly summoned to preach on the day after the execution of Charles; and the manner in which he performed this task has been regarded by many as presenting one of the most vulnerable points in his public life. It is remarkable that throughout the entire sermon no reference is made to the awful tragedy of which he must have been aware that every mind was full; and this has been denounced as selfish and cowardly temporizing, and a forgetting of the fearless fidelity that became his position. But what evidence is there that he condemned the act of which it is well known that Milton and many others approved? And if he even hesitated in his judgment regarding it, then the silence which he adopted was his wisest and most honest expedient. The *Discourse on Toleration*, which he appended to this sermon when published, and which he dedicated to Parliament, occupied the same ground as the treatise of Locke on the same subject,—viz., that "errors in religion are not punishable by the civil magistrate, with the exception of such as in their own nature disturb the order of society"—did much to confirm the opinions of the religious party of which he was the head, as well as to shape the sentiments of the political leaders and patriots of the age. Cromwell had not yet chanced to meet with the pastor of Coggeshall; but on an early occasion, when he was once more appointed to preach before Parliament, the Lord-General and the chiefs of the army were present; and on the following day, happening to meet in the garden of Fairfax, proposals were made by Cromwell to Owen to accompany him on his contemplated expedition to Ireland, both as chaplain and in order to investigate and amend the affairs of the University of Dublin. It was with little grace that Owen yielded to the wishes of Cromwell, whose proposals were gradually assuming more of the shape and tone of commands; and with less grace still did his flock consent even to a temporary separation. But the issue deserved the sacrifice. For the effect of Owen's visit was to awaken a deeper interest in the religious condition of Ireland, to reform the rampant abuses of the university of Dublin, and to obtain for Trinity College valuable immunities, which it still enjoys. He had scarcely been welcomed back from Ireland to Coggeshall, when a command of Parliament ordered him, along with Joseph Caryl, to accompany Cromwell, in the cause of the Commonwealth, to Scotland, and cast him a second time amid the uncongenial din of sieges and of battlefields. It has been surmised that Cromwell desired his help in his anticipated discussions with the Scottish ministers; and some have even affirmed that his hand can be distinctly traced in the letters which Cromwell addressed to the ministers who had taken refuge in the castle of Edinburgh, which certainly abound in "lumbering sentences with noble meanings." Owen was allowed to return to Coggeshall many months before Cromwell received his "crowning mercy" at Worcester, but it was only to find himself soon after severed from its seclusion and quiet activities for ever; for on the 18th of March 1651, "the House, taking into consideration the worth and usefulness of John Owen, M.A., of Queen's College, ordered that he be settled in the deanery of Christ Church, in the room of Dr Reynolds;" and on the 9th of September of the following year, letters from Cromwell nominated him vice-chancellor of the university; and thus he entered the gates of Oxford to become the head of that great and ancient seat of learning, from which, ten years before, he had consented to be exiled for conscience sake.

The elevation of Owen to the vice-chancellorship gave him the virtual command of the university; and a mind of no common energy and wisdom was needed to restore it from the ruined state into which the civil wars had plunged it. Casting itself with something more even than common chivalry into the cause of the royalists, it had not only drained its treasury and melted its plate, but incurred an overwhelming debt; halls and colleges, empty of students, had been transformed into barracks and powder-magazines; while many of the students who had become soldiers, returning again to their books, brought back with them the insubordination and the profligacy which they had learned in the camp and the field. We do not wonder that the hand of Owen trembled as he seized the helm of Oxford at such a period. But his administration was firm, liberal, and conciliatory. While profligate students were treated with a rigour which led him in some instances even to interfere with his own hand, and cast them into "Bocardo," the studious were encouraged, and poor students of merit admitted to free commons. While the law furnished him with ample power for disturbing the worship of Episcopalians, it was allowed to proceed in peace over against his own door; the jealousy of the Presbyterians was disarmed by his placing some of their most eminent and qualified men in offices of high honour and emolument; the religious condition of the students was sought to be improved by the regular ministrations of himself and Dr Goodwin in St Mary's church; and so great was the change wrought in a few years in the general condition of Oxford as to evoke at length the reluctant praise of Clarendon.

But even the government of a university, and the raising of its affairs from the brink of ruin, were not sufficient to exhaust the resources of Owen's mind at this period. Several of his greatest theological treatises, such as his *Diatriba de Divina Justitia;* his work on the *Perseverance of the Saints*, which extends over more than five hundred folio pages; his *Vindiciæ Evangelicæ*, of almost equal colossal bulk; and his practical treatise on the *Mortification of Sin in Believers*,—which might have been sufficient of themselves to absorb and to recompense the energies of a lifetime,—bear date during the period of his vice-chancellorship. And during the same engrossing period he was consulted and employed by Cromwell on almost every measure which contained in it an ecclesiastical element, and had for its avowed object the promotion of religion in England. We find him, under the immediate auspices of the Protector, engaged with divines of other sects in devising measures of ecclesiastical union and comprehension; holding a prominent place in the famous "Committee of Triers," for ejecting ministers and schoolmasters of heretical doctrines or scandalous lives, and giving liberal advice, in the face of some fanatical and violent opponents, on the admission of Jews to settle and trade in England. On one part of his conduct alone at this period has he been severely blamed by his enemies, while even his friends have in general only ventured on a timid and hesitating defence. We refer to his allowing himself to be returned as representative for the university of Oxford to the Parliament which was summoned by Cromwell to meet in 1654, and to his taking his seat in the face of the representations that he was disqualified as a clergyman. His zeal for the endangered interests of his university was no doubt the motive which prompted him

to assert this doubtful position; but when he found the validity of his election so vehemently and plausibly questioned, he would have consulted his dignity more had he declined to sit. His patriotism shone out with true lustre not long after, when, on the proposal of a majority of Parliament to bestow upon Cromwell the crown and title of King, he joined with Fleetwood and the majority of the army in opposing the movement, and even drew up the petition which is known to have defeated the measure, and to have constrained Cromwell to decline the perilous honour. This bold step, which made the Commonwealth his debtor, so far estranged from him the affection of Cromwell, and cost him his vice-chancellorship. He resigned the presidency of Oxford, and yielded up the academic fasces into the hands of Dr Conant, his Presbyterian successor, with dignity. Referring to the number of persons that had been matriculated and graduated during his administration, to the professors' salaries that had been recovered, to his successful defence of the rights and privileges of the university, to the visible reformation of manners among its students, and to the fact that he left its treasury increased tenfold, "I seek again," said he, "my old labours, my usual watchings, my interrupted studies."

The next public movement of importance in which we discover the presence of Dr Owen, who had been diplomated some time before his administration at Oxford ceased, is in the conferences of the Savoy Assembly or Synod, in which a "Confession" expressive of the faith of the Independents was framed, after the manner of that which had already been drawn up by the divines at Westminster, and in which he took the leading part. Except in its sections on church order, it very closely resembled, not only in sentiment, but in phraseology, the earlier compend, and served at the time of its compilation both to unite the party of the Independents in closer confidence among themselves, and to distinguish them from violent and fanatical sectaries who sought to obtain sanction for their extravagances under a respected name. But before the Savoy conferences were ended, the great spirit of Cromwell had left the world; and his death had taken from the Puritans the best security for their precarious liberty. It is the work of general history to describe the resignation and retirement of Richard Cromwell, the mysterious secrecy and duplicity of Monk, and the return of Charles to the throne of his ancestors, without any pledge being obtained for the rights of conscience and for liberty of worship beyond the promise that "he would have respect to tender consciences"—a pledge which was intended to be kept only so long as it was unsafe to violate it. The act which restored the king restored the laws, both civil and ecclesiastical, to the state in which they had been at the commencement of the war; re-established the hierarchy; and constituted all classes of Nonconformists a proscribed class. The years which followed accordingly exhibit the gradual diminution of the liberties of the Puritans, and their subjection to a succession of acts which left them the alternatives of silence, or conformity, or suffering. Owen, by this time severed also from the deanery of Christ Church, became the pastor of a little flock in his native village of Stadham, hoping in that obscurity to escape notice without being forced to silence. Informers, however, armed with powers supplied by the Conventicle and Five Mile Acts, as well as by the Act of Uniformity, and prompted by bribes, drove him even from this narrow sphere, rendering it only safe for him to whisper truth in upper chambers, or in midnight assemblies. The breathing times from persecution which were afforded by the plague and by the great fire in London were eagerly improved by Owen and the other Puritan preachers, who reared vast wooden structures, called *tabernacles*, in which their long silent voices were once more heard by wondering and awe-struck thousands. The Act of Indulgence by Charles, however questionable in its motives or in its principles, only gave back to the Nonconformists what was their right; and, taking shelter under its precarious protection, Owen ventured to form a church in Leadenhall Street, where there gathered around him many of the heroes of the wars of the Commonwealth, "honourable women not a few," and pious noblemen, such as Lord Wharton, who, while they did not join his church, delighted to wait on his ministry. His confidential intercourse with these noblemen enabled him at times to learn the dangers that threatened Nonconformity, to apprise his suffering brethren in rural districts of coming evils, and it is even understood afforded him the gratification of helping to release Bunyan from his prison at Bedford. While the liberty of preaching was thus restrained and fitful, Owen did noble service at this period with his pen, and made some of his greatest bequests to posterity. Only once in his many controversial combats did he retire unquestionably vanquished from the field. Having rashly called in question the statements of Walton in his Polyglott, in reference to the various readings in the original manuscripts and versions of the Scriptures, and having with equal rashness ascribed consequences to those statements which they did not bear, he drew down the exposure of the proud ecclesiastic, who proved by the tone of his answer that he was not displeased to find an opportunity of laying the leader and champion of the Puritans in the dust. But he was more than compensated for his mortification in this instance by his triumph over Parker in his argument against toleration, and in his base attempts to blacken the character of many of the Nonconformists,—a work in which Owen was at length joined by Andrew Marvel, in his *Rehearsal Transprosed*, which turned the laugh even of Charles and his court against the truculent defamer, and held him up to immortal infamy. It would occupy undue space simply to enumerate all the works of Owen which belong to this closing period of his life, and which were often born amid the depression and the darkness of persecution. Amongst his devotional and practical writings, those on *Communion with God*, on *Temptation*, on *Indwelling Sin*, and on *Spiritual Mindedness*, belong to this period; among his controversial works, his discussions on *Schism*, and his *Animadversions on Fiat Lux;* among his theological treatises, his *Theologoumena*, his work on the *Holy Spirit*, and his *Christologia;* and among his expository compositions, that on the 130th Psalm, and his *Commentary on the Epistle to the Hebrews*,—the gigantic work of a gigantic mind, which, for exhaustive fulness, exegetical tact, matured learning, and profound piety which doubles his power as an interpreter, stands unapproached, except by the colossal work of the Dutch Vitringa on Isaiah. His latest writings make it evident that his desires were intensely turned, towards the close of his life, to two great objects—union among Protestants, and the resistance of Popery; while his course as an author was sublimely closed by his *Meditations on the Glory of Christ*, to the first sheets of which he gave his finishing touch on the day of his death. That death came while he yet stood only on the confines of old age. The calm and the kind hospitalities of Lord Wharton's house at Woburn, and the sweet seclusion of Ealing, could do little to alleviate the asthma and the torturing stone which were shaking his iron frame to pieces. On the 24th of August 1683, the anniversary of St Bartholomew's Day, the spirit of the great Puritan passed upward from amid the strife of tongues. Eleven days afterwards, a long and mournful procession, composed of more than sixty noblemen in carriages drawn by six horses each, and of many others, in mourning-coaches and on horseback, silently followed the mortal remains of Owen along the streets of London, and deposited them in Bunhill Fields, the Puritan necropolis.

The popular conceptions that have generally been formed

of Owen have considerably differed in more than one respect from the facts. He was not, as many appear to have imagined from the magnitude and abstruse nature of some of his works, a mere recluse who delighted to pore over dim manuscripts and dusty tomes, but a man of large popular sympathies, capable of social delights, and with such commanding appearance and propriety of manners as made him fit to stand before kings. And those are equally mistaken who conceive of him as a sermon-maker, rather than a preacher who is able to inspire and illuminate his words by the looks and the living voice. He is described even by adverse contemporaries, such as Anthony Wood, as "able to wind himself almost as he pleased into the affections of his auditory;" and we may rest assured that the helmed heroes of the Commonwealth would not have so often invited to address them, on their days of highest festival, a mummy or an automaton. More than any other of the contemporary leaders of the Puritans, Owen was a man of affairs, and possessed in remarkable combination that clear apprehension and firm grasp of great principles, that quick perception of character and discovery of hidden motives in other men, that knowledge of the times,—when to act, and when to economize strength,—which go to form the social leader, and even the great statesman. Baxter, with his impulsive energy, would have led his friends into difficulties, or, with his love of dialectics and fine distinctions, would have reasoned and speculated when he should have acted; Howe was more formed for meditation than for the rough details of common life; Owen was the pilot to whom the Puritans looked whenever they saw the gathering storm. As a theological thinker and author he holds his own distinctly-defined place among those Titanic intellects with which his age abounded. Surpassed by Baxter in point and pathos, by Howe in imagination and in the higher philosophy,—without the tenderness of Flavel, or the native elegance of Bates,—he is unrivalled in his power of unfolding the rich meanings of Scripture, of bringing out the exhaustless treasures from the mine of a text, of disclosing the harmonies and connections of passages of Scripture; of doing the work of a biblical interpreter, one among a thousand. There is scarcely a great subject in the wide range of inspired theology on which he has not written a treatise that has now lived for two centuries; and his works are to this hour the armoury to which modern controversialists go the most readily to equip themselves in the well-tried panoply of the strong and sturdy Puritan. He was accustomed to read everything beforehand on the subject on which he intended to write, especially the writings of opponents; and when he sat down himself to write, he exhausted his theme, leaving to an author that should attempt to follow him not even the gleanings at the corners of the field.

His style has most hindered his popularity. Many fine passages might no doubt be extracted from his writings; but in general his manner of expressing himself is lumbering, involved, and unmusical, and the golden thoughts but seldom owe anything to skilful setting. We have elsewhere compared his motions to those of the elephant—slow and ungainly, but with a tread that shakes the earth, and with a resistless force that breaks its way through tangled thickets and serried ranks of armed men.' In his writings he was pre-eminently the great theologian, and in his practical counsels the Nestor, of the Puritans. (A. T.)

OWEN, *John* (called in Latin, *Ovenus* or *Audoënus*), a writer of Latin epigrams, once very popular all over Europe, was of Welsh extraction, and was born at Armon in Caernarvonshire. He was educated under Dr Bilson at Wykeham's School, Winchester, and afterwards studied at New College, Oxford, where he received a fellowship in 1584, and took the degree of Bachelor of Laws in 1590. (Wood, *Ath. Ox.*, vol. i., col. 471.) Throwing up his fellowship during the following year, he turned schoolmaster, and taught successively at Trylegh, near Monmouth, and at Warwick. He soon became distinguished for his perfect mastery of the Latin language, and for the humour, felicity, and point of his epigrams. As a writer of Latin verse he takes rank with Buchanan and Cowley. Those who, with Dryden, place the epigram "at the bottom of all poetry," will not estimate Owen's poetical genius very high; yet the continental scholars and wits of the day used to call him "the British Martial." "In one respect he was a true poet," says a biographer; "namely, he was always poor." He was a staunch Protestant besides, and could not resist the temptation of turning his wit against Popery occasionally. This practice caused his book to be placed on the *Index Expurgatorius* of the Romish Church in 1654, and what was yet more serious, led a rich old uncle of the Catholic persuasion, from whom he had "great expectations," to cut the epigrammatist out of his will. When the poet died in 1622, his countryman and relative, Bishop Williams of Lincoln, had him buried at St Paul's Cathedral, London, where he erected a monument to his memory bearing an elegant epitaph in Latin. (See Dugdale's *Hist. of St Paul's.*) Owen's *Epigrammata* are divided into twelve books, of which the first four were published in 1606, and the rest at four different times. The best editions are those printed by Elzevir and by Didot. Translations into English, either in whole or in part, have been made by Vicars, 1619; by Pecke, in his *Parnassi Puerperium*, 1659; and by Harvey in 1677, which is the most complete. La Torre, the Spanish epigrammatist, owed much to Owen, and translated his works into Spanish in 1674. French translations of the best of Owen's epigrams have been published by A. L. Lebrun, 1709, and by Kérivalant, 1819.

OWEN, *William*, one of the ablest of English portrait-painters, was the son of a bookseller, and was born at Ludlow in Shropshire in 1769. After receiving a good education in his native town, he repaired to London at the age of seventeen, and began to study under Catton, the academician. He sent his first portrait to the Somerset House exhibition in 1792, at the time when Lawrence, Beechy, and Hoppner were in their palmiest days. The easy and elegant touch, and the clear and strong perception of character which the young artist displayed, soon exacted attention. William Pitt sat to him in 1798; and from that time the merits of Owen in portraiture began to be generally recognised. The portraits of the Duchess of Buccleuch, Sir William Scott, Cyril Jackson, the Bishop of Durham, and the Marquis of Stafford, came to be admired for their freedom, vigour, and excellent light and shade. Owen was elected a member of the Royal Academy in 1806. The Prince of Wales made him his portrait-painter in 1810, and would have knighted him in 1813 had not the artist declined the honour. Meanwhile Owen had been rising to an equally high place in another province of his profession. His fancy sketches, especially that of "Peasants Resting by the Roadside," and that of "The Fortune-teller and the Lady," were remarkable for their exquisite delineation of ordinary life, and attracted crowds of admirers. Towards the close of his life, however, Owen found no time to indulge in these sportive exercises of the pencil, and was obliged to confine himself to portraiture. In 1818 his prosperity was at its height. The portraits he had painted amounted to nearly two hundred, and his income had risen to about L.3000 a year, when an attack of disease shook the brush from his hand. He continued to linger on in great debility, till a dose of opium, which he had swallowed by mistake, put an end to his existence on the 11th February 1825. (Cunningham's *Lives of Painters*, &c.)

OXENSTIERNA, COUNT AXEL, a distinguished Swedish statesman, was born at Fano in Upland in 1583. After studying at the universities of Rostock, Jena, and Witten-

berg, and graduating in arts, he visited most of the German courts, and returned to Sweden in 1602. Accomplished in scholarship, versed in foreign politics, taking to business spontaneously and eagerly, far-sighted, faithful, and patriotic, Oxenstierna now entered upon the career of a statesman under Charles IX. He conducted an important diplomatic mission in 1606, became a senator in 1608, and presided over the regency which governed the country during the superannuation of the king. His influence rose still higher on the accession of Gustavus Adolphus in 1611. The chancellorship, the chief office of the state, was conferred upon him; he became the able second of his sovereign in advancing the interests of his native country, and in defending the liberties of Europe; and it was soon proved that he was not unworthy to consummate by the art of diplomacy the enterprise which the royal hero had begun by the art of war. His negotiations brought to an advantageous close in 1613 one war with Denmark, and in 1617 another with Russia. It was, however, in 1632, when Gustavus fell at Lutzen, that Oxenstierna rose to the height of power. The great task of maintaining, in the room of the fallen hero, the cause of Protestantism, was entrusted to him; and that task he performed amid the onset of enemies and the dissensions of allies, with unwearied vigour and ultimate success. His authority as chancellor, and as one of the guardians of Queen Christina, was exerted in introducing an improved plan of finance, removing burdens from trade, and patronizing learning. He also succeeded in checking the misrule incident to a minority; and in 1645 placed an unimpaired government in the hands of the young princess. The high public influence of Oxenstierna declined considerably towards the close of his life, in consequence of the determined opposition which he offered to the abdication of Queen Christina. Although sometimes consulted by Charles Gustavus, he lived thenceforth in private till his death, in 1654.

OXFORD, the seat of the university and the capital of the county of the same name, is situated 53 miles from London by the road, and 63 by the railway. The name, as shown by Domesday the old Saxon chronicle, and the city arms, is derived from its originally being a ford for oxen. It stands in a richly-watered valley between the confluence of the Cherwell and the Isis; and when seen from the rising ground near the city, its appearance is singularly beautiful and impressive, from its panorama of towers and domes, stately collegiate and public edifices, amid gardens and waters.

In English history Oxford occupies an important position, second perhaps only to London. Its origin as a place of note is generally assigned to Alfred; but both an earlier and a later date than this have found favour. Before the time of the Conqueror we hear of it as an abode of the Saxon kings, of its having been thrice destroyed by fire, and of its having suffered severely from the ravages of the Danes. It is one of the seven fortified towns, during the Danish invasion, mentioned in the Saxon chronicle. At the time of Edward the Confessor there were 721 inhabited houses in Oxford; and at the time of the compilation of Domesday only 243. The town had resisted William, and this decrease was the result of his vengeance. The neighbourhood was strongly anti-Norman; and Robert D'Oiley, the chieftain to whom this tract of country was assigned, built a castle on the western side, to overawe the surrounding country. Henry I. was frequently here and at his neighbouring park of Woodstock. In the time of King Stephen, who held here his first gathering after his return from Normandy, we read of it as a place of great strength; and the town figures largely in the civil wars of that time. In 1141, after a long siege, it was taken by Stephen; Maud made her escape, dressed in white, over the frozen river, which was covered with snow. Henry II. visited Oxford, and he gave the city its great charter, assigning to it all the privileges and liberties of London, besides some extraordinary privileges. Richard I., who was born here, and for whose ransom the city raised a large contribution, confirmed these privileges, and greatly added to them. Simon de Montfort's celebrated Mad Parliament of Henry's rebellious barons was held here, and ordained the famous "Provisions of Oxford." The original writ of the king to the people, directing them to abide by the decisions of the new council of the nation, has been discovered in the city archives.

The most striking feature in the history of Oxford is the bitter hostility that ever prevailed between the town and the university. Their respective jurisdictions, rights, and privileges constantly came into collision; and these feuds, in that rough age, were frequently attended by most disastrous and fatal results. (See UNIVERSITIES, *Oxford*.) By far the worst of these was John Bereford's riot in 1355. The colleges and halls were completely sacked by the mob; many lives were lost, and vast injury was done. The town was placed under an interdict; and the university resigned its charter, as if insecure of its existence,—an example which was followed by the town. Both the charters were subsequently restored, with alterations in favour of the university. The latter part of the fourteenth century is a bright period in the annals of Oxford. It was the first seat of Protestantism, and Wycliffe, the morning-star of the Reformation. Henry VIII erected Oxford into a separate see: it had before been included in the diocese of Lincoln. In 1555, under Queen Mary, Ridley and Latimer suffered here at the stake, and subsequently Archbishop Cranmer. Queen Elizabeth visited Oxford, and displayed her erudition by making a long Latin speech to her learned audience. The plague raged here with dreadful severity in her reign. As fatal as the plague was the remarkable jail-fever which happened here in 1577, respecting which Lord Bacon has written. During a trial, several hundred persons sickened in court, among whom were jurors and magistrates, the high sheriff and the chief baron. James I. visited Oxford frequently; and the first Parliament of Charles I. was held here, in consequence of the plague being prevalent in London.

Oxford was greatly distinguished in the parliamentary wars for its loyalty and constancy to the royal cause. When the king wrote for help from York, the university sent him all their plate and ready money. In 1642 the city was occupied by the parliamentary troops; but after the battle of Edgehill the king established his court and camp here. The city was a second time occupied by the Parliamentarians, and again by the king. Oxford was one of the last cities that remained loyal to Charles, nor was it finally surrendered till every hope of saving him was lost.

Oliver Cromwell became the chancellor of the university. A parliamentary commission expelled some leading loyalists, and set aside some ceremonies that were opposed to the prevalent Puritanic spirit. In 1665, the year of the great plague, Parliament assembled in Oxford. The Parliament of 1681 was also summoned here, but was dissolved after a few days. James II.'s invasion of the rights of Magdalen College is closely connected with the Revolution, and belongs to English history. Oxford gave the title of Earl to the ancient family of the Veres, which became extinct in the twentieth earl in 1702; and in 1711 the title was revived in favour of Speaker Harley.

Oxford is in the form of an ellipse, and, including its suburbs, is at least 3 miles in circumference. It has its high steward, recorder, mayor, sheriff, aldermen, councillors, magistrates; and returns two members to Parliament. There is a free reading-room and library, and public baths and workhouses. The city is rich in various charities and institutions, among which should be especially mentioned the Ratcliffe Infirmary, and the Ratcliffe or Warneford Lunatic Asylum. Its civic buildings comprehend the town-hall, erected in 1753, and the council-chamber, where royal and illustrious visitors are received, adorned with an interesting collection of portraits. In 1840 a new county-hall and courts were erected, at a cost of about L.15,000. The castle of Oxford appears, from some interesting remains,—the crypt, the well-room, and the tower,—to have been an ancient Saxon fortress before its occupation by the Normans. The great ditch is now a mill-stream, and the castle is the county jail; but great taste and skill have been exerted to preserve the ancient remains as far as possible.

Anciently the city was strongly walled, and there are many mural remains, especially at New College. The principal streets are wide and regular; the four principal thoroughfares cross each other in a central situation by Carfax Church. The famous High Street commences with the beautiful bridge over the Cherwell. On its left are the Botanic Gardens, sloping down to the river, and adorned with fountains and conservatories. It passes the Magdalen Tower, one of the finest architectural ornaments of the university, and extends westwards, lined with numerous collegiate buildings. The intermingled town edifices add to the picturesque, while the curvature of the street gradually opens up fresh and striking points of view. Broad Street runs parallel with the High Street, deriving its name from its vast area. It was here, opposite Balliol College, that Ridley and Latimer suffered. Near the junction of Broad Street with St Giles, a beautiful Gothic monument has been erected to their memory—the Martyrs' Memorial. St Giles is a spacious street, somewhat irregularly built, with a church at each end, and a row of trees on each side. Beaumont Street, a fine modern street,

branches from St Giles, and fronts Worcester College. In Cornmarket Street are the buildings of the Union Society, who have recently erected a large debating-room, ornamented with wall-paintings by eminent pre-Raphaelite artists, illustrative of the Arthurean cycle of romance. At the end of Port Meadow—a pasture-ground belonging to the citizens, of 439 acres—are the ruins of Godstowe Nunnery, famous as the burial-place of Fair Rosamond. Iffley, with its beautiful Norman church, Headington Hill, Shotover Hill, Bagley Wood, and Nuneham Park, are well known localities in the neighbourhood of Oxford.

We now proceed to give some account of the more important public buildings of Oxford, chief among which are the colleges. (The history, constitution, and statistics of the university and colleges, will be found in the article UNIVERSITIES) We commence with Christ Church, from its importance and colossal proportions. Its Norman foundation and earlier buildings date from 1154. Its origin as a college is due to Wolsey, and it was originally called Cardinal College. But on his attainder in 1529, all the buildings and revenues lapsed to the Crown. In 1546 Henry transferred the new see of Oxford from Osney Abbey to Christ Church, and constituted it in the mixed form of a cathedral and academic college. The western frontage of Christ Church is of great extent and magnificence. It terminated at each end by a projecting turret, and between the two is the stately gateway, above which rises the tower containing the great Tom of Oxford, a bell weighing 17,000 lb., originally brought from Osney Abbey. The great quadrangle occupies a large area, and has a broad terrace on every side. The entrance to the hall is by Wolsey's ample staircase, above which Bishop Fell erected a roof of exquisite tracery, supported by the long slender stem of a single clustered column. The hall is very imposing, having a lofty oaken roof carved and gilded, armorial bearings emblazoned round the cornice, and numerous portraits on the walls. The college chapel, which is the cathedral of the diocese, is of great antiquity, and has traces of various additions and alterations in the course of time. It is rich in ancient windows and monuments, among which is the shrine of St Fridiswide; the choir, of black and white marble, has a Gothic roof of remarkable beauty. In 1857 the Dean and Chapter removed the wainscotting, restored the columns, and threw the choir and nave into one. The effect is exceedingly good, and there is a large gain of space. The chapter-house adjoining is an exceedingly remarkable and interesting room. The library contains a large collection of books, some rare coins and sculptures, and a splendid collection of chiefly Italian pictures, the bequest of General Guise. Merton College is interesting as the earliest instance of the present collegiate system, the founder being the first who settled the students in a regular abode and under a fixed discipline. Its chapel, a cathedral-like structure, is also one of the parish churches. The ante-chapel and the tower are very noticeable, as also are the library and hall. Exeter College has a long and handsome east frontage, the effect of which is greatly marred by the narrowness of the street which it partly lines. Of late years the college has almost been entirely taken down and rebuilt; some splendid piles of building are in progress, including a noble chapel. A new and handsome chapel has very recently been built for Balliol College, a college which has gained an enviable pre-eminence through the scholastic distinctions obtained by its members. New College is one of the most splendid structures of the university, and the chapel is by far its most striking feature. In the east end, tier rises above tier of canopied niches; and the altarpiece is almost unexampled for decorative richness, including six sacred subjects sculptured in marble by Westmacott. The ante-chapel is loftily roofed, sustained by two tall splendid pillars; its great west window is executed from a design by Sir Joshua Reynolds. The costly crosier of the founder, which is exhibited, is an object of great interest. Adjoining the chapel the cloisters inclose a square, at one corner of which rises an embattled tower.

The venerable buildings of Magdalen College present a low embattled front on the south side to the High Street, and here rises the noble tower mentioned above. Entering through a fine modern gateway, designed by Flaxman, and passing through the court which fronts the President's spacious lodgings, we pass into the chief quadrangle, through a second gateway, surmounted by a very beautiful and remarkable tower. A venerable cloister, around the interior of which is placed a series of curiously-sculptured hieroglyphics, surrounds the whole of the spacious quadrangle. The beautiful chapel was greatly defaced at the times of the Reformation and Rebellion, but it still ranks as one of the finest in the university. Each side of the choir has a range of five windows in *claro obscuro*; underneath the altarpiece is Morales' celebrated picture of Christ bearing the Cross; the pavement is of black and white marble; a screen of great beauty separates from the ante-chapel. This last has many monuments, and is lighted by eight fine windows in *claro obscuro*; the west window has Swartz's representation of the Last Judgment. The hall is an extensive and handsomely decorated room. The pleasure-grounds of the college are highly celebrated, consisting of a grove planted with noble elms, and the Magdalen meadow surrounded by shaded walks.

All Souls' College has a long frontage in the High Street, from which it is entered by two gateways It has two quadrangles, the first erected by the founder, plain and ancient; the second is in the later English style, and is very striking, though not without blemishes in an artistic point of view. The chapel and hall are worthy of great attention; but the library is perhaps the most striking feature of the college. It was founded by a bequest of books and money by Colonel Codrington. There is a large collection of works and many rare manuscripts; the spacious room is decorated with busts and vases, and the cases are separated by Doric and Ionic pilasters of dark green. The library of Queen's College is a noble room, taking up the entire western side of the inner court of the college, and has one of the largest collections of books in the university.

Among the buildings connected with the university, stands the Bodleian Library, founded through the munificence of Sir Thomas Bodley, and opened to the public in 1602. We do not here enter into any account of the countless treasures belonging to this invaluable library. The picture gallery of the Bodleian has a noble collection of British historical portraits, besides other paintings, busts, models, and various valuable curiosities. The library and gallery occupy a large portion of the quadrangle called the Schools; in an apartment on the north side are kept the Arundelian Marbles. The divinity school is a magnificent specimen of later English architecture; the tall windows, with their slender munnions and the exquisite tracery of their arches, are very striking; the roof, moreover, is of great beauty. Northwards of the schools is the Clarendon printing-house, erected from the profits of the *History of the Rebellion*, the copyright of which was presented to the university by the author's son. It was erected by Sir John Vanbrugh, the north front has a bold portico with massive Doric pillars; there are pediments to the four sides of the building, and statues of the nine Muses on the summit: Lord Clarendon's statue is over the south entrance. The Clarendon is now used for other university purposes, the university having been able from its profits to build a new printing-house. This is the most complete and largest printing-house in the world, with the exception of the celebrated one at Paris. The buildings occupy two acres and a half, and form a square, with a splendid gateway modelled after the arch of Constantine at Rome.

The Radcliffe Library was finished by Gibbs in 1749, from L.40,000 bequeathed by Dr Radcliffe. Situated in the centre of a square in the middle of the city, its vast dome is seen on every side to great advantage, and gives Oxford an appearance which somewhat reminds the traveller of the distant view of Rome. The building is circular, the ground-floor is unoccupied, and the principal room, which is probably the most beautiful in the university, is gained by a staircase. It is enriched with casts, busts, and statuary, and a valuable collection of works relating to medicine and natural history. The pavement is of Portland and Bremen stone; above the basement are duplicated Corinthian columns, supporting an enriched entablature, above which is a balustrade ornamented with urns; between the windows are sculptured foliage, fruit, and flowers. Kneller's portrait of the founder is over the principal entrance.

The Sheldonian theatre was constructed in 1664 by Sir Christopher Wren, at the expense of L.12,470 to Archbishop Sheldon, who left an additional L.2000 for its maintenance. It is built after the theatre of Marcellus at Rome, and can contain nearly 4000 persons. A new roof was constructed in 1802 with a magnificently-painted ceiling. It is used for university meetings and occasional concerts; in the summer term the commemoration of founders and benefactors is held, when honorary degrees are conferred upon distinguished characters.

The Ashmolean museum, provided for the reception of the celebrated collection made by the Tradescants, presented to the university about 1682 by Elias Ashmole, was erected after a design by Sir Christopher Wren. There is a valuable collection of coins, medals, manuscripts, and paintings; an important antiquarian library left by Dugdale and others; and extensive collections devoted to chemistry, mineralogy, and experimental philosophy. To provide for their increasing stores, part of which have been taken in by the Clarendon, and also to extend the study of the natural sciences, the university a few years back, resolved to build a new museum. This is now rising in proportions of vast extent and magnificence in the parks, and bids fair to be one of the finest ornaments of Oxford.

The Taylor Institute for modern languages is another magnificent structure, which has been added to Oxford of late years. It contains a fine reading-room and library, chiefly of works in mo-

dern languages, and a magnificent collection of paintings, drawings, and statuary. We should also mention the observatory and music-room. There are numerous churches in Oxford, and the chief of these may be considered that of St Mary, the university church. The chancel was built in 1492, the rest of the church in 1498. Both the exterior and interior of this beautiful church are striking, the splendid tower and spire being special objects of remark. In the north part of the church is the monumental chapel of Adam de Broom. The church of St Peter in the east is one of the most ancient in England, dating back probably to the ninth century. The chancel is spacious, with a cluster of columns and a finely ornamented roof. Beneath the chancel is the crypt, still in good preservation, its arches supported by low ranges of Saxon pillars. In striking contrast to this is All Saints' church, built in the Grecian style after a design by Dean Aldwick, with a profusely-ornamented interior.

There are a number of other old churches, and of late years, to meet the wants of an increasing population, new churches have been built of great neatness and utility. There are a number of interesting remains of ancient religious houses in Oxford and its neighbourhood. Dissenters of various sects have their different chapels, which are neat and spacious. The city has a general air of cheerfulness, cleanliness, and prosperity. The university authority is paramount, extending five miles in every direction. Pop. (1851) 27,843. (F. A.)

OXFORD, Earl of. See Harley.

OXFORDSHIRE, an inland county of England, is bounded on the S. by the Thames, and, as it follows the windings of that river, is in shape very irregular. The breadth near Oxford is only 7 miles, its greatest breadth in the north is 38 miles, and the extreme length nearly 50 miles. The River Cherwell bounds it on the N., with the counties of Warwick and Northampton; Buckinghamshire is on the E.; and Gloucestershire on the W. It contains 479,267 acres.

The surface of the county is very varied, from the rich water meadows of the Thames, to the high, bare chalk hills. For a southern county, the climate is certainly cold; dense fogs often hang heavily over the Chiltern Hills and woodlands, and, according to meteorological returns, there is considerably more rain in Oxford than in London. The geological strata of the county confer upon it a directly agricultural character, being those termed the secondary series, including also a small portion of the lower bed of the tertiary. These scarcely yield any minerals: the varying constituents of the strata exhibit alternately clay and stratified rock and sand. Here there is a numberless variety of soils which are not capable of a very strict classification, and as regards the practical agriculture, we must chiefly consider superficial accumulations and alluvial deposits. The soil by the Thames is rich black mould; in the midland districts it is the decomposed stone-brash or limestone, with sand and loam; in the north there are the fertile red soils; and in the Chilterns a sandy loam laid on chalk. These are the main agricultural divisions.

Owing to this character of the county, there is no particular system of agriculture, and the same course is scarcely pursued in the same parish or on the same farm. An irregularity of cropping is unavoidable. Wheat, barley, and oats are generally cultivated; pease and beans occasionally. The turnip, both the common and the Swede, are grown to a great extent; it is also a practice to sow beans and pease mixed, chiefly on the lighter lands, and this is called *poulse*. Clover, trefoil, and sainfoin are grown to a great extent. On the banks of the Thames and the Cherwell the best feeding lands are found; and in some places the meadows are mown twice a year. The Thames meadows are subject to frequent and injurious inundations. There have been as many as seventeen floods in a year; 6000 acres have been under water, and three-fourths of the hay has been known to be swept away. A good system of artificial drainage is much wanted; neither are there many water-meadows, though the soil is well adapted for irrigation. It is by no means a grazing county, the stock being chiefly kept for dairy purposes. The county is celebrated for its half-breds or Down-Cotswolds, which in process of time has become a distinct breed of sheep, the management of which is brought to a high state of perfection. The use of the thrashing-machine has become very common.

Great improvements have taken place in the last twenty years by the extension of inclosures. The hedging is good, the ditching very inferior; in the N.E. of the county stone walls are common. In 1853 an act was passed to disafforest the wild Wychwood Forest, and to constitute it a parish, with church, schools, &c. The woods and wastes of Wychwood lie between the Evenlode and the Windrush; quarries of stone, slate, and one of marble are found beneath its stone-brash soil; springs of water and clear rills add great beauty to the wild scenery; the glens and copses are crowded with deer and game. In Cornbury Park are some ancient oaks and long avenues of stately beeches; and the antiquities connected with the forest are numerous and interesting. The farm-steadings in the county are of a very inferior description, and the farms are for the most part small. On the Blenheim estate the farming is of a first-class character. Leases are seldom given; the tenant generally holds from year to year, a system which is a fatal bar to improvement on the part of the tenantry. Under the colleges, however, families have held land from generation to generation. One-sixth of the income from land belongs to the university and other religious bodies; and the general impression seems to be that they are far from being well managed.

Oxfordshire is remarkable for its many rivers, the principal being the Evenlode, the Windrush, the Cherwell, and the Isis; the last, when it is joined by the streamlet Thame, below Dorchester, is called the Thames. The river by Oxford should rightly obtain the name; and indeed it is so styled in the earlier charters. The banks of the river are studded by various beautiful country seats; the prospect is always pleasing and sometimes beautiful, growing, however, somewhat bare and tame towards the N. and N.W. Among the different seats, the famous residence of the dukes of Marlborough stands pre-eminent; we should also mention Nuneham-Courtenay, Wroxton Priory, and Stanton-Harcourt. The antiquities of the county are numerous and interesting: there are several Roman and some very curious British remains; the Ikenald Street, one of the four prætorian ways, skirted the base of the Chiltern Hills. There are some ancient tumuli and encampments in the neighbourhood of Wychwood Forest; and a considerable number of Roman coins, and even some old British coins, have been discovered. In this county, too, are many marks and remains of the old warfare between the Danes and Saxons, chiefly in the way of military entrenchments and sepulchral mounds. Interesting reminiscences of the civil wars are everywhere suggested. To the geologist Oxfordshire is a very interesting county; its beds afford some of our national geological characteristics, and abound with interesting and rare fossils.

We cannot speak highly of the accommodation provided for the peasantry; and the character of the Oxfordshire labourer for temperance and intelligence does not stand high. Some of the roads in the vicinity of Oxford are in a disgraceful condition. Of late years much has been attempted in extending education and church accommodation among the poor, and with favourable effect. The smaller towns of Oxfordshire are mentioned elsewhere: the more noteworthy are Banbury, Woodstock, Henley-on-Thames, Witney, Bampton, Bicester, Burford, Chipping-Norton, Thame, Watlington. These are the market-towns; the two first are also boroughs, each returning a member to Parliament; and the county returns three members, elected at Oxford.

The population of the county amounted in 1851 to 170,439; in 1841 it was 163,143; while in 1801 it was

111,977. Thus, while England has more than doubled its population in the half century, this county, in common with other midland counties, has only increased 52 per cent. It contains 1 city, 11 market-towns, 14 hundreds, and 278 parishes. It contains a population of 2·8 acres to a person; throughout England the proportion is 1·9 acres. Oxfordshire contained in 1851, in all, 504 places of worship, with 110,666 sittings. Of the former, 266 belonged to the Church of England, 116 to Wesleyan Methodists, 50 to Baptists, 43 to Independents, 12 to Quakers, and 8 to Roman Catholics. There were in the same year, 591 day-schools, with 23,498 scholars (12,135 male and 11,363 female). Of these schools 247, having 16,574 scholars, were public; 9, with 613 scholars, being supported by general or local taxation; 51, with 3014 scholars, by endowments; and 181, with 12,582 scholars, by religious bodies. Besides these, there were 314 Sunday-schools, with 19,776 scholars (9573 male and 10,203 female), and 19 evening schools, with 373 scholars. (F. A.)

OXIDE, and OXIDATION. See CHEMISTRY.

OXUS (Ὦξος), a great river of Central Asia, called by the natives on its banks the *Amoo*, and by Turkish and Persian writers the *Jihon*, rises in a lake called Sari-Kol, about 15,600 ft. above the sea, among the Pamir Mountains or Tartaric Caucasus, in Badakhshan; Lat. 37. 48. N., Long. 73. 40. E. The river issues from the west end of the lake, and thence flows N.W. until it falls into the Sea of Aral. Near its origin the Oxus receives several tributaries from the Hindoo Koosh; and during its course there are many large affluents of which comparatively little is known. Its whole length is about 1300 miles, and it drains an area estimated at about 221,256 square miles. The most remarkable fact connected with this river is, that the testimony of antiquity is almost unanimous in representing the Oxus as flowing into the Caspian. Pomponius Mela is the only ancient writer whose description of the Oxus agrees with its modern course; but his single testimony cannot be considered of much value, since both Strabo, who lived but a short time before him, and Ptolemy, within a century after, assert that in their time it followed a different course; while the former writer informs us that merchandise was conveyed from the East by this river to the Caspian, and thence to the Euxine. It is therefore the opinion of most modern authorities, that the river did formerly discharge itself into the Caspian; and some traces of its mouths, it is thought, have been discovered in the Bay of Balkan. Humboldt supposes, that down to the time of Alexander the Sea of Aral and the Caspian formed one great sea; that by some violent convulsion, or by the gradual effects of evaporation, they were separated; and that the Oxus then had two branches, one flowing to the Caspian, and the other to the Aral, the former of which has become dried up, so that the latter only now remains.

OXYGEN. See CHEMISTRY.

OYER AND TERMINER (Fr. *to hear and determine*), two words in ancient law French, applied to the commission by which authority is granted to certain individuals to establish a court of criminal judicature for *hearing and determining* certain specified offences.

OZANAM, JACQUES, a laborious French mathematician, was of Jewish extraction, and was born at Bouligneux, in the principality of Dombes, in 1640. His passion for mathematics was developed at an early age. On the death of his father, who had designed him for the church, Ozanam abandoned divinity and took to mathematics, at Lyons. His removal to Paris soon afterwards was the means of increasing alike his zeal and his fame. He devoted much of his time to his pupils, both native and foreign; and he wrote many valuable mathematical works. The latter part of the career of Ozanam was clouded with domestic suffering; and the war of the Spanish succession deprived him of many of his pupils. Yet he preserved his cheerful and amiable disposition, until a stroke of apoplexy closed his career on the 3d April 1717.

Among a great number of works on theoretical and practical mathematics, the best known and most esteemed are the *Dictionnaire Mathématique*, Paris, 1690, 4to; *Cours de Mathématiques*, ibid., 1693, 5 vols. 8vo; *Récréations Mathématiques et Physiques*, ibid., 1694, 2 vols. 8vo, improved by Montucla, Paris, 1778, 4 vols. 8vo, and still further improved in the English edition of Dr Hutton, London, 1803, 8vo. Ozanam left in manuscript a treatise on the Analysis of Diophantus, which was in the library of D'Aguesseau. (See his *Eloge* by Fontenelle, the *Mémoires* of Niceron, and the Dictionary of Chauffepié.)

OZELL, JOHN, an industrious translator, was born about the close of the seventeenth century. At the school of Ashby-de-la-Zouch, and at Christ's Hospital, he acquired a knowledge of Latin, Greek, and Hebrew. Having entered an accountant's office, his leisure hours were devoted to the cultivation of the literature of France, Spain, and Italy. He published metrical versions of some of the works of Molière, Corneille, Racine, Boileau, and Tassoni; and prose translations of Fenelon *On Learning*, *The Port-Royal Logic*, Rabelais' works, *Don Quixote*, Vertot's *Revolutions of the Roman Republic*, and a Life of Veronica. The vanity of the translator has preserved his name longer than the merit of his translations. The conceited author was exalted to a place among the immortal dunces of Pope; he retaliated by inviting the public, in an advertisement in the *Weekly Medley* of 1729, to judge between his genius and that of the great poet; Pope replied by inserting the absurd advertisement into the notes of a succeeding edition of the *Dunciad*; and the translator thus acquired a notoriety, which still lives. He died in 1743.

OZEROV, VLADISLAV ALEXANDROVITCH, a celebrated Russian tragic poet, was born in the government of Tver in 1770. The early part of his life was spent in the public service. At the age of six he entered the army as a cadet, and on retiring from military life he had attained to the rank of major-general, and received a civil appointment. Meanwhile he devoted his leisure to the composition of tragedy; and surpassed all preceding Russian dramatists in his knowledge of stage effect, in the conception of his plots, in the pathos of his incidents, and in the warmth and harmony of his poetical colouring. The *Death of Oleg* in 1798, *Œdipus* not long afterwards, *Fingal* in 1805, and *Demetrii Donskoi* in 1807, were all received with deserved applause by the public. The only other tragedy that the author produced, although he retired from the public service in 1808, was *Polyxena* in 1809. During the rest of his life a settled melancholy seems to have overclouded his mind and chilled his imaginative faculty. He died in 1816. The complete works of Ozerov, containing, besides his tragedies, some lyric poems, and accompanied by a Life, were published by Prince Viazemsky, in 2 vols., St Petersburg, 1818.

OZIERI, a town of the island of Sardinia, division of Sassari, in a valley surrounded by hills on all sides but the N., 15 miles E.S.E. of Sassari. It is substantially built on uneven ground; but the streets are narrow and irregular. Ozieri is the seat of the Bishop of Bisarcio, the town of that name having long since entirely fallen. It contains a cathedral, several other churches, a court-house, town-hall, prison, episcopal college, and several other schools. Woollen and linen stuffs are manufactured; and some trade is carried on in these, as well as in horses, cattle, hides, wool, &c. Pop. 8433.

OZORKOV, a town of the Russian empire, in Poland, province of Warsaw, stands on the right bank of the Bsura, 75 miles W.S.W. of Warsaw. Considerable manufactures of cloth are carried on. Pop. 8000.

P.

P, the sixteenth letter of the English alphabet, is a consonant of the labial series, and is formed by a close compression of the anterior part of the lips. As may be ascertained from inscriptions and coins, the Latin form of this letter, which we have adopted, originated in shortening and bending round the right leg of the Greek Π, the character representative of the hard labial in that language. (See ALPHABET, with Plates XIX. XX. and XXI. corresponding.) P is liable to be converted with all labials, and is not unfrequently interchangeable with other letters. The soft labial B is most frequently convertible with this letter, however, of which we have examples in nearly all languages, and especially in the German. In addition to the labials *m, v, f, pf,* P is likewise occasionally interchangeable with *c, k,* or *q,* with *t,* and with *pt.* When P is aspirated or followed by an *h,* it is equivalent to the Greek φ, and corresponds in sound with the English *f,* as in *physic, philosophy,* &c. In some words borrowed from the Greek, the letter P is mute, as in *psalm, ptisan,* &c. If we may judge from the line of Ugutio, P stood for 100 among the ancients; for he says "P similem cum C numerum monstratur habere." Baronius, however, is inclined to think that it represented T. With a dash over it ($\bar{P}$), it stood for 400,000. Among the Greeks π′ was used for 80, and π for 80,000; but on inscriptions Π stood for 5 (πέντε). Among physicians P stands for *pugil,* or the eighth part of a handful; P.Æ., *partes æquales,* or equal parts of the ingredients; P.P., *pulvis panium,* or Jesuits' bark in powder; and *ppt., preparatus,* or prepared. In music *p.* stands for *piano,* or softly; *pp.,* for *pia piano,* or more softly; and *ppp.* for *pianissimo,* or very softly. In printing, *p.* stands for *page,* and *pp.* for *pages.* (For other abbreviations of P, see the article ABBREVIATIONS.)

PACARAIMA, SIERRA, a mountain chain of South America, forming the boundary between Venezuela and Brazil. It divides the waters of the Orinoco and Essequibo on the N., from the Amazon and its affluents on the S., and extends E. and W. for about 200 miles, near the 4th degree of N. Lat. The height of the range towards the E. does not exceed 1500 feet; but Mount Pacaraima, near the western extremity, is estimated at 2000 feet high. The geological formation of the mountains is for the most part granite; and they are in general quite destitute of wood, forming a boundary between the dense forests on the N., and the vast grassy savannahs on the S.

PACCA, BARTOLOMEO, a Roman cardinal and statesman, was born of a noble family at Benevento in 1756. After studying in his native town, he repaired to Rome, and entering the church, was speedily recognised as a candidate for promotion. From 1786 to 1800 he held the office of papal nuncio at Cologne and Lisbon in succession; in 1801 a cardinal's hat was conferred upon him; and in 1808 Pius VII. made him his prime minister. The destiny of Pacca now became intimately connected with that of the supreme pontiff. He was the pope's accomplice in drawing up the bull which excommunicated Napoleon in 1809; he was consigned for this offence to the dungeon of Fenestrelle, at the same time that his master was imprisoned at Fontainbleau; and he shared in the honours of the pontiff's triumphal return to Rome in 1814. Such a severely-tried fidelity was rewarded by Pius VII. with ever-increasing confidence and regard. The cardinal continued to hold in succession several high civil offices till 1821, when he retired from public life. The rest of his days were chiefly devoted to literary pursuits. He died at Rome in 1844. The *Historical Memoirs* of Cardinal Pacca have been translated into English by Sir G. Head, in 2 vols. 8vo.

PACCHIAROTTO, JACOPO, one of the most eminent painters of the Sienese school, was born at Siena in the latter half of the fifteenth century. His style seems to have been formed on that of Pietro Perugino, and he must also have been a careful imitator of Raphael. Until 1535 his brush was chiefly employed in painting frescoes and altar-pieces for the churches of his native city. Then being obliged to escape to France on account of the active part he had taken in a conspiracy against the Sienese government, he began to assist Rosso. From this period there is no further trace of him. For a long time the works of Pacchiarotto were commonly ascribed to Perugino. Now, however, his name has been rescued from neglect; and although scarcely known beyond the limits of his native town, he is praised by critics for his skilful composition, and for the vivacity and grace of his heads and figures. The most famous of his pictures is "The Visit of St Catherine to the Body of St Agnes of Montepulciano," in the church of Santa Caterina in Siena. (Lanzi's *History of Painting.*)

PACE (*passus,* from *pando,* I extend), the unit of itinerary measure among the Romans, consisting of 5 Roman feet. The *passus,* or double step, was distinguished from the *gradus,* or single step, in not being the distance from heel to heel when the feet are at their ordinary extension in walking, but the distance from the point which the heel leaves to that in which it is again set down. A thousand of such paces formed the *mille passus,* or Roman mile. The word *passus* was sometimes applied to the distance formed by the extension of the arms in the same straight line (the Greek ὀργυιά), which accounts for Paucton's derivation of the word *à passis manibus,* instead of *à passis pedibus.* The Roman "pace" was equal to about 58·1 English inches, or 4·841$\dot{6}$ feet.

PACHECO, FRANCISCO, an eminent Spanish painter and historian of art, was born at Seville in 1571. His first lessons were received from Luis Fernandez; and from that time he was a busy and zealous student. He pored over the history of painting to learn the precepts and artistic usages of the ancient masters; the stray prints of Raphael that fell in his way were taken as models; and it became his custom never to execute a picture before making two or three studies of the heads and figures. The first engagements of the young artist were in decorative painting. In 1594 he adorned with figures and heraldic bearings the banners of the fleets of New Spain and the mainland; and in 1598 he executed in distemper some of the paintings on the monument erected on the occasion of the funeral honours of Philip II. By this time the peculiar style of Pacheco was beginning to appear and to be appreciated. His composition, though deficient in spirit and vigour, was simple and correct; his colouring, in spite of its harshness and dryness, was never glaringly unnatural; and if among the various provinces of art which he tried he did not shine in any, he made a respectable appearance in all. Accordingly, in the midst of other engagements, he was employed to paint some incidents from the life of St Raymond for the convent of Mercy in 1600, and the fable of Dædalus and Icarus for the palace of the Duke of Alcala in 1603. It was not long after this that the busiest part of Pacheco's life began. Opening an academy of painting, he was soon engrossed with numerous pupils. At the same time he was expending great labour and patience on his masterpiece, "The Last Judgment," an immense work, which was completed in 1612. Nor did his appointment in 1618 to the office of inquisitor of art, by giving him new employments, lessen his old. More commissions poured in upon him

than he could execute; and he was hired to paint many portraits, both in oil and crayons. In 1623 Pacheco had reached the acme of his reputation; and the latter years of his life began to pass by in the midst of peace and prosperity. Having accompanied his pupil and son-in-law Velasquez to Madrid in that same year, he spent the next two years in mingling with artists and men of letters, and enjoying the striking achievements and rising fortunes of his young relative. On his return to Seville he resigned himself to the pleasures and pursuits of literature. His brush was laid aside; his table was made the rendezvous for all the intellectual among the citizens; he found a refined amusement in the composition of occasional poems; and in 1649, after several years of congenial labour, he gave to the world the fruits of his extensive reading and ripe experience in his most important work, the treatise *On the Art of Painting*. His death took place in 1654.

The above-mentioned book of Pacheco, though pedantic in its style, prolix in its plan, and absurd in many of its speculations, contains much curious information, and is an invaluable authority on the history of Spanish art. It has never been reprinted, and is now exceedingly scarce. (Stirling's *Artists of Spain*.)

PACHETE, a district of British India, presidency of Bengal, lying between N. Lat. 22. 56. and 23. 54., E. Long. 85. 46. and 87. 10., is bounded on the N. by the districts of Ramgurh and Beerbhoom; E. by that of Bancoora; S. by those of Pooralia, Barabhoom, and Singhbhoom; and W. by that of Chota Nagpore. Length, from N.E. to S.W., 105 miles; breadth, 95 miles; area, 4792 square miles. The surface is occupied in many parts by hills of inconsiderable size, covered with forests and jungles; but in some places there are plains and valleys of small size, in which the soil is cultivated, rice being the principal crop raised. Much of the ground that now lies waste was formerly tilled; and its present neglected condition arises from the habit the people have of cultivating the land without intermission as long as it will yield anything, and then letting it lie fallow for a long time. The rocks of the district belong mostly to the primitive formation; and iron and coal are the principal minerals. The chief rivers are, the Damooda, Soobunreka, and Cossye, with their tributaries. The principal place in the district is Pachete, which can hardly be considered a town. It stands 6 miles from the right bank of the Damooda, 150 miles N.W. of Calcutta. Pop. (1855) of the district, along with that of Barabhoom, 772,340.

PACHOMIUS, or PACHUMIUS, the founder of the first organized monastic community, was born in the Thebaid in 292. He was educated in paganism; but the events of his early manhood began to lead him towards a new religious life. At the age of twenty he was impressed into the military service, and, in company with his fellow-recruits, was conveyed down the Nile in a transport. During a halt at Thebes some Christians, paying a kindly visit to the soldiers, explained to him their religious views and sentiments. He was converted, and forthwith made a vow to consecrate his days to the service of the true God. Accordingly, no sooner had an arduous campaign come to a close, than, hastening back to his native country, he received baptism, and began the great work of his career. It now became the aim of Pachomius to apply the principles which regulated the life of a single anchorite to the life of an organized society; or, in other words, to seek the salvation of men by withdrawing them from the depraving habits of the world, and subjecting them to a system of religious discipline. Accordingly, Tabenna, an island of the Nile in Upper Egypt, was selected for the site of the monastery; three disciples became the germ of the society; many more began to join; and the first specimen of a regular cloister was soon presented to the world. (See MONACHISM.) The founder himself, in the capacity of abbot, continued to govern and extend the influence of the rapidly-flourishing institution, till a pestilence cut him off, about 348. The extant works which pass under the name of Pachomius, and which consist of *Regulæ Monasticæ*, *Monita*, *Præcepta*, and *Literæ*, are contained in Galland's *Bibliotheca Patrum*, vol. iv., 1768.

PACIFIC OCEAN, sometimes called the SOUTH SEA (Fr. *Ocean-Austral*, *Mer-du-Sud*, or *Grand Ocean Pacifique;* Germ. *Südsee*, *Grosser-Ocean*, or *Stilles-Meer*), the largest of the great divisions of the water on the surface of the globe, stretches from the west coast of America to the east coasts of Asia and Australia, and from Behring's Strait on the N. to the Antarctic Circle on the S. It is separated from the other oceans by distinct boundaries on all sides but in the south, where it is divided from the Antarctic Ocean by the Antarctic Circle, from the Atlantic by an imaginary line drawn from Cape Horn to that circle, and from the Indian Ocean by a similar line, from South-West Cape in Tasmania to the same circle. It occupies nearly one-half of the entire surface of the earth, an area greater than that of all the dry land together; being estimated at more than 70,000,000 square miles. Its narrowest portion is in the north, where the continents of Asia and America, at Behring's Strait, approach within forty miles of each other; while further south the two continents recede to a great distance. Between the extremities of the peninsulas of Kamtschatka in Asia and Alashka in America the distance is more than 1200 miles. At the northern tropic the breadth of the ocean is about 8500 miles; at the equator it attains its greatest width, upwards of 10,000; and at the tropic of Capricorn it diminishes again to 8200 miles. The outline of the Pacific differs from that of the other great oceans in nothing more remarkably than in the absence of those great inland seas and gulfs, which in many parts of the others extend far into the heart of the continents. There are, indeed, especially along the Asiatic coasts, several portions of this ocean separated by peninsulas and chains of islands from the vast central expanse of water; but the Pacific has no inlets to be compared to the Mediterranean Sea, or Gulf of Mexico in the Atlantic, nor even to the Red Sea or Persian Gulf in the Indian Ocean. Throughout the whole of the eastern boundary of the Pacific the general character of the coast is high and bold, the lofty chains of the Andes and Rocky Mountains rising at no great distance from the sea. From Cape Horn northwards to the borders of Chili there extend a multitude of small islands, and the coast is indented by a number of bays and fiords. Farther north these islands cease, and the indentations, though numerous, are not of any size, as far as the northern extremity of South America. There the Gulf of Panama washes the inside of the curve formed by the Isthmus of Darien, 30 miles broad, which here is the only barrier between the Atlantic and Pacific oceans. Beyond this, the North American coast stretches in a north-westerly direction, without any remarkable features, as far as the long and narrow Gulf of California, the greatest of the inlets on the eastern shore of the Pacific, formed by the peninsula of the same name, which stretches southward parallel to the mainland. In the higher northern latitudes of this coast, as in the higher southern, the same features are discernible. Vancouver's Island is the most southerly of a series of islands similar to those that fringe the Patagonian coast; and in this region, as in that, the land is penetrated by numerous arms of the sea. With the peninsula of Alashka, stretching south-west from the American continent, a different character makes its appearance on the shores of the Pacific. Along the whole of the Asiatic coast there are ranges of islands, of greater or less size, which lie at a considerable distance from the land, and separate large portions of water from the rest of the ocean. The Aleutian Islands stretch westward from

Alashka, and terminate not far from Kamtschatka. North of them lies that portion of the Pacific called the Sea of Behring, or Kamtschatka Sea. The peninsula of Kamtschatka projects southwards from the Asiatic mainland, and, along with the Kurile Islands, that stretch to the south-west, forms the Sea of Okhotsk. The Sea of Japan lies between the Japan Islands and the continent; and the Yellow Sea is formed by the peninsula of Corea stretching to the south. Farther south, the Chinese Sea is separated from the Pacific by the island of Formosa and the Philippines; so that there is hardly any portion of the Asiatic coast that is not more or less protected from the Pacific by a barrier of islands. South of the Philippines the ocean washes the Moluccas and the north-east coasts of Papua, communicating by many channels with the Indian Ocean. The Solomon Islands and the New Hebrides inclose between them and the Australian coast a portion of the Pacific called the Coral Sea; but the east coast of Australia has not any remarkable capes or bays. The peculiar nature of the western shores of the Pacific seems to be due in a great measure to volcanic action; since all the chains of islands from Kamtschatka to New Zealand contain either active volcanoes, or evident traces of the former existence of such. Besides the islands already noticed lying near the shores of the ocean, the Pacific contains an immense number of others far removed from any continent. A vast extent of water, however, including the northern, eastern, and southern portions of the ocean, an area far exceeding that of the Atlantic, contains hardly any islands, the only important group being the Galapagos, which lie directly under the equator, 700 miles west of South America. In the central and western parts of the Pacific the islands are so thickly scattered, chiefly in groups, that they are sometimes considered a separate division of the globe, under the name of Polynesia. The Ladrone, Caroline, and Sandwich islands are the principal groups north of the equator; to the south, where the islands are more numerous, lie the Marquesas, Society, Navigator's, and Friendly islands, besides many others, singly and in groups. The large islands of New Zealand lie in the Southern Pacific, S.E. of Australia. Notwithstanding the vast area of the Pacific, and the extent of the coasts that it washes, but little of the river water of the world finds its way into this ocean. The great mountain range that divides the waters of the American continent is so near the shores of the Pacific, that not more than one-fifth of the area of the continent is watered by the affluents of this ocean. The only rivers of any size that enter the ocean from the east are the Rio Colorado, falling into the Gulf of California, and the Columbia River in Oregon, falling into the Pacific, to the south of Vancouver's Island. In Asia, there are three large rivers that fall into the Pacific—the Amoor, in Mongolia and Manchooria; and the Yantse-kiang and the Hoang-ho, in China; but the area watered by these, and by a few smaller streams, does not exceed one-seventh of the whole of Asia. There are no rivers of any size on the eastern coast of Australia, as the mountains that divide the waters approach there within a short distance of the sea. The Pacific, as well as the other great oceans of the world, is subject to regular winds; and these are less variable in their continuance and limits in this ocean than in the Atlantic. The N.E. trade-wind prevails throughout the ocean between the fifth and twenty-third degrees of north latitude. At different seasons, however, the northern limit varies from 20. to 27., and the southern from 1. to 11. The boundaries of the S.E. trade-wind are also different at different seasons, varying in the N. from 5. N. to 1. S. Lat., and in the S. from 20. to 25. S. Their mean extent is from the equator to 21. S. Between these two regions of the trade-winds there is a belt of about five degrees in breadth under the influence of varying winds and calms, and frequently visited by violent storms of lightning and rain. For a considerable distance from the coasts both of the American and also of the Asiatic and Australian mainlands the influence of the trade-winds is not felt, and the breezes in these parts are very irregular. The currents of the Pacific have not the same velocity or regularity as those of the Atlantic. There are, however, several worthy of notice, though comparatively little has been ascertained respecting them. South of the 33d or 34th degree of south latitude, a strong current flows from the S.W., with a velocity varying from 10 to 35 miles a day. Meeting the South American continent near the island of Chiloe, this stream divides into two parts, the one running round Cape Horn into the Atlantic, and the other, called the Peruvian current, flowing northwards along the coasts of Chili and Peru. This great body of cold water exercises a cooling influence on the climate of Peru, and extends as far north as Cape Blanco, where it turns to the west, and joins the great equatorial current moving from east to west in the southern region of the trade-winds. A south-western branch of this current washes the shores of Australia, and circles round between it and New Zealand. The region of the variable winds and calms is occupied by a current flowing from west to east; and the northern region of trade-winds, like the southern, has one which flows in an opposite direction. The latter, after being turned towards the north by the Philippine Islands, washes the coasts of Japan, and flows partly northward through Behring's Strait, and partly eastward to America, whence it circles round on its former course. The calm portions of the ocean in the centre of the revolving current in the North Pacific, and of the smaller one between Australia and New Zealand, form the principal whaling grounds in the Pacific. The tides of the Pacific are of small size. The Pacific Ocean was discovered in 1513 by Vasco Nuñez de Balboa, the Spanish governor of Darien, who crossed the isthmus, and obtained a view of this vast ocean. In 1521 Magellan entered it by rounding Cape Horn, and gave it the name of *Pacific*, on account of the calm weather he enjoyed after entering it, in contrast with the storms he had previously met with. This name, though not very appropriate, has continued to be that by which the ocean is most generally known. This vast expanse of water is not only very favourable to the commerce of the countries adjacent to it, but, by its productive fisheries, and its numberless islands, rich in many kinds of produce, adds in no small degree to the wealth of the world, and contributes to the necessities and to the luxuries of mankind.

PACIOLI, or PACIOLUS, LUCAS. See ALGEBRA.

PACTOLUS, a rivulet of Lydia, rises in Mount Timolus, and flows in a northerly direction into the Hermus. The particles of gold which it occasionally brought down in its mud gave it a celebrity in ancient fable. (See MIDAS.)

PACUVIUS, MARCUS, an old Roman dramatist, was the nephew of Ennius, and was born at Brundusium about 219 B.C. Repairing to Rome, he soon gained general esteem for his skill both in poetry and painting. One of his pictures was hung up in the temple of Hercules in the Forum Boarium at Rome, and many years afterwards elicited the commendation of the elder Pliny. But the best fruits of his genius were those tragedies which, for eloquence and refinement, rivalled all their predecessors on the Latin stage. Not content with merely translating, as was the custom with the early Roman dramatists, the plays of the Greeks, he exercised his own artistic ingenuity upon the borrowed materials, and even wrote purely original dramas upon the history of his own nation. The closing years of the long life of Pacuvius were spent in the retirement of his native town. There he was wont to entertain with generous friendship his successful rival Accius; and there he died, at an advanced age, about 129 B.C. The fragments of Pacu-

vius have been printed in Stephen's *Fragmenta Veterorum Poetarum*, Paris, 1564; and in Bothe's *Poetarum Latii Scenicorum Fragmenta*, Leipsic, 1834.

PADANG, a town on the west coast of the island of Sumatra, capital of a Dutch province of the same name; S. Lat. 0. 57., E. Long. 100. 20. It is built on a small river, in a valley bordered by wild and rocky hills, and consists of several distinct portions. The quarter which is farthest from the sea is chiefly inhabited by Chinese, who carry on an active traffic. It is very populous; and the river is navigated by many neat boats. Almost all the houses in this part of the town contain shops. The quarter inhabited by Malays, which lies near the mouth of the river, is poor and wretched, consisting of huts built of bamboos or the bark of trees. The European quarter is widely scattered over a plain to the N.W., and contains a few stone houses, but is chiefly built of wood and bamboos. Besides some small chapels, the principal building in the place is a large and well-arranged ball-room. Until recently, Padang was a very wretched place, but many new buildings and improvements have been recently made. It is the seat of the provincial governor, and of courts of law. In the vicinity there are extensive marshes, and the town has the reputation of being unhealthy. Pop. 10,000.

PADDINGTON, a parish in the county of Middlesex, England, forming a suburb of London to the N.W. It contains many fine streets, squares, and houses, and has places of worship belonging to the Church of England, the Baptists, Wesleyans, and other sects. The Great Western Railway has a large and convenient station here. The Paddington Canal communicates on the one hand by the Regent's Canal with the Thames, and on the other by the Grand Junction with the principal canals in England. Pop. 46,305.

PADERBORN, a town of Rhenish Prussia, government of Minden, province of Westphalia, stands at the source of the Pader, 50 miles S. by W. of Minden. It is an ancient town, surrounded by walls, through which there are five gates; and though pretty well built, it presents a gloomy appearance. The cathedral, completed in 1143, is a large building with two handsome portals; but among the monuments in the interior there are none of much interest. Of the other churches, that of St Bartholomew is remarkable for its architecture. There is a town-hall, a Roman Catholic theological college (occupying the place of a former university), several schools, convents, infirmary, and other establishments. Starch, leather, tobacco, beer, and brandy are made here; and there is some trade. Paderborn was made a bishopric by Charlemagne, being thus the oldest see in Westphalia. It was subsequently a member of the Hanseatic League. Pop. 11,028.

PADIHAM, a town of England, county of Lancaster, on the Calder, 4 miles W. of Burnley, and 15 E. of Preston. It is small and not very well built; containing a parish church with an old tower, and places of worship for Methodists, Baptists, and Unitarians, as well as several schools. In the vicinity there are coal mines; and the manufacture of cotton goods is actively carried on. Three annual fairs are held here. Pop. 4509.

PADILLA, JUAN LOPEZ DE, a famous Spanish patriot, was the eldest son of the commendator of Castile, and was born in Toledo towards the close of the fifteenth century. He grew up a brave, high-souled, and patriotic citizen, and only waited for an opportunity to play a distinguished part in the history of his country. This opportunity was soon brought about by the series of events which followed the accession of Charles V. to the crown of Spain. The entire administration during the absence of the king was placed in the hands of his Flemish favourites. A Flemish cardinal, Adrian of Utrecht, held the regency; Flemish courtiers sold the offices of state to the highest bidders; and Flemish place-hunters, after a short and lucrative sojourn, carried the wealth of Spain home to their own country. Incensed at this system of oppressive misrule, the rich and powerful cities of Castile laid before Charles, by the hands of their deputies, a long list of grievances; and finding that their claims were treated with silent neglect, they took up arms in vindication of their rights in 1522. It was then that Juan Lopez de Padilla appeared in the arena of history as the leader of the citizens of Toledo, and the most zealous promoter of the cause of the general insurrection. His first act was to form the deputies of the several towns into an association under the name of the "Holy Junta," which should take charge of the general interests of the people. Then proceeding at the head of a body of troops to Tordesillas, the residence of Joanna, the imbecile grandmother of the king, he succeeded in gaining admittance into the town, obtaining an audience of the queen, and exacting from her a sanction to do whatever should be necessary for the public welfare. His next enterprise was to strip the regent of the authority and ensigns of government. He marched to Tordesillas, the seat of the regency, seized upon the treasury books, the archives, and the seals of the kingdom, and left Adrian in the position of a private individual. At this juncture, however, the over-arrogant and injudicious measures of the Junta began to check the successes, and led to the ruin of Padilla. That body, by inserting among their plans of reformation a direct attack upon the power of the nobility, brought upon themselves the armed hostility of the warlike and chivalrous aristocracy of Spain. Not content with one indiscretion, they intrusted the defence and maintenance of their cause to Don Pedro de Giron, an individual who had no recommendation but his high birth. The consequence was, that the army of the nobility was allowed, without opposition, to attack and capture the important town of Tordesillas, and thus to inflict a deadly blow upon the success of the revolution. Again did Padilla assume the chief command, and, by the capture of Torrelobaton and other towns, maintain the cause of the Junta. But again did the Junta themselves, by granting a suspension of arms, betray that cause. At the end of the truce, Padilla found that so many of his soldiers had departed to their homes that he could not face the advancing enemy. He retreated towards Toro; the enemy overtook him on a piece of disadvantageous ground near Villalar on the 23d April 1522; and all his desperate measures and chivalrous valour could not prevent his fatigued and disheartened recruits from yielding before the dashing charge of the royalist cavalry. The hopes of the revolutionists were thus irretrievably ruined. Padilla, resolving not to survive the frustration of Spanish freedom, fought till the very last; but he was carried, captive and wounded, from the field to brave a public execution. On the next day, after addressing to his wife and his native city respectively, two letters full of tender devotion and triumphant heroism, he bravely laid down his life for his country.

PADILLA, *Doña Maria Pacheco de*, the wife of the preceding, proved herself a worthy mate to the leader of the forces of the "Holy Junta." During her husband's life she rendered a bold and active assistance to his warlike enterprise. On his death, she seized the standard of freedom as it fell from his lifeless hand; and although all the other insurgents were cowering in submission before the victorious royalists, she resolved to make Toledo the last citadel of liberty, and to defend it against the whole country. The commanding spirit of the heroine immediately brought into simultaneous action all the devices that could awaken sympathy for herself, or interest in behalf of Spain. She rallied the citizens around her, and kept their enthusiasm ever burning by constantly calling to their remembrance the deeds and death of her husband. She gave a sacred

Padron || Padua. character to the contest by using crucifixes instead of colours, and employing the revenues of the cathedral to defray expenses. She was also continually despatching letters and emissaries to implore assistance from the other cities of Castile, and the French general in Navarre. Thus did Doña Maria for several months, in the face of a powerful government, hold the city of Toledo. At length her influence, which could not be overcome by external force, began to be undermined by internal dissension. The troops, though victorious in several sallies, became hopeless of ultimate success; the mob grew impatient of the rigours of a blockade; the clergy took advantage of this disaffection to accuse the heroine of using witchcraft; and the noble woman was driven out by her ungrateful fellow-citizens. Yet Doña Maria made a becoming exit off the stage of history. Retreating into the citadel, she held out for four months longer; and not until she had been reduced to the last extremity did she retire into Portugal to pass the rest of her life. (Robertson's *Charles V.*)

PADRON, a town of Spain, province of Coruña, Galicia, on the Sar, near its confluence with the Ulla, 50 miles S. of Coruña. It contains a cathedral, a court-house, schools, and a prison. The body of St James is said to have landed at Padron, after miraculously sailing from Joppa in seven days. It was on this account a favourite resort of pilgrims. Pop. 6108, employed in farming and in the making of woollen and linen stuffs.

PADSTOW, a town of England, county of Cornwall, on the estuary of the Camel, 26 miles N. by E. of Falmouth. It is an old-fashioned fishing-town, and contains an old Gothic church, a custom-house, and some other public buildings. Ship-building is the business chiefly carried on. Corn, slate, and other minerals are exported. Pop. 2224.

PADUA, a province of the Lombardo-Venetian kingdom, in the government of Venice, is bounded on the N. by the province of Treviso, E. by that of Venice, S. by the Polesine, W. by Verona, and N.W. by Vicenza. It extends over 835 English square miles, and is divided into eight districts, containing 104 communes and 771 villages. Its population, which in 1834 was 286,800, in 1857 had risen to more than 318,000 persons. The land is an extensive plain, except on the S.W. side, where the volcanic group of the Euganean Hills rises. It is chiefly drained by the Brenta, the Musone, the Bacchiglione, and the Adige which skirts it on the S.; and has numerous canals, many of which are for irrigation, and some for navigation. The fertility of the soil is very great, and agriculture is well conducted; wine, wheat, maize, rice, oil, great variety of fruit, sheep, poultry, &c., are copiously produced. Hemp, flax, and silk are also extensively grown, and afford some employment to manufacturers, but they are chiefly exported in a raw state. The district of the Euganean Hills has numerous mineral springs; those of Abano, only 6 miles from Padua, are much resorted to by invalids.

PADUA (the anc. *Patavium*, Ital. *Padova*), the capital of the province of the same name, and one of the most ancient cities in Italy, is situated on the River Bacchiglione, in 45. 23. 40. N. Lat., and 11. 46. 38. E. Long. It stands in the midst of a garden-like plain, and is connected with the Lagunes by the Large Canal, with the River Adige by the Monselice Canal, and with Venice, Verona, and Milan by railway.

Legendary tradition attributed the foundation of *Patavium* to Antenor, after the fall of Troy:—

> "Antenor potuit, mediis elapsus Achivis,
> Illyricos penetrare sinus, atque intima tutus
> Regna Liburnorum, et fontes superare Timavi . . .
> Hic tamen ille urbem Patavi, sedesque locavit
> Teucrorum . . .
> . . Nunc placida compostus pace quiescit."
>
> *Æneid*, i. 243.

A large skeleton, grasping a sword in his bony hand, found in a marble sarcophagus discovered in 1274, was supposed to be that of the Trojan founder. *Patavium* was the capital of the Veneti, and at an early period was so flourishing that, according to Strabo, it could send an army of 120,000 men into the field. The Patavians were constantly at war with, and successfully withstood, the Cisalpine Gauls; and in 301 B.C. they also defeated Cleonymus the Lacedæmonian, who had unexpectedly landed at the mouth of the *Medoacus* (the modern Brenta), and attacked them. *Patavium* fell eventually under the power of Rome, though it seems to have retained a semblance of independence. At the time of Strabo it was still the first city in Upper Italy; but it was gradually eclipsed by Aquileia and Mediolanum. Its prosperity came suddenly to an end in 452, when it was taken and destroyed by Attila; and in 601 it was again taken and burnt to the ground by Agilulf, King of the Longobards. It rose, however, from its ashes; and in the tenth century it had already become, as it has continued ever since, one of the most important cities of Upper Italy. Padua.

In 1164 Padua formed, with Verona, Vicenza, and Treviso, a league for the protection of their liberties against Frederic I. Barbarossa; in 1167 it joined the great Lombard League; and by the peace of Constance in 1183 had at length its liberties acknowledged. In 1239 Eccelino da Romano made himself master of it, and after having practised unheard-of cruelties, in 1256 he was driven out and defeated by a crusade formed against him by most of the towns of Upper Italy. After a period of stormy independence, Padua in 1337 fell under the sway of the house of Carrara, who held it till the year 1405, when it was taken by the republic of Venice, with which, in 1797, it passed into the hands of Austria by the treaty of Campoformido.

The modern city contains upwards of 50,000 inhabitants, and is the see of a bishop, and the residence of the civil and criminal courts of first instance of the government of Venice. It is surrounded with walls and ditches, and defended by several bastions; it has many churches rich in works of art, many magnificent public buildings and old palaces, and several fine squares; but the streets are generally narrow, and most of the houses are supported by long rows of pointed arches. Its university, one of the oldest in Italy, enjoyed great celebrity as early as the beginning of the thirteenth century; and some of the greatest medical names in the sixteenth and seventeenth centuries, are among its professors. Galileo was for many years its professor of mathematics. There are five faculties—theology, law, medicine, philosophy, and mathematics, with 46 professorships, and from 1200 to 1800 students. In consequence of disturbances that took place on the 9th of February 1848, the university was closed on the 15th of that month by the Austrian military authority, and was not re-opened till 1850. Connected with the university, but at a distance from it, is a library of more than 100,000 vols. and 1500 MSS. The Episcopal and Benedictine libraries have more than 50,000 vols. each; and the Capitular library, of which Petrarch was one of the founders, 10,000 vols. and many MSS. There are connected with the university a botanical garden, founded by the Venetian senate in 1543, and containing some of the oldest specimens of exotic trees and plants in Europe; an astronomical observatory, founded in 1769; four clinical schools for medicine, surgery, midwifery, and diseases of the eye; and a veterinary and agricultural college. The Palazzo della Municipalità, or town-hall, erected in the twelfth century, is a vast building upon open arches, and contains a hall 267 feet long, and 89 in height and width. The chapel of St Maria dell' Arena, erected by the Scrovegno family, contains the most perfect and genuine frescoes by Giotto. The church of St Antonio is remarkable for the richness and beauty of its internal decorations. The Prato delle Valle is an irregular open space, in which are numerous statues of great men, chiefly natives of Padua.

Livy, and Thrasea Pætus, who was put to death by Nero, were born at Patavium; and modern Padua has been the birth-place of many distinguished philosophers and literary characters.

PADULA, a town of Naples, province of Principato Citra, 6 miles S.E. of La Sala. It contains several churches, and an hospital. Near the town are the remains of the once famous monastery of St Lorenzo, which was destroyed by the French. Pop. 9000.

PADUS, a river of ancient Italy. (See Po.)

PÆAN (παιάν, παιήων, and παιών), a hymn or song originally sung in honour of Apollo, and deriving its name, as is generally supposed, from Pæan, the god of healing, who, although alluded to in Homer as a distinct deity, was in all probability identical with Apollo. At all events, the name and office of healing after Homer's time were transferred to Apollo; he was invoked by the cry ἰήιε Παιάν (Æsch. *Ag.* 146; Soph. *Œd. Tyr.* 154); and in the choral chants sung to his honour the burden was ἰή or ἰώ Παιάν (Athenæus, xv., p. 696, &c.) The pæan was invariably a loud and joyous song expressive of hope and confidence. It was sung after any great deliverance, as a plague (*Il.* i. 473), or a battle (*Il.* xxii. 391). The Greek troops occasionally sung it as a war-song previous to an engagement (Xen. *Anab.* i. 8, § 17), which, if we may trust the statement of the scholiast on Thucydides, i. 50, was sacred to Ares or Mars; while that engaged in after the victory was addressed to Apollo. Other gods, and even mortals, had pæans occasionally sung to their honour. Thus the Lacedæmonians sang a pæan to Poseidon (Xen. *Hell.* iv. 7, § 4), and the Greek army to Zeus (Xen. *Anab.* iii. 2, § 9). Aratus sang pæans to the Macedonian Antigonus (Plat. *Cleom.* 16); a similar practice was employed at Delphi in honour of the Macedonian Craterus; and the Rhodians chanted the triumphant song to the praise of Ptolemæus I. of Egypt (*Athen.* xv., p. 696). (See Muller's *Dorians*, and *Hist. of Greek Literature.*)

PÆDO-BAPTISTS (from παις, *a child*, and βαπτιζω, *I baptize*), those who maintain that baptism should be administered during infancy. (See Baptism, and Baptists.)

PÆSTUM, or Posidonia, an ancient city of Lucania, was situated near the shore of the Pæstanus Sinus (*Gulf of Salerno*), about 5 miles S.E. from the mouth of the Silarus (*Sele*). The facts of its primitive history are very few. A colony of Greeks from Sybaris were probably its founders; it was originally called *Posidonia* ("the city of Poseidon or Neptune"); the magnificent remains of Grecian architecture that are still seen on its site indicate that it rose under its first inhabitants to opulence and splendour; and we infer that it passed, along with the neighbouring colonies, into the power of the Lucanians, and afterwards into that of the Romans. Not much greater is the historical importance of Pæstum during the period which followed its subjugation to Rome. During the second Punic war it had become one of the *Coloniæ Latinæ;* in the time of Strabo the stagnation of a rivulet that flowed past the walls had rendered the inhabitants unhealthy; during the period between the fifth and tenth centuries the town is noticed by ecclesiastical historians as the seat of a bishopric; and immediately afterwards it fell into ruin and desolation under the devastations of the Saracens. It was not until the eighteenth century that Pæstum attained its chief celebrity on account of its splendid architectural remains. These stand on a level uninhabited plain by the sea-shore, and are descried by the mariner from afar as he sails across the Gulf of Salerno. The principal structures are two hexastyle peripteral buildings, which, with the exception of the temple of Corinth, are considered to be the most severe and massive specimens of Doric architecture now extant. The finer and older of the two, which is known by the name of the temple of Neptune, is hypæthral or open to the sky, and occupies a space of 180 feet long by 80 wide. The other, differently called the temple of Vesta and of Ceres, is 108 feet in length by 48 in breadth. There is also another edifice which is supposed to have been a *basilica.* The remaining vestiges of the city consist of the ruins of an amphitheatre, many private houses, the walls and the gates, interspersed occasionally with the famous Pæstan roses, which were celebrated by Ovid, Virgil, and other Latin poets, and which still, in their wild state, flower twice a year, and shed a surpassing fragrance. (Swinburne's *Travels into the Two Sicilies* in 1777–78–79–80, in 2 vols. 4to, London, 1783–85; and Wilkins' *Magna Græcia*, fol., Cambridge, 1807.)

PAEZ, Pedro, a famous Spanish missionary, was born at Olmedo in New Castile in 1564. Having entered the Order of Jesus, he devoted himself to foreign missions, and repaired to Goa in 1588. His toils and sufferings, however, in the cause of proselytism did not commence until, in the course of a year, he was despatched along with a fellow-missionary to Abyssinia. The vessel was boarded by pirates off the coast of Arabia; he was doomed to hard labour during a captivity of seven years at Sana, the capital of Yemen; the next few years were spent in sojourning at Diu and Camboya; and it was only in 1603 that he reached his destination, the Abyssinian town of Massowa. Paez now set himself to spread Christianity throughout the country. Within a year he had made himself a proficient in Geez, the chief of the native dialects; had translated into that tongue the catechism of Marcos George; and had by these means been enabled to instruct in Christianity several Abyssinian children. This vigorous beginning soon led to important results. The success of the missionary was quickly known throughout the country; he was summoned to preach before the court, and so effectual was his sermon, that the king Za-Denghel professed himself a convert, and wrote to Europe for more missionaries. Even although this last act led to a civil war, and cost the king his life in 1604, the influence of Paez continued to increase. The successor to the throne, Melek-Seghed, recalled him to court, and presented him with a piece of ground at Gorgora, for the purpose of building a convent for his order, and a palace for himself. At length the king and the nobility were induced to abjure paganism and embrace Christianity. The missionary was rejoicing at the success of his labours, when he was seized with a fever, which brought his life to a close in 1612. Paez was the first European who visited the Abai, the supposed main branch of the Nile, although this honour was afterwards claimed by Bruce the traveller.

PAGAN, Blaise-Francois Comte de. (See Fortification, § *Rampart or Town Fortification.*)

PAGANINI, Nicolo, the most distinguished violinist of his time, was born at Genoa on the 18th of February 1784. His father was a small shopkeeper, and fond of music. Nicolo's musical talent manifesting itself in his infancy, his father resolved that it should receive proper cultivation; and therefore placed him under Costa, chief violinist at Genoa, with whom he studied the violin for six months with great assiduity. When twelve years old he performed in public, at Genoa, variations upon the air *La Carmagnola*, and was received with rapturous applause. His father then placed him under Alessandro Rolla, at Parma, and afterwards under Ghiretti, for instructions in instrumental composition. He laboured incessantly to perfect his violin-playing; and having accidentally met with Locatelli's ninth work, *L'Arte di Nuova Modulazione*, devoted himself to the study of that music, full of excessive difficulties and novel effects. It seems probable that he was also acquainted with that very extraordinary book, *Hortulus Chelicus*, &c., published in 1688 by the German violinist Walther, who held an office at the electoral court

of Mayence. In Walther's book we find very difficult passages in single and double stops; imitations of cocks and hens, of the nightingale, of the guitar, of the muffled harp, and of the bagpipe, &c., all for one violin. The writer of this article has a copy of that curious work, but wanting the last seven pages. In 1801 Paganini began his professional travels in Italy; and in 1827, at Rome, received from the Pope the Order of the Golden Spur. Between 1801 and 1805 he studied the guitar for nearly four years. He visited Germany in 1828, and gave his first concert at Paris on the 9th March 1831, and was everywhere heard with delight and astonishment. In the same year he went to London, and afterwards to Dublin and to Edinburgh. He returned to Italy in 1834, and purchased several properties, among others the Villa Gajona, near Parma. In 1836 he was unfortunately led by some speculators to join in the establishment of what was named the "Casino Paganini," in one of the fashionable quarters of Paris. Concerts were given there, but did not pay the expenses of the casino. Paganini was too ill to perform at these concerts. The creditors of the speculators raised a process against him, and he was condemned to pay 50,000 francs, and a warrant was issued for seizing his person. When that judgment was pronounced, he was dying at Nice, after having languished for some time in the south of France. He died on the 27th May, 1840, leaving considerable wealth to his only son. The peculiarities of Paganini's style have been carefully described in a work by Carl Guhr, chapel-master and director of the theatre in Frankfort-on-the-Maine. His great superiority as a violinist excited much envy and jealousy, and thence arose a number of absurd and atrocious calumnies directed against him, especially in Paris. He published the testimonies of Italian ambassadors and public functionaries in disproof of the accusations of his enemies, and reduced them to silence. Several spurious works were published under Paganini's name. The following is the list given by himself of his published works:—12 Caprices ou études pour violon seul, Op. 1, Milan, Ricordi; Paris, Pacini. 6 Sonates pour violon et guitare, Op. 2, ibid. 6 Idem, Op. 3, ibid. 3 Quatuors pour violon, alto, guitare, et violoncelle, Op. 4, Milan, Ricordi; Paris, Richault. 3 Idem, Op. 5, Milan, Ricordi. (G. F. G.)

PAGANISM is a general term applied to all forms of religious worship that differ from Christianity, Judaism, or Mohammedanism. It is thus equivalent to the term *heathenism*. The name pagans (*pagani*, villagers) was employed by the early Christian writers to designate those who, after Christianity became the prevailing religion of the towns, still adhered to the old Roman faith. (Isidorus, viii. 10; Cod. Theod. 16, 10.) These *pagani*, or occupants of the *pagi*, into which the country people of the Roman nation were divided as early as Servius Tullius (Dionys. iv. 15), or, according to some, of Numa (Dionys. ii. 76), and which continued down to the latest times of the Roman empire, were, by a necessity of their position, excluded from the superior influences of civilization known to the towns, and practised rites and celebrated festivals quite peculiar to themselves. The most famous was their annual festival of the *Paganalia*. Gradually the term *pagani* came to signify those who adhered to heathenish observances, or to the worship of false gods.

PAGGI, Giovanni Battista, an Italian artist, was born at Genoa in 1554. In addition to his passion for pictorial art, he attained early to a high celebrity in poetry, philosophy, and history. His first lessons in painting were received from Cambiaso; and he was gradually rising into notice in his art, when he was compelled to flee his country for homicide. He took up his residence in Florence, where he remained for twenty years, executing pictures of great merit. His works were characterized by dignity and nobleness, combined with a grace and delicacy which brought him occasionally into comparison with Baroccio, and even Coreggio. Witness his pictures in the church degli Angioli, in the cloister of S. Maria Novella, his stupendous "Transfiguration" in S. Marco, and his three pictures at Pavia. His reputation obtained his recal to Genoa in 1600, and he set to work to revive the declining art of his native town. Vandyck and Rubens had just visited that place, and left behind them some of their masterpieces, which provoked the competition of Paggi, and led to the production of his best works, the "Slaughter of the Innocents," and the two paintings at the church of S. Bartolommeo, executed in 1606. The better to further his design in reviving Geneose art, Paggi published in 1607 a useful compendium, designed for the use of young painters, entitled *Diffinizione o sia Divisione della Pittura*. This distinguished artist died at Genoa in 1627, leaving behind him a school of painters who did much to sustain the reputation of their master. (Lanzi, *History of Painting*, vol. v.)

PAGNINUS, Sanctes, a learned Italian Dominican, was born at Lucca in 1466. He was deeply and accurately skilled in Latin, Greek, Chaldaic, Arabic, and particularly Hebrew. After examining the vulgar translation of the Scriptures, he pronounced it very inaccurate, and undertook to make a new one from the Hebrew text. Under the patronage of Leo X., his version was printed at Lyons in 1528. This is the first modern translation of the Bible from the Hebrew text. Pagninus, however, is thought to have adhered with too great servility to the original, and thus to have rendered his translation obscure, barbarous, and full of solecisms. He also translated the New Testament from the Greek; and was author of a Hebrew Lexicon and a Hebrew Grammar. He died in 1536, at the age of seventy. Luther spoke of him and his translations in terms of the highest praise.

PAGO, an island of Austria, kingdom of Dalmatia, belonging to the circle of Zara, and lying to the N.N.W. of that town. It is of an irregular form, 37 miles in length by 6 in breadth; area, 106 square miles. The inhabitants are employed in fishing, making salt, tending sheep, and growing the vine. Pop. 5000. The town of Pago had, in 1846, 3078 inhabitants.

PAGODA (Pers. *pout ghod*, or *boot khoda*, house of an idol, or abode of God), is the name ordinarily applied by Europeans to eastern temples dedicated to the worship of idols. The pagodas of Hindustan and China usually consist of three subdivisions,—viz., a porch, a vestibule for the priests, and an inner sanctuary, where the principal idol (often called *pagoda*) is placed. Many of the Chinese temples, or *taas*, as they call them, are lofty, storeyed towers, gradually diminishing in height and width as they approach the summit, each storey ornamented by a projecting roof of glazed tiles, with bells suspended from the eaves. The taa or pagoda of Nanking, the most famous of the Chinese structures, will be found described under Nanking. The pagodas of Benares, Siam, Pegu, and Orissa are well known. (See Juggernath, and Architecture, § *On Indian Structures*.)

The term *pagoda* is also applied to a gold or silver coin current in Hindustan, value from 8s. to 9s., and probably deriving its name from the images of the gods originally stamped upon it.

PAHANG, a territory of the Malay Peninsula, lying between N. Lat. 20. 10. and 4. 15., is bounded on the N. by Tringanu, E. by the Chinese Sea, S. by Johore, and W. by Salengore. The coast, which is skirted by numerous small islands, is in some places low and swampy, but in others presents a bold rocky front to the sea. The interior is little known. Along the western frontier runs a chain of hills, sending several small rivers to the sea. The country contains gold and tin, the latter of which is exported in

large quantities. The rajah of Pahang, though nominally subject to the sovereign of Johore, is virtually independent. Population variously estimated from 50,000 to 16,000. The town of Pahang stands at the mouth of a river of the same name, 135 miles N.E. of Malacca. It is chiefly built of wood and bamboos, and has 8000 or 10,000 inhabitants.

PAHLUNPORE, a small state of British India, under the superintendence of the presidency of Bombay, lies between N. Lat. 23. 57. and 24. 41., and between E. Lon. 71. 51. and 72. 45. It is bounded on the N. by the Rajpoot principality of Serohee, E. by Keyralla and Daunta, S. by the district of Puttun, and W. by Thurraid; area, 1850 square miles. The north-east part of the country is occupied with mountains, from which the rivers Bunass, Surruswuttee, and Numrodakee take their origin, and flow into the Runn. The reigning family of Pahlunpore is of Afghan origin, and received this country from the Emperor of Delhi towards the end of the seventeenth century. This state being in 1813 in a condition of anarchy and civil war, the British government interfered to restore order. An arrangement was accordingly made that Futteh Khan, the rightful heir, should reign under the guardianship, during his minority, of his uncle, Shumshere Khan. But the latter, having failed to fulfil his agreement, was in 1817 deprived of his authority; and Futteh Khan finding himself unable to manage his affairs, a British agent was sent to superintend the finances, but with no power to interfere, except by recommendation, with the internal affairs of the state. No tribute is paid to the British beyond the expenses of this agent, but L.5000 is paid to the Guicowar. The average annual revenue is little less than L.30,000; the expenditure, exclusive of the above tribute, L.20,000. Pop. 130,000. The town of Pahlunpore stands on the road between Neemuch and Deessa, 80 miles N. of Ahmedabad. It is walled, and has some trade and manufactures. Pop. estimated at 30,000.

PAIMBŒUF, a town of France, capital of an arrondissement of the same name, in the department of Loire-Inférieure, stands on the left bank of the Loire, here 3 miles broad, 24 miles W. of Nantes. The river is lined with quays; and the town contains dockyards, a customhouse, school of navigation, and has a convenient harbour for the largest vessels, formed by a mole 214 feet long. The people are employed in ship-building, making bricks, tiles, canvas, cordage, marine stores, and other articles; as well as in the fisheries and the coasting trade. Steamers ply daily to Nantes; and large vessels generally discharge their cargoes into lighters here. Pop. (1856) 4135.

PAINE, Thomas, a notorious political and deistical writer, was the son of a Quaker, and was born at Thetford in Norfolk in 1737. The early part of his career was marked by a restless love of vicissitude. A scanty education had scarcely been received, and his father's trade of staymaking had scarcely been learned, when he went out into the world to seek his fortune. He shifted ceaselessly from town to town; divorced one wife after burying another; and plied, according as necessity compelled him, the various vocations of staymaker, sailor, exciseman, schoolmaster, grocer, and tobacconist. In 1774 he was a garret writer in London; and in the following year he arrived in Philadelphia, a literary adventurer, with a letter of introduction from Dr Franklin. Paine now began a new era of his life by appearing upon the field of political controversy as a defender of the rights of the American colonies. For engaging in such a contest with spirit and success he was well qualified both by disposition and training. His weapons were a rough, ready, and vigorous intellect; a coarse and merciless wit; a stock of impudence with which he could out-brave all the claims of propriety; and a supply of venomous ill-humour into which he could dip all the darts of his satire. He begun the attack in January 1775 by publishing *Common Sense*, a pamphlet which boldly sounded the note of rebellion, and summoned the colonies to prepare for separating themselves from the mother country. The stirring effect which this work produced, and the unprecedented popularity which it acquired, fairly involved the author in the contest. As the great struggle for independence proceeded, he found himself called upon, in a series of papers called *The Crisis*, to console the Americans for any check they might have encountered, and to ridicule the British for any deed they might have done. All these services were rewarded during the continuation of the war by the office of clerk to the Committee for Foreign Affairs, and at the conclusion of hostilities by a donation of 3000 dollars and an estate near New Rochelle. The peace which followed between America and Great Britain was not the proper element for a spirit that revelled in revolution and misrule; and accordingly, in no long time, Paine had begun to look towards a new sphere of action. Repairing to Europe in 1787 with the professed purpose of exhibiting a model of an iron bridge, he commenced to incite and inflame the insurrectionary feeling that was secretly growing in England, and openly venting itself in France. For some time he continued to pass between the two countries like a firebrand, carrying the flame of rebellion from the one to the other. At length, in 1792, his arraignment by the British government on account of his seditious publication *The Rights of Man*, forced him to flee to France, and to play an active part in the bloody and undiscriminating revolution which was raging there. Barely escaping the guillotine on one occasion, and suffering imprisonment on another, he was for several years a member of the French National Convention. He brought his destructive labours to a climax in 1794–5 by attempting, in his celebrated book *The Age of Reason*, to overthrow Christianity, and introduce into religion the anarchy and disorder of his political creed. From this time the influence and happiness of Paine began simultaneously to decline. During the remainder of his stay in France he was fast falling into disrepute, and yet he was afraid to set sail for the United States lest he should be seized by British cruisers. On his return to America in 1802, the decay of his fortunes became still more apparent. His profane attacks upon religion had alienated many of his political friends; his growing worthlessness cooled the attachment of the few that were left; and his insolent resistance of all interference, repelled those strangers who would willingly have done him service. The wretched old man was thus driven to throw off all regard for his fellow-men, and consequently all respect for himself. Thenceforth he lived alone in lodgings, abandoning himself to sordid sloth, and deadening the pangs of his awakening conscience, and the uneasiness of his diseased body, with the stupor of intoxication. His miserable condition was terminated only by his death in June 1809. (Cheetham's *Life of Paine.*)

PAINGTON, a town of England, county of Devon, at the head of Torbay, 6 miles N.N.E. of Dartmouth. The parish church is an old building, containing a curious stone pulpit. There are several other places of worship, schools, and a reading-room. Large quantities of cider are made in the vicinity. Pop. of parish, 2746.

PAINSWICK, a town of England, county of Gloucester, stands on the southern slope of Sponebed Hill, near the Slade Water, 6 miles S. of Gloucester. It is irregularly built, and has an old church, several other places of worship, schools, and benevolent institutions. A large number of the inhabitants are employed in the manufacture of woollen cloth; and freestone quarries are worked in the vicinity. Many Roman coins and antiquities have been found in the neighbourhood. Pop. of parish, 3464.

PAINTING.

Painting.

Definition.

PAINTING is the art of conveying thought by the imitation of things through the medium of form and colour, light and shadow. Colour, and light and shadow, can by themselves do little more than excite sensations of harmony and sentiment, independently of action, passion, or story; but if founded upon form, thoughts become clear, expressions of passion intelligible, and actions, gestures, and motions of the human frame defined and decided. *Form* therefore is the basis of painting, sculpture, architecture, and design of every description.

Any school of painting, therefore, which is established upon a principle different from this, or which makes the subordinate parts of colour, light, and shadow the principal law of its practice instead of a component part, is in opposition to the most celebrated schools in the world; for the most eminent both in Greece and in Italy, were indebted for their celebrity and renown to the strict observance of the doctrine here enunciated. In Greece, the schools of Sicyon, Corinth, Athens and Rhodes, and in Italy, those of Pisa, Florence, Rome, and Bologna, were the most important, the most useful, and the most intellectual; and in all these *form* constituted the great and fundamental law of their practice. But in Venice, colour took the lead; it predominated too in Holland and Flanders; and it has always reigned, to the sacrifice of common sense, in Britain. Yet for sound and philosophical views of art, as a vehicle of passion or of moral national influence, neither of these schools can be referred to, with the same conviction or confidence with which all nations can refer to the former great sources of sense, principle, and genius.

Origin of painting.

In what country Painting first originated, is nearly as difficult to discover, as it is to find a country where it never existed at all. Design, the basis of painting, must have begun with the very first instrument of necessity which man required. The origin of any art, science, or discovery, is not so much owing to the particular accident which happened to the individual concerned, as to the intellectual adaptation of that individual to receive impressions of a peculiar nature from the particular circumstance which occurred. Thus whether Music was invented by the man, who, listening to the sound of an anvil, instantly composed notes; or whether Painting was discovered by the lovely girl, who, watching the shadow of her lover, as he sat silent at the prospect of parting, traced it upon the wall as a memento of their mutual affection; whether it originated with Philocles in Egypt, or Cleanthes in Corinth, or long before Egypt or Greece were habitable; the *principle* is the same. Without an inherent susceptibility to the impressions of sound, in preference to all other impressions, in the man, or an inherent susceptibility to the impressions of form equally intense in the girl, the intellectual faculties of either would have never been excited to compose notes, or to define figures. The art originated with the first man who was born with such acute sensibility to the beauty of form, colour, and light and shadow, as to be impelled to convey his thoughts by positive imitation.

When the Spaniards landed in South America, the mode by which the natives conveyed intelligence of their arrival to king Montezuma was by painting the clothes of the strangers, their looks, their dress, and their ships. This certainly must have been the most ancient, because the most simple and obvious mode in the world of conveying thought, after oral communication. But independently of all theory, there cannot be a doubt of the extreme antiquity of painting. The walls of Babylon were painted after nature with different species of animals, hunting expeditions, and combats. Semiramis was represented on horseback striking a leopard with a dart, and her husband Ninus wounding a lion. "And I went in and saw, and behold every form of creeping things, and abominable beasts, and all the idols of the house of Israel, *pourtrayed on the wall round about.*" (Ezek. viii. 18.) "She saw men *pourtrayed upon the wall*, the images of the Chaldeans *pourtrayed in vermilion*, girded with girdles upon their loins, exceeding in *dyed attire* upon their heads, all of them princes to look at, after the manner of the *Babylonians and Chaldeans.*" (chap. xxiii. 14, 15.) It is inferred from a passage of Diodorus Siculus, that these figures were painted first on the brick before burning, and then vitrified by fire.[1] But before this was done, experience must have been acquired of the liability to decay of painting upon external walls; and considering, too, that great statues were erected in Babylon, the arts must have existed amongst the Babylonians long before the period here referred to.

Antiquity of art in Ethiopia.

But a great revolution has taken place in our ideas on this subject, from the decyphering of hieroglyphics, and we are now assured of the extreme antiquity of art, in ages hitherto deemed almost entirely fabulous. From Asiatic art we have been accustomed to turn to that of the Egyptians; but it is no longer considered as a matter of speculation that the Ethiopians preceded the latter in knowledge, and that from this ancient people the Egyptians received gradually a knowledge of art. The course of civilisation probably descended from Ethiopia to Egypt; and yet we have evidence of the existence of Egyptian painting and sculpture more than eighteen centuries before Christ, and even then the arts were in the highest condition that the Egyptian school ever attained. From the most ancient records of the Jewish and Greek historians, in which Egyptian and Ethiopian monarchs are mentioned, and their actions narrated, we can now turn to corresponding traces of their existence and exploits commemorated upon the durable materials of the temples, tombs, and palaces which still remain. When therefore it is found that this method of interpreting hieroglyphics has proved to be correct, in all that we know of the Cæsars and the Ptolemies, or see casually alluded to respecting the Pharaohs, we have no right at all to dispute the truth of the same mode of interpretation when it indicates a still higher antiquity, though we have not the means of confirming it by collateral reference. Eighty miles above Dongola, Lord Prudhoe discovered the remains of a magnificent city, which he conceives to have been the capital of Tirhakah mentioned in the Bible; and amongst these ruins he observed two nobly executed lions, specimens of Ethiopian skill. On the shoulders of one is the name of Amenoph III., who was called Memnon by Greek historians. The style and execution of these great works are evidence of the talent of this people.[2] It is now certain that as early as the nineteenth century before Christ, the walls and temples of Thebes were decorated with paintings and sculpture, commemorating personal and historical events; and certainly in comparing the designs on these temples with those of a later period, we must conclude that the Egyptian school of painting never exceeded their merit.[3]

The conclusion to be drawn is, that at this time the Egyp-

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[1] Barry's *Lectures*.

[2] Now in the British Museum.

[3] See last vol. of *Sculpture* (Dilettanti).

tian priesthood had not interfered with art or artists; but that the painters were left freely to commemorate the great actions of their employers, to study nature, and to do as they liked. Many of these actions are delineated in a natural manner, and there is a great deal of dignity in the figure of the hero; the sea fights are also well grouped, and there are many of the Trajan-column figures, and not more gross perspective is visible. The colour is a mere illumination, and the composition as a whole infantine; but there is proportion, and not absolute ignorance of the component parts.[1] After this period, art became a mere tool in the hands of the priests; and as the law compelled the son to follow the profession of his father, it may be supposed that painting degenerated into the mere fac-simile of prescribed forms of gods, goddesses, and men, and that in the time of the Ptolemies it was little better than an illuminated hieroglyphic.

Character of Egyptian design.

The Egyptians appear to have done every thing with reference to form. Their painting was at best but coloured sculpture. They seem to have been aware of the mortality of colours, and to have said, "As colours must go, let us cut out the designs in stone, so that at least form may remain in our granite sculpture, and defy every thing but the convulsion of the earth." First the designer drew the outline in red, then the master artist corrected it, then the sculptor cut it, then the painter coloured it, gods blue, goddesses yellow, men red, and draperies green and black; and such is the extreme dryness of the climate, that a traveller says, he saw in Nubia, a bas-relief half cut, with the red outline left for the rest, and that he wetted his finger and put it up, and immediately obliterated a part of the red chalk.

The Egyptians would seem to have been a severe people, as hard as their own granite.[2] They had an awful feeling of respect for the wisdom of their ancestors; they hated reform; no physician dared to prescribe a new medicine, and no painter dared to invent a new thought. Plato says, that the pictures of his day in Egypt were just the same as from ages immemorial;[3] and, according to Winkelman, another cause of their inferiority in painting, was the little estimation in which painters were held, and their extreme ignorance. Not a single painter of eminence has reached us, and but one sculptor, viz. Memnon, author of three statues at the entrance of the great temple at Thebes. In the knowledge of the figure it is impossible they could be great; for there is proof that they dared not touch the dead body for dissection, and even the embalmers risked their lives from the hatred of the populace.

Winkelman divides Egyptian design into three periods: First, from the earliest times to the conquest of Cambyses; secondly, from the conquest of Cambyses to the subjugation of the Persian and the establishment of the Greek dynasty in Egypt; and, thirdly, from that period to the time of Hadrian.[4] When the paintings at Thebes were executed is not known. But they were upon the walls at the expulsion of the Shepherd Kings,[5] and this was the first period of their art, and before Moses. The Egyptians never, in either art, reached the power of making men, as Aristotle said of Polygnotus, *better* than they were; in other words, they never attained the true ideal beauty, founded on nature, yet above it. Their figures are debased transcripts of what they had about them, and therefore, so far authentic as to character. The Egyptian female heads are far from displeasing; they have a sleepy voluptuous eye,[6] a full and pleasant mouth, high cheek bones, dark brows, and there is something by no means disagreeable in the silent lazy look of their expression. But the very want of ideal beauty gives an assurance that the figures are Egyptian nature, and that every habit, public, private, civil and religious, is laid open to us, by the wonderful discoveries of Belzoni and his followers: it is almost as impossible now for an artist to be incorrect in painting an Egyptian subject, as it would be to err in painting a British one. In a tomb laid open by Belzoni, the characters of the procession were admirably distinguished; the Jew, the Egyptian, the Negro, and the Chaldæan, were as little liable to be confounded as if they had been before us. In their sculpture, however, there is more of science than in their painting. Sculpture was practised by the priesthood, and sculptors were called sacred stonecutters. The great head of Memnon in the British Museum is beautifully cut, the nose and mouth especially; and, considering its remote antiquity, it is really a great wonder.

Upon the whole, it is impossible to believe that the art of painting, amongst other nations, owed much to the Egyptians; they had no colour, and no light and shadow, but only some form, some expression, and some character. The groups of the ruins of Elythia shew a great deal of nature and simplicity; the animals are varied, and the cows are lowing and gamboling; yet it is after all but childish work, and as the paintings at Thebes are the best, those of Elythia have not much to boast of.

Whether the Greeks owe their beginnings to Egypt, is more than doubtful, from the simple fact of the early Greek painters using *no blue*, whilst it was the constant practice of Egyptian painters to use blue in every thing.[7] Athens was founded by an Egyptian colony, and painters might be amongst the emigrants, as well as masons and sculptors; yet in the early state of things, painters were not an article of necessity, and it is problematical if in this alleged emigration, there were any persons of that class. The beginning of art was the same in all nations. They might improve each other; but we do not believe that painting was ever originally brought into one nation by another, or that there ever existed any, where it has not always been more or less known from the remotest period of their history.

State of art amongst the Hebrews and other Eastern nations.

After Ethiopian and Egyptian art, that of the Hebrew people must next be examined. That they had sculptors and chasers, is evident; but it is not so certain that painting was practised. Though the cunning work of the curtains in Exodus means tapestry, and for any cunning work of the kind, designs coloured must have been executed; yet there is no proof in any part of the Bible that painting as an art was ever practised by them; and even the designs alluded to were exclusively applied for the purposes of religion. "Moreover, thou shalt make the tabernacle with ten curtains of fine twined linen, with blue, and purple, and scarlet; with cherubim of cunning work shalt thou make them." (Exodus xxvi. 1.) "And the Lord spake unto Moses, saying, See, I have called by name Bezaleel the son of Uri, the son of Hur, of the tribe of Judah; and I have filled him with the spirit of God, in wisdom, and in understanding, and in knowledge, and in all manner of workmanship, to devise cunning works, to work in gold, and in silver, and in brass, and in cutting of stones, to set them, and in carving of timber, to work in all *manner of workmanship*." (Exod. xxxi. 1—5.) Yet when Solomon wanted artists, he sent to Tyre, which is presumptive evidence of a deficiency of skill at Jerusalem. No allusion is made to the existence of the art of painting amongst the Hebrews; yet it is hardly possible to suppose a people working in stone, and silver, and gold, and timber, designing and weaving a cunning work of cherubims on curtains and bor-

[1] See the French national work on Egypt.

[2] *Odyss.* lib. xvii. v. 448.

[3] *De Legibus*, lib. 2.

[4] Wink. lib. ii. chap. 2.

[5] See 2d vol. of *Ancient Sculpture*, (Dilettanti.)

[6] See *Description de l'Egypte*, tom. i. plates.

[7] Col. Leake says there is a remnant of blue on the temple of Theseus; but that may be as applied to architecture. The question is, whether the great painters used it in their art. Pliny says no, and Quintilian confirms him by applying to them the expression *simplex color*. No colour is *simplex* where pure blue is used.

ders for garments, and having been so long amongst the Egyptians, to have been ignorant of painting; but it is the opinion of one of the greatest living authorities in the church, that the representation of any object by painting was not permitted to the Hebrews.

With respect to the painting of the Phœnicians, Persians, Indians, and Chinese, it was in the earliest ages, and has ever since been, miserable and wretched. Although the Indians and Persians have always been celebrated for their tapestry, yet it is more for the excellence of the material than the purity of their designs. You may know a tiger from an elephant, though scarcely from a monkey, in their tapestry, shawls, and carpets; but in their utter ignorance of the naked figure, their long, barbarous, and cumbersome garments, and their want of science, are so grossly palpable, that they have never been, and never will be, referred to by any nation as authority in design. In their coins, however, the ancient Phœnicians shewed more knowledge of the form than the Persians, the Chinese, or the Indians.

Etruscan art.

From the painting of these Eastern nations, we may now justifiably approach a people, whose origin, history, and science, have puzzled historians more than perhaps the Atlantides themselves. Who the Etruscans were nobody knows; but all agree that they were not aborigines, and this is establishing something. Yet it can scarcely be questioned that in their most remote, as well as their more refined periods, they were indebted for their arts, their language, and their religion, principally to the Grecians. The time when the Etruscans had commercial relations with Egypt and Greece, is hardly known;[1] but as their early style of art is a little Egyptian and their subjects Grecian, they were no doubt connected with both, even before the Greeks had settled in Italy. It is not yet decided where they came from, and who they were, and if one consults all who have written on the subject from Herodotus to M. Raoul-Rochette, he is likely to be as open to a new theory as when he began. Their early works prove nothing. These are like the early works of almost all barbarous nations. The gods of the Etruscans are, in point of art, the gods of the Peruvians, the Sandwich Islanders, or the Esquimaux. Idols are idols, in early nations all over the world; and the bandy-legged Apollos, squinting Pans, and *Dii indigenetes*, sixteen heads high, of this mysterious people, would do as well for any of the gods of the South Seas, as the early barbarians of the Mediterranean.[2] When commerce brought them in contact with Greece and Egypt, traces of the art of both nations become apparent; but this is no evidence that they came exclusively from one nation or from the other.

Winkelman is a person of great genius, and always touches art as if he saw the whole ground. He divides Etruscan art into three epochs, Heyne into five;[3] he goes to leading points, Heyne enters into details. The first epoch was gross; the second exhibited traces of Greek or Pelasgic art; the third had a taint of Egyptian; the fourth was better; the fifth produced ideal beauty and Greek mythology; and this completes the period till decay. Campania was colonized 801 B.C.; but the Eubœans had founded Cuma 1550 B.C. This neighbourhood brought the Etruscans in contact with Greek art, when about the ninth or eleventh Olympiad Greek colonies were established in Sicily; and the intercourse being reciprocal and complete, it cannot be wondered, that the more ignorant of the two nations became fascinated and inoculated by the superior one, and thus rendered Etruscan so like Greek art, that it has ever since produced doubt and confusion.

According to Pliny, the arrival of Demaratus with Cleanthes from Corinth, first brought art into Etruria about 650 B.C.; yet, he says, there were beautiful pictures at Ardea and Lanuvium, which were older than Rome, and Rome was founded 754 B.C. Heyne says, that before Rome was built, casting of metal, sculpture, and painting existed in Etruria anterior to any connection of the Etruscans with Greece; according to Winkelman the Etruscans were advanced in art before the Greeks, and it was a tradition of the remote ages, that Dædalus flying from Minos settled in Etruria and first sowed the seeds of design. When Etruria became a Roman province, Marcus Flavius Flaccus besieged Volsinium, the etymological meaning of which is, "The town of artists," and brought away two thousand statues from that city alone. An able writer in the "Newcastle Transactions" contends, that it is doubtful if the Etruscans had any art before the arrival of the Greeks.[4] No historian of this nation has reached us; their inscriptions are not yet thoroughly decyphered; and as the Romans destroyed every monument of surrounding nations, there is no fixing their antiquity. It is clear, however, that painting flourished in Italy before it did in Greece; such at least is the opinion of Tiraboschi.[5] Pliny says nothing about it before the 18th Olympiad in Greece, whereas in the 16th there were paintings in the above towns in Italy, and works too shewing great refinement; which the Romans admired in their days of splendour, and which their emperors wished to remove, surrounded as they were by the finest productions of Grecian art. Their civil and religious rites not being the same as the Egyptians, and there being no traces of embalming, it may thence be concluded that they were not of Egyptian origin.

All hopes of discovering any of their paintings, any important work which should give us evidence of their talents in art, were given up, till in 1760 Pacciaudi discovered at Tarquinia, tombs decorated with designs; and in 1837 fac-similes of pictural decorations of other tombs were exhibited in London, with the monumental statues themselves, and in parts were extremely beautiful in taste, design, expression, and drapery. The extremities were correctly and sweetly drawn; and the expression and character of the head, which were very interesting, would not have disgraced any period of Greek or Italian design, though they would not have honoured the finest. It is impossible to judge of the colour of the Etruscan school from these specimens, or from the vases called Etruscan. Fresco, stucco, or distemper are adapted neither for depth nor for tone; oil or encaustic is the only vehicle fit for harmony, and oil or encaustic was never practised by them. With respect to the painted vases called Etruscan, because they are found in Etruria, we might just as well assert, if one discovered in the middle of Yorkshire, a mass of china, that it must be of English manufacture because it was found in Yorkshire. After the Greeks had settled in the south, their vases might be and no doubt were an article of commerce; of course they were imitated, but surely the design and origin are wholly Grecian, whatever the Etruscans might after long intercourse do in the way of imitation. The principles of design and proportion in these beautiful productions, are the same as in the finest works of Greek sculpture, with an occasional but trifling variation. Raffaelle himself could not have exceeded the purity of form expressed by line, in drapery or figure. In the finest vases the artists seem to have been perfect masters of the figure, and to have gone right round with the stylus, till the contour of the part was completely expressed. Nor is there any thing wonderful in this, considering the manner in which Greek artists and manufacturers began, proceeded, and concluded their studies. According to Plato, a perfect mastery of the forms

[1] B.C. 1556. [2] See Gorius. [3] See Heyne's Notes on Winkelman, vol. i.
[4] This is a most able article, and the reader is referred to it for more extensive information on the Etruscans.
[5] *Storia della Letteratura Italiana.*

of man and animal was the basis of all instruction in design.

We have thus brought down the history of the art to a period, when our information, though imperfect, is more certain; but we can never sufficiently estimate the loss of all the ancient treatises on art, though we ought to be very grateful for what we possess in Plato and Aristotle, Pliny and Quintilian, and other ancient writers, Greek and Roman, down to the middle ages, and till the subject was taken up by Vasari and Lanzi.[1] The continued existence of this glorious art, can always be proved, more or less subject of course, like every thing human, to those alternations of splendour and calamity, triumph and misfortune, which are the lot of every thing here below.

Greek school of art.

The superiority of the Greeks in art is always attributed to the secondary causes of climate and government, forgetting the one important requisite, without which the influence of the most genial climate, or the patronage of the most perfect government could avail little; we mean natural and inherent genius. If the Athenians, the Rhodians, the Corinthians, and the Sicyonians owed their excellence in art to the climate, why did not the same climate produce equal perfection in the Spartans and Arcadians? If climate be the secret, why are not all people under the same latitude equally gifted and equally refined? Climate may be more or less favourable to intellectual development, but is never the cause of its existence. Government may elicit genius by fostering and reward, but can never create it. All the lamentation about the climate of England, Scotland, or Flanders, did not prevent Hogarth's appearance in the first, Wilkie's in the second, or Rubens' in the last of these countries; nor could all the beauty of climate in Greece or Italy, ever have made Mengs a Raffaelle, or David the Titian of modern times. It would be absurd to deny altogether the influence of climate in the extremes. It is not impossible but that genius might melt to indolence under the line, or freeze to apathy within the arctic circle; but even genius there would assert its superiority in something or in some way. What we contend for is, that Winkelman's theory of limiting the gifts of God, intellectual or corporeal, to latitude or longitude, is not borne out by facts, the great test of all theoretical principles.

The Greeks were idolaters, and their love of beauty was a principle of their religion. The more beautiful a face or form could be rendered in painting or sculpture, the better chance had the artist of the blessing of the gods here, and their immortal rewards hereafter. As beauty was so much prized by this highly-endowed people, those who were gifted with it became ambitious of making it known to great artists, and by them to the world. Artists fixed the fame of beauty in man or woman, and even children who gave promise of being beautiful were allowed to contest for a prize, and the child who won it had a statue erected to him. Many people were complimented by being named from the beauty of any particular part, and Winkelman quotes an instance, where one was called *Χαριτοβλεφαρος*, that is, "having eyelids where the graces sat." There were games instituted near the River Alphæus, where prizes were adjudged to the most beautiful; and the Lacedæmonian women in their bed-rooms kept continually before their eyes the finest statues. Still, this admiration of beauty was but a secondary cause; for though the Lacedæmonians showed this love of beauty, they did not produce great artists. The Greeks had a strong sensibility to beauty and an intense acuteness of understanding. Every artist was a philosopher, and every philosopher relished art, and understood it. The artists began by the study of geometry and of form; they analyzed the peculiarities of the form of man, by contrasting it with that of the brutes, and they settled the principles of beauty in that form and figure. The philosophers recommended to all classes the study of art, as a refined mode of elevating their perception of beauty; and the government seconded the recommendation of the philosophers. The priests found the religious feeling rendered more acute by painting and sculpture; and the authorities discovered, that the emotions of patriotism were doubled by the commemoration of great national events, in temples and in public halls. Now, add climate as adapted for such productions and their preservation, and genius, the gift of God, as the first cause, and no one surely need wonder that all these causes mutually acting on each other produced the miracles of perfection in art which the world has gazed at ever since with an incredulous and bewildered astonishment.

The passion for the beautiful in poetry, painting, music, and nature, led them to abhor the bloody amusements of the Romans. To contest for glory by pictures, poems, or music, to race for the prize of swiftness, or wrestle for the crown of strength, were the innocent and delightful objects of their Olympic games; and during those noble commemorations, war ceased, and all Greece assembled in happiness and joy. Even the harsh Spartans signed a truce of fifty days with the Messenians, that they might keep a fête in honour of Hyacinthus. The greatest men disdained not these contests. Plato appeared amongst the wrestlers at Corinth, and Pythagoras carried off the prize at Elis. What must have been the effect of all this upon a people of strong susceptibilities and of high natural genius?

Consider the respect which must have been paid to great artists, when such a man as Socrates pronounced them the only wise men. Æsop took the greatest pleasure in lounging in their painting-rooms; Marcus Aurelius took lessons in philosophy from an artist, and always said that the latter first taught him to distinguish the true from the false; and when Paulus Æmilius sent to the Athenians for one of their ablest philosophers to educate his children, they selected Metrodorus the painter, and, let it be remembered, that amongst the children placed under *his* care, was one of the Scipios. What must have been the effect on the rising youth of Greece when the Amphictyonic council decreed that Polygnotus, their greatest monumental painter, should be maintained at the public expense wherever he went, as a mark of the national admiration for his greatest work, the Hall at Delphi. The glory and the fortune of a great painter did not depend, as now, upon the caprice of individuals; he was the property of the nation; he was employed by countries and by cities; and his rewards were considered as a just portion of the national expenditure. The educated and the high-born were brought up with a conviction of the propriety and justice of this principle; and when they became members of the government, considered this as useful a method of public expenditure, as squandering thousands on matters merely diplomatic, or in vain shows, mummings, and pageants. And such will yet be the system of our own country, when the people become fully instructed, and are made sensible of the moral and commercial influence of painting.

When we reflect upon the money spent in England by the government, and the consequences which so often attend that expenditure, and when we find in Greece the different results of the same interference on the part of the state, and that the works there produced have been canons of beauty to the world ever since; it is natural to inquire, what was the system by means of which genius was so successfully rewarded? The secondary causes must have been, the competence of the tribunals to which poets, painters, musicians, sculptors, historians, wrestlers, boxers, and philosophers with such confidence appealed. It must have been the taste and

[1] See a beautiful passage *De Legibus*, lib. ii. p. 669.—If every scholar would mark and transcribe every passage relating to art, a code might soon be made out.

knowledge of the members which composed the judgment-boards, and their sincere conviction of the importance of their office. One has only to sift for a moment the nature of their greatest tribunal, that of the Olympian games; one has only to reflect on the deep feeling, the solemn sincerity, the awful piety of their conviction, that what they had to do involved the future prospects of the rising youth of Greece, and that on their moral honesty depended the glory of their country, and that of its painters, sculptors, architects, philosophers, poets, and heroes. Before proceeding to detail the rise and progress of Greek art, and Greek artists, as the painting of every nation is connected with its civil, religious, and scientific institutions (though more must always depend on highly-gifted individual effort to advance the knowledge of mankind, than any given assemblage of inferior individuals); a rapid examination of the principles which guided the decision of one of their most important tribunals, composed of the greatest men the world has seen, ought to form a portion of every history of the art.

Olympic tribunal.

Aristotle in his *Politics*,[1] as quoted by Mr Hamilton in his pamphlet on the Houses of Parliament, observes: "All were taught γραμματα or literature, gymnastics, and music, and many την γραφικην, or the *art of design*, as being abundantly useful for the purposes of life, but mainly because it enables us to appreciate the merits of distinguished artists, and carries us to the contemplation of *real beauty;* as letters, which are the elements of calculation, terminate in the contemplation of truth." A people thus educated, to understand the basis of beauty in art, and to believe that their decisions, when they became judges of genius, involved their own intellectual taste and repute, and who gave their decisions in the presence of kings, philosophers, and people, were as little likely to be biassed by unjust predilection as human nature could be; though, of course, in the corrupt times of Nero and the emperors, great abuses took place. But in the Marathonian period, if ever partiality was banished from human honours, it was banished from the Olympic games, in those immortal days of glory and patriotism. At this extraordinary assemblage, kings entered the lists, and nations respected the judgment, or if they refused to abide by the decision of a just tribunal, they were excluded by vote till they paid the fine and acknowledged their error. And what was the result? The highest honours were obtained in these contests, because every one gifted in art, poetry, music, or physical strength, knew that if he deserved the olive-crown, no partiality, no nephew of the judge's sister, or first cousin of the judge's wife, would deprive him of his due. Every being did his best, and if that *best* failed, he had a consoling conscious conviction that he had been honourably, and honestly, and nobly beaten by a better. It is astonishing, if once entire confidence exist between judge and competitor, to what a degree this confidence affects both; what a spring it gives to mind and body, and how honestly every thing is done: And if confidence be, from repeated experience, withheld, it is wonderful how half the faculties of the mind, and the powers of the body and soul, sink under the impression. Napoleon used to say, "that if the moral feeling of an army was in favour of a campaign, it was equal to 40,000 men." If moral confidence be lost in such cases, disgust is generated, and apathy, indifference, and failure are the result.

In order to understand the Greek character thoroughly, the system of excitement that was worked on, and the materials that were used to rouse the energies of competitors, it will conduce to the understanding of the secondary causes of their perfection, if the nature of the Olympic games be examined.[2] They are universally acknowledged to have subsisted before the rise of chronological dates and records; and the record of the Olympic conquerors after their restoration, is the first known chronological date. Pausanias says they were celebrated every five years, that is, they were celebrated on the fifth year after the fourth had passed; and Sir Isaac Newton is of opinion that they were originally instituted in celebration of victories. Why the Olympic games had always the preference, there is no knowing; but the grand statue of Jupiter at Elis, must no doubt have had considerable influence.

The privilege of presiding at the Olympic games was attended with such dignity and power, that the Eleans who had been in possession of it from the earliest times, were more than once obliged to maintain their right by force of arms. After various disputes about the number of presidents or hellenadicks, they remained at the original number of ten; and Pausanias says, that for ten months preceding the games, they dwelt together in a house appointed for them, and called from them, hellanodiceum. By the most scrupulous attention, they did every thing to qualify themselves for being deservedly the judges of *all Greece;* to which end they were patiently instructed by officers called guardians of the laws, and they attended every day in the gymnasium, upon the preparatory exercises of all those who were admitted as candidates, and who entered their names also ten months before, and exercised during a part, not the whole, of this time, in preparing themselves for the combat. Being exposed to the severest scrutiny, the judges had by these means frequent opportunities of trying the skill of the combatants, and also of exercising their own judgment; and both prepared themselves for the praise or censure of an awful tribunal, and a numerous assembly, whose censure could only be escaped by the most exact impartiality on the part of the judges, and the most sincere and earnest efforts for superiority on that of the competitors. In addition, the judges swore a solemn oath before the statue of Jupiter, upon their finishing the examination, to act according to the strictest equity and to all these precautions against human frailty, liberty of appeal to the senate at Elis was allowed to any one who felt aggrieved. The judges had also the power of excommunicating whole nations. Once an Athenian found guilty of corruption was fined, and refused to pay. The Athenians sanctioned his refusal, and were instantly excluded from all the games, till they repented and paid the penalty. When the Lacedæmonians were impertinent, other nations took up arms, and compelled them to submission. Such power had a wonderful effect on all the nations of Greece.

As the time approached, the candidates were rigorously examined as to their virtuous descent, and their own moral life; and when they passed in public review down the stadium, a herald demanded with a loud voice, "Is there any one who can accuse this man of any crime? is he a robber? is he a slave? is he wicked or in any way depraved?" Themistocles once stood up at the ceremony and objected to Hiero, king of Syracuse, because he was a *tyrant*, a name odious to the democracies of Greece; and there could not be a stronger evidence of their utter detestation of the name, than refusing to admit a king to contend because he was a tyrant; thus placing him upon a level with a slave, who could not by law be admitted. The candidates having passed in public review with honour, were then sworn, that they had done all which was required by law; and marching to the stadium, attended by their friends, connexions, and families, who encouraged them to do their best, and appealed to the gods to smile on their exertions, they were left for the fight. And being thus thought worthy of the contest, even defeat was considered by them as an evidence of their honour. The olive crowns and palm branches were placed before their eyes on beautiful tripods, to excite their utmost exertions, and when victorious it was announced by proclamation; they were crowned by the heralds, and then led along, preceded by trumpets, their names being shouted aloud throughout the vast assembly; and on

[1] Lib. viii. c. 31.

[2] See West's *Pindar*.

their return to their native city, they entered through a breach in the wall, drawn in a chariot. And such was the high feeling engendered by these judicious excitements, that even Alexander himself was refused permission to contend, because he was a barbarian, nor was he allowed until he had proved his ancient descent at Argolis.[1] "In the republic of the fine arts," says the catalogue to the designs for a National Gallery, "competition is the great source of excellence; but so to frame institutions, and invite competition as to secure all the attainable talent, and so to form a tribunal as to derive all benefit for the public, and to do justice to the competitor, have been matters of great difficulty in all ages and all countries."

The whole history of ancient art shews the estimation in which the unsophisticated judgment of the public was held. Aristotle[2] says, "The multitude is the surest judge of the productions of art;" "If you do not get the applause of the public," says some one else, "what celebrity can you attain?" and Cicero[3] makes the public the supreme judge. Thus then, no one ought to wonder at the perfection of Greek genius in every thing, stimulated as it was by these secondary causes, and the one acting upon the other, in a climate adapted in every way for comfort, for health, and for convenience. The Greeks were men like ourselves, not larger as their arms prove, and not handsomer, for there exist as fine forms in either sex, in Great Britain, as ever graced the atelier of Zeuxis; indeed Cicero complains of the plainness of the Athenians. When genius and secondary causes unite, as they sometimes do, then such men as Pericles and Alexander, and Polygnotus, Zeuxis, and Apelles, are the result; for all the Olympic games, and Greek tribunals, could never have made Hudson Apelles, nor Caligula the benevolent Howard. "If any thing were wanting," says Flaxman, "to convince us of the high estimation painting was held in by the Greeks, the facts alone, viz. that Plato studied it, and Socrat s was a sculptor by profession, are enough. But nothing is wanting."

In ancient painting, we certainly owe more to Pliny than to any other author; though in point of exquisite tact for hitting at once the characters of the great geniuses in art, he is not to be compared to Quintilian. There is more discrimination in the short account Quintilian gives of the painters and sculptors, than in all the delightful connoisseur chit-chat for which Pliny must ever be the leading favourite. Yet certainly his gossip and anecdotes are sometimes underrated by learned critics; for in two instances of gossip, about the partridges and grapes of Zeuxis and Protogenes, and the contest of Apelles and Protogenes very deep principles of Greek form and Greek imitation may be settled. Painting is said by Pliny to have existed before the foundation of Rome in Italy, as illustrated by designs on the walls at Ardea, Lanuvium, and Cœre. This is always mentioned with a sort of doubt by antiquarians, who suspect that to the arrival of Demaratus from Corinth, the father of Tarquin, king of Rome, Italy owes her first knowledge of painting; but it has been shewn that this cannot be so, if pictures were executed in Italy before Rome was founded. Pliny sneers at the Egyptians for boasting of the antiquity of their painting; whereas the Greeks equally deserve a sneer for believing that they had invented design.

Tabular and mural pictures; distemper and encaustic painting

The Greeks painted tabular pictures on wood, and mural pictures on walls. The materials were either encaustic or wax painting, and distemper or glue-painting. In encaustic on wood, they painted with a metal point called *stylus*; in distemper they painted with brushes, and in encaustic on walls they also used brushes. Tabular pictures were prepared with a ground of wax, and the composition was drawn in with a *stylus* or point as we draw upon an etching ground with a needle. At a sale of antiquities in London there was a regular Greek tablet with a wax ground, a stylus attached to it as boys hang slate-pencils to their slates, and a sentence of Greek actually half-cut. The word γραφω being used for painting, design, or writing, makes the instrument the same in either case. This tablet was like a slate; the middle had been planed smooth, and the frame was left round it. The progress of the Greeks is very interesting, and shews how the mind gradually advances to the imitation of reality, and rests impatiently on mere outline, as a representation of nature. After a certain time, the early artists, when they had drawn an outline, ventured to colour it inside with black. This mode of imitation was called σκιαγραφια, and the paintings σκιαγραμματα, or skiagrams, from σκια shade, and γραφω to draw. Our black profiles and whole figures seen in shop windows, are the skiagrams of the ancient Greeks. This was hailed as a great step, and the painter who could fill up a face or a figure with black was regarded as a man eminent in art. After a little came the genius with more extended views, who invented the μονογραμμα or monogram from μονος only, and γραφω, to draw; that is, to define *by line only*, an outline without a shade. Next came the man who had the nerve to try a *positive colour*. Pliny has preserved his name, Cleophantus of Corinth; he ground up a red brick,[4] and therefore the Greeks claimed the invention of colour, although the Chaldæans had painted men red on the walls of Babylon, and so had the Egyptians on their tombs, nearly a thousand years before them. This discovery was called μονοχρωμα, or monochrom, single-coloured from μονος alone and χρωμα colour, and this was their first attempt at imitating flesh.[5] Next came the white ground (the *gesso* of the Italians and lime and plaster of the Egyptians) covered with wax. From one colour, naturally enough came the others; for if brick produced red, earths, burned or natural, would produce other colours, and polychrom, from πολυς many, and χρωμα colour, was formed.

The art having now discovered its materials, soon advanced steadily and gloriously to excellence. "How long the brush assisted only the cestrum, and when it superseded it," says Fuseli,[6] "cannot be ascertained; it cannot be proved, that it ever entirely superseded it, and there is every reason to believe they were always combined." It has been contested that painting was not known in Homer's time, because he speaks not of art; but what would be said of any man who argued that painting was not known in Milton's time, because *he* did not speak of it. Homer speaks of *painting ships*, and Milton alludes to "the *painted stoa*;" but colouring and design must have been known from the shield of Achilles, and the tapestries of Helen and Andromache, if the walls of Thebes and those of Babylon had not settled the question. Troy was taken 1184 before Christ; but painting flourished in Egypt 1900 years before our era, that is, 716 years before Troy was taken, and 993 years before the era of Homer.

The nature of distemper and encaustic painting amongst the Greeks involves one or two questions interesting to artists. Their distemper was our tempera, and consisted in dissolving colour in water, and mixing it with glue; and though in Pliny, glue is only mentioned once, and that in conjunction with *(tectores)* plasterers, it is evidently to be inferred from the brushes used in its practice, that tempera intensely varnished was the general practice of the tabular painters, and encaustics the exception. On all encaustic pictures, the Greeks put (ἐνεκαυσεν) "burnt in;" and what justified them in doing so? Merely the general application of fire to melt wax, or a particular mode of practice. Was the cestrum or stylus heated, whilst finishing the work, after the wax had been laid on? or was any actual

1 See *Notes on West's Pindar*.
2 *De Republica*, iii. c. 7.
3 *De Oratore*, c. 49.
4 Testa, ut ferunt, trita, Plin. lib. xxxv.
5 Μονοχρωματον dictum. ibid.
6 Fuzeli, Lecture first.

heat applied to amalgamate the colour in the conclusion, which justified such a term? or was the wax actually melted and used whilst boiling? Pliny says, that there were certain colours which would not stand without varnish; and that after they were laid on walls and dry, they were varnished with a mixture of warm punic wax and oil. Every Greek artist had his chafing-dish or καυτηριον; and when the varnish was dry, it was heated by fire from the chafing-dish "usque ad sudorem," *until it sweated*, when it was rubbed with wax candles, and polished with white napkins. This method the Greeks called καυσις[1] or the burning mode; and why might it not be applied as well to encaustic pictures, when finished either on wood, copper, walls, or stone, thus harmonizing and judiciously amalgamating fierce execution or distinct touches, and authorising the word ἐνεκαυσεν being put after the artist's name?

All the artists in Europe know well how often they use a vehicle[2] for a varnish, and a varnish for a vehicle in practice; and hence it is too absurd to doubt for a moment, that any Greek painter who had once used oil and wax as a varnish, would not use it as a vehicle at the first opportunity. Pliny infers, that "ceris pingere," to paint with waxes (coloured) and "picturam inurere," to burn in the picture, were *the same methods*. "There were anciently," he adds, "two methods, one *cerâ*, with wax, and another on ivory with a cestrum; then came a third, boiling the wax and painting ships at once with it, which was a lasting mode, so that neither sea, wind, nor sun destroyed it." It appears from another passage, that the ships were painted in the same way[3] as pictures which were burnt in. "Waxes are tinted with these colours for pictures which are burnt in; a different manner of painting from that employed on walls, but like that (of waxes tinted) employed for painting ships." Were tinted waxes applied hot? From this it may be inferred that they were.

Encaustic painting may be divided into four methods: 1st, mixing the colours with wax, and thinning them at the moment of painting with a liquid; 2d, placing wax in colours on the ivory, distinctly like mosaic, and uniting them by working them over with a heated cestrum; 3d, boiling the wax and using it hot; and, 4thly, softening the whole picture after completion, by heating it with a chaffing-dish or cauterium. Both Pliny and Vitruvius describe this last method of varnishing; and it is curious to contrast their relative descriptions. Pliny is rapid, careless, general, desultory, as if talking at a party; Vitruvius, accurate, mathematical, careful, and architectural, as if every word was a brick, that must be poised and balanced. Pliny says you must liquefy punic wax with oil,[4] and rub it with a candle and napkins. Vitruvius says, after your wall is dry and smooth, liquefy punic wax, *paulo*, a little by fire, then *temper* it with oil. In Pliny the *paulo* is left out, and so is the fire; but Vitruvius guides you to the *degree*, which is every thing in the practice of the art of painting. The *paulo*, therefore, is invaluable; do not boil, but heat your wax, then liquefy it, then varnish, then when dry heat it with a chaffing-dish and rub it smooth. To artists this practice is beautiful, and though oil-painting was supposed to be unknown to the Greeks, this was very near the point, and if used by Polygnotus at Delphi or Thespiæ, would have justified the term *burnt in*, without the use of the cestrum.

It is not settled by Pliny who first discovered encaustic painting; it is not known, he says, whether Aristides may have invented it, or Praxiteles completed it. But there existed on the walls encaustic paintings by the old painters Polygnotus and Nicanor; Lysippus at Ægina put his name to his tabular works with ἐνεκαυσεν; Pamphilus the great master of Pausias, did not practice it exclusively; and Pausias was the first in this art. Pausias, Pliny adds, repaired the walls of Thespiæ, painted by Polygnotus, but being obliged to use the brush, failed, because he handled an instrument which he was not accustomed to. It appears, however, that the walls of Thespiæ were painted in encaustic by Polygnotus, and with the brush; or Pausias, the greatest encaustic painter, would not have been employed to repair them, nor would he have gone out of the way to use the brush, if Polygnotus had used the cestrum. But Pausias failed, because the brush was not his instrument; therefore encaustic on walls was not worked with the cestrum, as it was on tablets, and the burning in on tablets was not of the same nature as that on walls. That the brush and the cestrum were totally different in practice there is no doubt; but that there was ever a time when the brush was not used in painting is absurd; and Pliny is evidently wrong in saying it was the last method.

It stands to reason that to paint ships was the earliest necessity of navigation. The ark was pitched inside and outside (Gen. vii. 14). Pitch melted is in fact like wax or oil; and how was it to be equally spread over so vast a surface except by brushes? In fact, amongst the Egyptian antiquities imported of late years, brushes have been abundant. Thus the Greeks painted on walls, wood, stone, ivory, copper, and canvas; on walls it was *mural painting*, and on either of the other materials, *tabular painting*.[5]

There is another question which remains to be settled before touching on the great artists and their works: Did the Greeks paint in fresco? The belief has been that they did. Vasari affirms it; but Letronne certainly establishes the suspicion that they did not, except in a few ornamental parts of architecture, and that stucco was more in practice. In fresco the colours are placed on wet mortar, and become a part of it. In stucco the colours do not become a part, and can be separated. Certain colours are destroyed by contact with lime, and yet those colours which fresco would have ruined, *are always found on ancient painted walls*.

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[1] It is clear that *fire* was always an important part in an encaustic painting, because Philiscus painted a painter's room (atelier) with a little boy *blowing the fire* (Pliny, xxxv.)

[2] Vehicle, as distinct from varnish, means the liquid you paint with; varnish, the liquid you put over the work, when done, to preserve it.

[3] "Ceræ tinguntur iisdem coloribus, ad eas picturas, quæ inuruntur; alieno parietibus genere, sed classibus familiari."

[4] That Reynolds introduced wax into British art from this passage, there is no doubt.

[5] Not many years ago a dispute raged in France and Germany whether tabular painting was or was not the principal practice of the ancients, and whether mural painting was ever practised to any great extent. Letronne says cloth was not used *anciently* to paint on, and that Pliny thinks the man mad who painted Nero on cloth one hundred and twenty feet high; but the madness insinuated does not apply to the *cloth or canvas*, but to the *absurdity* of a portrait one hundred and twenty feet high in cloth. Why should canvas be only *once* used in antiquity, and never before or after till the middle ages? Is this likely? As a curious specimen of the blind violence of party, the friends of one of the combatants, Letronne, wrote to him from Athens, that in the temple of Theseus they discovered by candle-light round the upper part of the wall, *actual contours* of the works of Polygnotus *cut in on the plaster with the cestrum*, the colours having been picked out by the early Christians; thus proving that Letronne was decidedly right as to his theory of painting on walls. Yet would it be believed, that the friends of his opponent, Raoul-Rochette, wrote him in turn that they *did not see a single contour cut in*, but that they discovered a *sinking in* of the plaster as if fitted to receive tabular works which were let into the walls, and thus the theory of Raoul-Rochette,—viz., that pictures were scarcely ever painted on walls, but nearly always on wood, *is right*, whilst the former gentlemen assert that there are contours on the walls. But the theory of M. Letronne *is also right*; for the ancients painted on walls as well as wood; and though Pliny says that the greatest glory was obtained by easel pictures, he affirms that there were also pictures on walls, because in giving one of his reasons for preferring tabular pictures, he says pictures on walls cannot be saved in case of fire (*ex incendiis rapi non possunt*), and that he prefers tabular pictures. If pictures had not been painted on walls as well as on wood, how could he have illustrated his preference?

Letronne says, that there does not exist a well authenticated evidence of fresco, except as mere ornament in ceilings.

Having thus laid before the reader the different modes of Greek practice, without which no subsequent account of their arts or artists would have been intelligible, it is time to say something of the artists themselves, who practised these various modes of imitating nature. Of their different methods, their white grounds descended to them from the eastern nations, and have come to us through the middle ages. Some of their colours we use now, and for some we have substitutes as good. If their principles were as easily attainable as their colours, we should have very little to desire.

Ancient Greek artists.

In the earliest state of Greek art, Philocles from Egypt, and Cleanthes from Corinth, were the inventors of outline, and Ardices from Corinth, and Telephanes from Sicyon, the first who put it in practice, without any colour. To this early period may be applied the accusation of Ælian,[1] that the artists were obliged to write underneath their wretched illustrations, "This is a bull, this is a horse, this is a tree." The next were single-colour painters, or monochromatists, as Hygiomon and others. Now the sexes began to be distinguished, when Cimon the Cleonean had energy to attempt the imitation of every thing. He it was who invented fore-shortening, and drawing things at an angle.[2] He it was who had courage to vary the characters and forms of heads, to make them looking up, looking down, and looking behind; he articulated his joints, shewed the veins and muscles, and gave undulation and folds to his draperies. Panænus, Phidias's brother, painted the shield of Minerva at Elis, and also the battle of Marathon; and so much had the knowledge of colour and art advanced, that portraits of the great leaders, Miltiades, Callimachus, and Cynegyras, on the part of the Greeks, and of Datis and Artaphernes, on that of the barbarians, were introduced, and known by the spectators. It was at this period that the glorious contests for victory in art were begun at Corinth and Delphi; and Panænus was conquered by Timagoras of Chalcis, who commemorated his victory by a poem; "though I doubt not," says Pliny, "there is some chronological error."

The Greek national and monumental painter Polygnotus, flourished at this period or before it. He seems to have been really a great man, and to have possessed a mighty soul. He was born in Thasos, an island in the Ægean Sea; and his works seem all to have been national, votive offerings of cities and his country. He was worthy of the finest period of Greece, and met his noble patrons by a suitable return; he was one of those beings who are born for the time or beyond it, and of whom the time is in want, or for whom it is not enough advanced. He first clothed lovely women in light and floating draperies, adorned their beautiful heads with rich turbans, and thus advanced the art immensely. In expression of face he ventured to make the mouth of beauty smile, and thus softened, by shewing the teeth, the ancient rigidity of his predecessors. He painted gratuitously the Hall at Delphi, and the Portico at Athens, called Ποικιλη, thus offering a contrast to Micon, who was paid. Such conduct was immediately judged worthy to be commemorated by the highest authority in Greece, the Amphictyonic Council, who ordered that Polygnotus should henceforth be maintained at the expense of Greece. Pliny has certainly not said enough of Polygnotus, whose great work at Delphi, described by Pausanias, proves him to have had colour in a high degree, imagination in the highest, and all which, according to Aristotle, forms the most important requisite in the language of painting. His work at Delphi was executed by order of the Cnidians, who had a treasure there, and had also built a stadium. Besides this building, they employed Polygnotus to adorn the great Hall, leaving him the choice of subjects; and as Neoptolemus, the son of Achilles, was murdered and had a tomb near the spot, these subjects related to the Trojan war.

It is supposed that because Pausanias describes one thing as above another, composition was little known, and that there were several subjects in one plane. But any one might describe the Cartoons at Hampton Court in the same way, and make a reader, who had never seen them, believe that one figure was above another, and several subjects too. Might not one say, "*Above* Pythagoras in Raffaelle's *School of Athens*, is Alcibiades listening to Socrates;" but because they are *above* one another, that is no proof that they do not *retire*. Aristotle settles his high rank better than Pliny or Quintilian. "Polygnotus," says he, "made men *better* than they are, Pauson worse than they are, and Dionysius the same as they are."[3] Polygnotus, therefore, expressed the leading points of the species man, and cleared the accidental from the superfluous. Cimabue did not do this, nor Massaccio, nor Giotto; but Raffaelle and Michel Angelo did; and when this is done, in painting or sculpture, the component parts of art must be equally advanced. Besides, when did Polygnotus flourish? Between the 84th and 90th Olympiad. The Parthenon must have been built; the beauties of Phidias's immortal hand must have been executed, such as we see them in the Theseus, Ilyssus, metopes and frieze of the Elgin marbles. And could any painter be a Goth in composition, when such knowledge of the art is visible in these perfect wonders? Polygnotus put the names to many of his figures; Annibale Caracci put "genus unde Latinum" to Venus and Anchises; Raffaelle gilded his glories; but what argument is that against the genius of either? The power of Polygnotus in painting the dæmon Eurynome, with a skin the colour of a blue-bottle fly, shews the truth of his imagination, as well as his power of observation and imitation. Polygnotus was a great genius, worthy of his age; and the "simplex color," applied by Quintilian to his works, only proves the purity of his taste in using it.[4]

Simplicity is not barbarism, any more than gorgeousness is true taste. About the 90th Olympiad the light began to dawn and to give promise of a glorious sunrise. Aglaophon, Cephissodonus, Phrylus, and Evenor, the father of Parrhasius, and preceptor of the greatest painters, appeared. These were all celebrated in their day; but one of the most important reformers was Apollodorus the Athenian, who flourished in the 93d Olympiad. He was the first, according to

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[1] Ælian, lib. x. chap. xii.

[2] Catagrapha invenit, hoc est, obliquas imagines et varie formare voltus, respicientesque, suspicientes vel despicientes. Fuseli says *catagrapha* means *profiles*; but how could he *invent* profiles when *profiles* are the characteristics of the *earliest* art? At first all art is profile; but Cimon was a reformer. To draw downwards he invented oblique views, and varied the views of the head and face, looking behind, looking up, and looking down. Fuseli says *catagrapha* means profile; but profiles are not oblique representations but sections of the figure and face, in the same sense as architectural sections, that is, equal halves. The "obliquæ imagines," are *angular views*, seeing things at an angle; the passage is directly illustrated by the circumstances, that he made his heads looking behind, &c.; and how can a head looking behind be a *profile?* In some places it may mean so; in Pausanias, κατα in radical meaning is *downwards*, as if the eye looked at the top of the head to the feet, which is *fore-shortening*.

[3] Aristotle, *Poetics*.

[4] Hardouin's *Pliny*, lib. xii. c. 10, p. 893. Clari Pictores fuisse dicuntur Polygnotus, atque Aglaophon; quorum *simplex color* tam sui studiosus adhuc habet," etc. Now the *simplex color* of Polygnotus and Aglaophon was not *one colour*, like monochroms, but modesty in the arrangement of the *three* colours, red, yellow, and black, without blue. How then could the monochrom apply to Polygnotus, whose works at Thespiæ, Delphi, and the Poikile at Athens, were painted in all the variety these three colours could produce, and not confined to *one colour?*

Pliny, who expressed the *species;* and he was also the first who did honour to the glory of the pencil. But, after Phidias, Panœnus, Micon, and Polygnotus, one is inclined to question whether he was the first who expressed the species. Phidias, in the opinion of the ancients, was the greatest artist in sculpture. Plato says that Phidias was "skilled in beauty;" but to be skilful in beauty, argues the power of expressing the species, and a perfect knowledge of the construction; for beauty is the last operation, and is based upon the first. How then Apollodorus could have expressed the species better than Phidias or Polygnotus, it would perhaps have puzzled Pliny to explain. However, let us take what the gods have spared, and be grateful. "His, is the adoring priest," says Pliny, "and Ajax defying the lightning at Pergamus; nor was any tablet worth looking at before." That may be. The previous works were monumental, national, or mural, painted with brushes, and bold in execution. Tabular painting may have been a more delicate workmanship; but it is not to be compared with the true epic, any more than the highly-wrought easel pictures of Raffaelle, are to be compared with his frescos.

Ancient Greek painters.

"The doors," says Pliny, "that Apollodorus had opened, Zeuxis boldly marched through, about the 95th Olympiad; daring every thing the pencil could do, and carrying it to the greatest glory." Some place him in the 89th Olympiad; but this is a mistake. Demophilus or Naseas was his master. Apollodorus became envious of Zeuxis, because the latter improved upon the style he had introduced, and wrote a lampoon. Zeuxis became very rich, grew very haughty, and always appeared at the Olympic games in a purple robe, with his name in gold letters on the border. So high was his opinion of his own pictures, that, thinking no money could equal their value, he gave them away. From this feeling, he presented an Alcmena to the Agrigentines, and a Pan to Archelaus; he also painted a Penelope, in which her moral beauty of character was visible, and an athlete, so much to his own delight, that he wrote underneath, "It is easier to criticise than to execute." His great works were Jupiter and all the gods, and Hercules strangling the serpents. He was censured for large heads and violent markings, but otherwise he was strictly correct. Pliny varies his history with current stories, and we can almost get at the principles of Greek art from them as well as from the account of the art itself. Current stories and proverbs should never be disregarded; for, if not true, they may be taken as inventions characteristic of the parties, or they would never have been believed. The Agrigentines, says Pliny, ordered a picture for a temple of Juno Lucinia, and they allowed the painter to select the finest girls as models. Cicero[1] says it was the Crotoniates who employed him; and as Zeuxis always studied nature, the most beautiful girls were ordered by government to come to him, and having selected five, he then painted his Helen. Zeuxis made his sketches in black and white (*pinxit et monochromata ex albo*) or of a single colour heightened by white. His contemporaries and rivals were Timanthes, Androcydes, Eupompus, and Parrhasius. The contest of the last with Zeuxis, in which the one deceived the birds by grapes, and Parrhasius Zeuxis himself by his curtain, contains the great principle of Greek art, viz. *That the most perfect imitation of reality was not incompatible with the highest style.* Antiquaries are disposed to laugh at these stories as beneath the dignity of belief; but artists know well enough, that, so far from being unworthy of credit, all the stories of Pliny and Ælian tend more or less to illustrate a principle. Zeuxis painted a boy and grapes, and the birds flew at the fruit; but his rival observed that, if the boy had been equal to the grapes, the birds would have been frightened. Zeuxis was a great painter and discovered the principles of light and shadow.

After Zeuxis came Parrhasius, "liquidis ille coloribus,"[2] who was born at Ephesus, and celebrated for great excellence. He first gave correct proportions to painting; airs to the head, elegance to the hair, and beauty to the countenance. By the acknowledgment of all artists, the manner in which he *lost* the contours of his forms, was exquisite. Many people can execute the parts of which the middle of things is composed; but few can finish the boundaries of objects as if the substance was round, and did not end with the contour which defined it; thus giving one an idea as if something was concealed, and exciting the imagination to conceive what the eye did not see. This excellence Xenocrates, and Antigonus, who wrote on painting, conceded to Parrhasius; and not this excellence alone, but also many others. The best idea than can be given to the moderns of the works of Parrhasius, is by referring them to the pictures of Corregio, of which this is the great excellence. Parrhasius appears also to have had the same defect; for he softened the centres of his figures, and gave them too much pulpiness for the heroic. There remained, in Pliny's time, sketches of subjects, and of hands and feet, from which artists learned a great deal. He contrived in a picture to paint the people of Athens, and to give a true idea of their variable character; humble yet vain-glorious, timid yet ferocious;—and all these contrasts he expressed with great power. But Parrhasius disgraced his genius by yielding to what Johnson calls "the frigid villany of studied lewdness," and sacrificed his noble art to pander to the beastly appetites of the debauched; in fact, Tiberius kept one of his licentious pictures in his bed-room, namely, that of Meleager and Atalanta. But whatever may have been the habits of antiquity, and however indecencies may have been connected with religion, it is clear the greatest men did not approve of such prostitution of talent. Aristotle censures the practice, and warns tutors to guard their pupils from such corruptions.

Timanthes followed, the great painter of the sacrifice of Iphigenia in Aulis. No picture had more reputation for touching art and delicacy than this. After exhausting expression in all the principal agents, the artist covered the face of the father, not daring to trust his hand to attempt imitation, and leaving every spectator to imagine an agony of his own. As Euripides has the same incident, Fuseli thinks the honour of being the first inventor is due to Timanthes. In the death of Germanicus, Poussin hid the face of his wife. Timanthes seems to have been ingenious in his inventions; to give the idea of great size to a sleeping Cyclops, he introduced two satyrs trying to span his thumb. Pliny adds, that there was a head painted by him in the Temple of Peace at Rome, and which was a perfect specimen of art.

Euxenides taught Aristides, the great master of expression, and Eupompus taught Pamphilus, who was the master of Apelles, a name synonymous with perfection in finish, but not for invention like Zeuxis, monumental commemorations like Polygnotus, composition like Amphion, or expression like Aristides. No; Apelles was the deity of tabular pictures, the greatest glory of the art in Pliny's mind, but not in the minds of those who see beyond the range of a dining-parlour. Eupompus painted a victor with a palm branch in his hand; and such was his influence in Greece, that he was allowed to divide painting into three schools, viz. the Ionian, Sicyonian, and Athenian. Pamphilus was a Macedonian, who combined literature with painting and made it a principle of tuition, that no man could be great in either who was not a mathematician; for he denied that without geometry art could be perfected. He taught nobody under a talent, which both Apelles and Melanthus paid. So great was the influence of this distinguished man, that first at Sicyon, and afterwards in all Greece, he got it established as a principle of education, that all clever boys should be taught on tablets the art of delineating, which is the foundation of

[1] De Invent. lib. 2, chap. x.

[2] Horace.

painting. He considered this art as the first that should be taught in a liberal education. Slaves were prohibited the exercise of design; which was an absurd law, because in literature it would have prevented Æsop or Terence from developing their genius. What right have any creatures, who are obliged to eat and sleep like the meanest slave, to pass a law to prohibit the exercise of any natural talent, if the Almighty has not disdained to think one worthy of being so gifted? The consequence of this was, that no slave ever distinguished himself in the arts.

About the 107th Olympiad, after Echion and Theramichus, came the god of high finish and grace, Apelles. His style is always the precursor of decay. First came a race in art, amongst whom invention, expression, form, colour, and execution, in a series of pictures intended to illustrate a principle were enough, provided the principle was expressed. These were the *monumental geniuses*. But when the art becomes national and glorious, the noble and the opulent become ambitious to share the glory with their country; and the art sinks to the humble office of adorning apartments. As is the demand, such will be the supply; and the genius of a country is thus turned from national objects and public commemorations to private sympathies and domestic pleasures. At this period of Greek taste appeared Apelles; refined, accomplished, delicate, devoting his whole soul to single perfections equally adapted for a temple or a palace, and patronised equally by his sovereign and the people. Educated by Pamphilus, he was grounded to the very foundation, and consequently drew, as Burke says to Barry, with "the last degree of perfection." Apelles, Aristides, Nichomachus, and Protogenes, were the most distinguished artists of Alexander's time.

Apelles wrote copiously on his art, and explained its principles. His treatises were extant in Pliny's time, and even in that of Suidas,[1] who speaks of them; and as they were probably illustrated with designs, the loss is much to be deplored. Beauty was the leading feature of his style, as well as of that of the greatest painters of the same period. In grace he defied competition; and this explains the secret of his triumph. "I know when to leave off," said he, "which is a great art; Protogenes does not. Over-working is injurious." He was a very generous man, and acknowledged when others were superior to him; observing that Amphion[2] was a better composer, and Asclepiadorus more correct in proportion. Amongst all the stories of Pliny, the most delightful is that of Apelles and Protogenes, which seems to be an authentic fact; and even if it were not, it would illustrate the principles of Grecian art. Protogenes lived at Rhodes and Apelles sailed to see him. Having landed, he called, and found the artist "not at home." Being shewn by an old woman into his painting-room, he found a tablet with its wax ground ready for a picture, and taking up a brush, drew an exquisite line in colour down the tablet. Protogenes having returned, was shewn what had happened; and, contemplating the beauty of the form, he said it must be Apelles, as nobody else could draw so perfect a work. He then took the brush and drew another still more refined, saying, if the stranger call again, shew him this, and say that that is what he is seeking. Apelles returned, and blushing to see himself outdone, again took a brush and drew a third, leaving nothing to be exceeded in refinement, *(nullum relinquens amplius subtilitati locum.)* Protogenes when he saw this immediately sought his visitor, saying that he could carry the line no further. The tablet with these lines upon it, was considered by all the Greek artists as a miracle of drawing. After the death of Apelles and Protogenes, and the conquest of the Romans, it was preserved in the palace of the Cæsars on the Palatine hill, where it was seen by Pliny containing nothing but three fleeting lines *(tres lineas effugientes)* and yet superior to all that was to be found in the finest works. Unfortunately it was burned at the destruction of the palace.

Now comes the question, what were these lines which could thus speak to artists who had never seen each other, the common language of a common code of law for design. "*Secuit lineas*" does not mean actually to cut the lines in two, but in the technical idiom of English artists, to strike a line. It was not the metal cestrum, but the hair brush, and therefore *cut* in this sense could not have been meant. To *cut* with a brush means to design with an air of power. Three lines varied in shape would mean nothing, if nothing was expressed; but if some known contour of the body was taken in repose, three variations of its position without alteration would be as much as could be expected in the contour. Suppose that Apelles drew a line from the clavicle A to the pubis B of a body in profile, shaping all the parts as he went correctly like fig. 1. Next, suppose that Protogenes having come in saw the line, and knew that in finely-formed men, the stomach, from great exercise and temperate living, becomes small; the contour would curve in at C, so that that portion of the *rectus* muscle would retire, as in many of the Greek statues. He would then take the same contour, draw it again on the wax tablet, and make this variation. Again, suppose that Apelles returned and on seeing himself vanquished, took the brush and drew the same contour, allowing the variation of Protogenes, but remembering that in powerful men, the *pyramidalis* D, fig. 3, arising from the *pubis* and going into the *rectus*, makes another and the last variation. Then Protogenes returning, and seeing that nothing more could be done unless the body was altered in position, he would acknowledge the line to be completed.

Fig. 1.

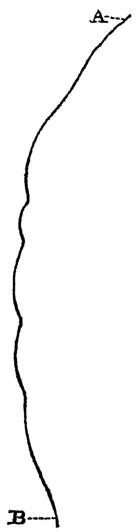


Fig. 2.

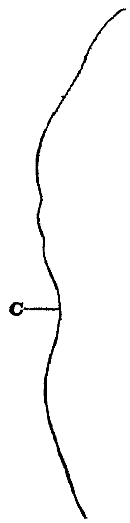
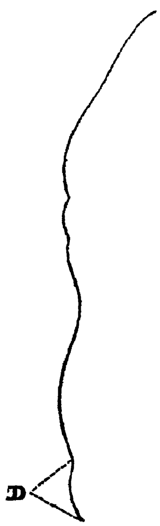


Fig 3



In Conduci's Five Dialogues, it is stated that Michel Angelo thought it must have been a contour of some part of the body. Now, this singular contest would be felt by all artists as one of the greatest utility. It would be wondered at by connoisseurs, and would illustrate a great principle; namely, that a knowledge of construction was the basis of correct design and the foundation of all beauty.

It was the continual practice of this eminent man to do something every day, whatever happened; and hence the proverb, "No day without a line." If artists were to write

[1] About the year 1100 of our era.

[2] Junius (*De Pictura Veterum*) only finds Amphion mentioned twice in ancient authors, and it is hence supposed that Echion would be a better reading.

Painting. this over their painting-room doors, it would not be without advantage. Rubens rose at four, and was in his painting till five in the afternoon, with occasional variations. All the greatest men of antiquity and of modern art, have been the most diligent and the most industrious. And here is the most celebrated of the tabular painters of antiquity afraid to let a day pass without the use of the pencil. Apelles used also to hide himself behind his works to hear the remarks of the public. This deference to the public voice evinced by sculptors, painters, and statesmen, is a beautiful proof of the sense and understanding of the time. Nothing was done in defiance of public taste, but every thing in conformity to its dictates; and though this does and often did lead to great injustice in political matters, in art the maxim is infallible.

Apelles of Cous excited envy enough, and notwithstanding his graceful manners, his tender heart, and his accomplished mind, when driven by stress of weather into Alexandria, the courtiers of Ptolemy, hating his superiority, and fearing his probable fortune, sent him a pretended invitation to sup with the king. Apelles went; the king felt astonished at the liberty, and sending to demand explanation, discovered the imposition. On inquiring if Apelles knew the person who had given him the invitation, he immediately sketched his face on the wall, and the king recognised the culprit. Courts, kings, and people can only judge of results. The infinite number of repeated acts, the *nulla dies sine linea*, the failures, the recoveries, the musings, the thinkings, that had taken place with the "cestrum cum lumine," they had not witnessed; therefore, knowing their utter incapacity to do as Apelles did, they concluded that he was a wonder, and he of course became a favourite. As an evidence of that peculiar tact by which such men are sure to please kings and nobility, namely, by the power of seizing the most agreeable expression of any sitter's face, however ugly, and rendering his very defects a cause of elegant concealment; he painted Antigonus, who had lost one eye, in profile, concealed his defective eye, and made him as graceful as if he were Alexander. This was the great secret of his fortunes, as it was that of Titian's, Vandyke's and Reynolds'; and though not to be compared in point of taste or knowledge of the art, this was also the secret of the popularity of Lawrence, mere portrait painter as he was, and nothing more.

Polygnotus, Pausias, Aristides, Timanthes, Zeuxis, Parrhasius, Pamphilus, Euphranor, and Timomachus did not so completely gratify the vanity of their contemporaries, and were not such personal favourites as Apelles; for there is no gratitude equal to the gratitude of being successfully painted. Kings bow to the unknown power of having their momentary expressions observed, seized, transferred, and fixed for ages, and whilst colours and canvas last, carried on, for the admiration of a distant age, when the existing one is past and forgotten. What can equal the gratitude of a woman to have her beauty preserved, whilst she is in her bloom, for the admiration of her children when age has shrivelled her form, or misfortune destroyed her happiness? The world may be elevated, excited, roused, by the commemoration of the great deeds of ancestors or heroes; but no sympathy is ever excited, and no personal vanities are ever so happily gratified by any class of painters, as by the great portrait-painter. The degree of imagination required is not of that irresistible kind which forces him to leave the model before him, using it only to realise his own burning conceptions, so that all likeness of the *individual* is lost; he requires no more than to retain in his mind the best expression of the individual before him to identify it upon canvas. But it must be exactly like, or it is nothing. After the likeness is completed, the sitter will have no objection to the highest degree of embellishment. There the great portrait-painter shews the degree of *fancy* wanted, and he that embellishes most, without losing resemblance, will be the most welcomed, as Apelles was, by the world. Painting.

To put Apelles in comparison with Polygnotus is out of the question. Highly-wrought individual figures, little more than portraits of beautiful nature, cannot rank so high in the judgment, though they may in the delicate sympathies of the world. But that single terrific conception of the demon Eurynome, for which no prototype in nature could be found, that momentary blush which crimsoned his Cassandra,[1] Aristotle's praise that he made men better than they were, and Plato's ranking him with Phidias, settles the question of his greatness; and as a portrait expression must be seen before it can be done, and must be like or it is nothing, there is an end of the highest quality of human genius, invention. Indeed, whatever the vanity of the world may be inclined to feel, the greatest portrait painter is but an inferior artist.

The age of Polygnotus and Phidias was the meridian age of Greek art; and that of Apelles was the setting glory. From the latter period it sunk gradually as if nature had been exhausted by the previous effort. Such ages have never since been seen; such perfection had never been realized before, and never will be again; for in order to become such sculptors and painters, men must also become idolaters. But to return and conclude the notice of Apelles, this court-favourite of antiquity. Notwithstanding the education of Alexander by Aristotle, notwithstanding that ἡ γραφικη was a portion of his education, Alexander was little more than a glorious barbarian in art. He talked so absurdly in the painting-room of Apelles, that the artist was obliged to request that his majesty would be cautious, lest the boys should laugh as they ground their colours. Apelles may be considered as the Titian of Greek art, with the addition of all that vast knowledge of form, which every painter and every school was obliged to master. But the disposition to perfect single figures, and the acknowledgment that others exceeded him in composition, clearly point out the extent of his fertility. Though Pliny describes many beautiful pictures, his greatest are single figures. His Venus Anadyomene was the most celebrated of all his works; but being painted upon wood, it was destroyed by insects in the time of Augustus. He began another, and having completed it as far as the bosom, died; but although the contours were completed for finishing, nobody would venture to touch it, such was the extreme veneration entertained for him. By this description we see the nature of the Greek process; first, the ground, then the drawing in, next the impasto preparation, and then the completion part by part. He had got the picture finished as far as the bosom; and therefore to finish highly by degrees was his system. He was not deficient in expression, for he painted persons dying with great power. His imitation must have been perfect, for his painted horses are said to have made real horses neigh; and his colour must have been exquisite, for he glazed like the Venetian school. Pliny mentions him as one of those who painted with four colours; but this is a mistake; for it was in the age of Polygnotus that *blue* was not used. From a passage in Cicero,[2] it appears that that age was famous for "form and contour;" whereas, according to the same writer, *all* things were perfect in the works of Protogenes, Nichomachus, Echion, and Apelles.

Pliny is therefore right in saying that pictures which constituted the opulence of towns, were painted with four colours only; but he is not as clear as usual in regard to the period to which this observation applies. Quintilian, calling the colour of Polygnotus "simplex color," seems to indicate the absence of *blue*; whilst *red*, *yellow*, *black*, and *white* did not produce such gorgeous splendour as in the age of Apelles. Thus Quintilian, as well as Cicero, collaterally proves Pliny to be in part right. It is extraordinary that Reynolds did not

[1] Lucian.

[2] *Brutus*, c. 18.

allude to the absence of blue in the enumeration of Pliny. Great depth, fine tone, simplicity, and modesty, can be obtained without blue, but never that tremendous magnificence produced by the contrast of the deep and awful azures of Titian. Though Polygnotus did not use blue, his black was made from vine-stalks and wine-lees,[1] which render black more blue than the ivory black of Apelles, which was discovered by him, and is used to this hour in Europe. There were several of the same name, but *Apelles Cous* distinguishes the great Apelles, as *Aristides Thebanus* does the great Aristides.

After this long account of the courtly, accomplished, and highly-wrought Apelles, there may be something interesting to allude to Aristides the "great master of expression," as Fuseli calls him. He was the first who painted deep human emotions, fierce passions, and distressing perturbations; but he was hard in colour, says Pliny, and not so harmonious as Apelles, probably like Raffaelle, the great Italian master of expression, in comparison with Titian. His finest picture was that of a mother dying from a wound which she had received in the sacking of her native city. Her infant was trying to reach the nipple with its boneless gums, whilst the mother, faint and exhausted, appeared struggling to save it from sucking, lest blood might mingle with its nourishment; a tender and affecting thought. Alexander was so touched by this picture at Thebes, when the city was taken, that he sent it to Pella.[2]

Protogenes was another of the great men of this time. It is indeed extraordinary to reflect how genius in art and literature seems always to come in clusters in every country. He was born at a small town on the coast of Asia Minor, subject to the Rhodians; and he got his living till he was fifty years old, in great poverty, painting beautiful ornaments for the prows of ships. He was not a man of fertile invention, and spent years over single works, which induced Apelles to say that he never knew when he had finished. His celebrated work was Talissus, which occupied him seven years. Titian took eight to paint the Pietro Martyre, and seven to finish the Last Supper for Charles V.;[3] and yet in Titian's works there is no appearance of over diligence. Pliny says he painted his pictures four times over, so that if one picture was destroyed another might be ready. Nothing shews so completely the exact degree of knowledge which Pliny had of art as this absurd conclusion from an admirable practice. Protogenes proceeded with his works as Titian did, by *stages;* and each stage was a separate impasto of colour, which helped the next till completed. Of this artist the story is told of his flinging his sponge at a dog's mouth in a rage, because he had vainly tried to hit breath coming out of it, and by that accident succeeding; a circumstance which shews that it was tempera painting, for a sponge would not have done for wax. Such a habit of daily application had Protogenes, that when Demetrius besieged Rhodes, he would not leave his painting-room, but proceeded daily in his studies amidst the noise of battering rams and catapultae. The king came often to visit him; and that part of the town where he worked was spared, and the picture thus finished was said to have *been done at the point of the sword.* Protogenes painted the mother of Aristotle; and the philosopher urged him to execute the battles of Alexander; but he was not a man of rapid conception or fertile invention for a series, and could not be moved.

It is curious to reflect, that all the great painters painted portraits; which proves that they thought it essential to that truth which was the foundation of their ideal beauty. Indeed, every great painter *should paint a portrait a month;* and if, like the Greeks, he has always nature for his works, he never can degenerate into manner.

Of the other painters, Asclepiodorus was celebrated for proportion; Nicomachus for rapidity of hand, and Theon for wild conceptions, "quas Græci vocant φαντασιας." Pliny places Theon amongst the herd, whilst Quintilian and Ælian place him amongst the illustrious, where he ought to be. He painted a single warrior dashing forward on the spectators; and collecting the public, he kept the picture behind a curtain, when in the midst of a blast of trumpets, the curtain was dropped, and the wonderful figure terrified the people. He also painted Orestes, distracted and insane, and proved himself a great and wild inventor. The three remaining great men of the fine period, were Pausias, Euphranor, and Timomachus. No passage has excited so much discussion as the well known one in Pliny, where he says, "nulla gloria artificum est, nisi qui *tabulas* pinxêre," as if he meant that the only glory in art consisted in tabular pictures, "πινακες," on wood, and that there was but little in monumental and mural efforts. Pliny, however, does not here contrast the tabular pictures of Apelles with the mural paintings of Polygnotus, but with the works of one Ludius, a Roman, a mere ornamental landscape-painter upon walls, like our Bond Street paper painters. This was much the fashion in Pliny's time, which he laments; and many examples of the same species may now be seen in Pompeii.

Having thus described the fancies and caprices by which the art had been degraded, Pliny turns to the highly beautiful tabular works of Apelles, and observes naturally enough; "This is not the thing; the glory of art and of artists consists in the Venus of Apelles, the mother of Aristides, the Ialysus of Protogenes, and not in this mechanical whim, which is not the glory and the end of painting." This, perhaps, is the explanation which he would give if he were alive and able to answer us. Is it not unjust then to take up such ground as M. Raoul-Rochette has done in France, and Payne Knight in England, and infer that there was no real glory in any other mode of painting? The ancients estimated mural painting at Delphi, as the Italians do in the Vatican. But they did not undervalue tabular painting, small pictures, encaustic, landscapes, or humour; they painted in every style and they excelled in all.

Pliny now proceeds to the encaustic painters, of whom Pausias and Euphranor appear to have been the greatest. Pausias was a master of foreshortening, as we learn from Pliny's description of a bull which he painted in front and projecting beyond the tablet. After Pausias came the Isthmian Euphranor, who wrote on symmetry and colour, painted great and small works, and delineated statues and animals. He said of his Theseus, that "it was real flesh, whilst that of Parrhasius had fed on roses." Then came Nicias who painted women beautifully, understood light and shadow, and was another pillar of art. Metrodorus was both a philosopher and a painter; and when the victorious Paulus desired Perseus to send him a philosopher to educate his children, and a painter to arrange his triumph, Metrodorus was despatched as a person capable of executing both tasks. Timomachus is the last of this splendid list whom it is necessary to mention. He died, like Apelles, leaving an important work unfinished.

Glory and decline of Greek art.

Such were the most illustrious men of the three finest periods of Greek painting. The first period of Greek art was that before Pericles; the second, or that of Pericles himself, was the finest, the highest, and the purest in painting, sculpture, and architecture; the third was the epoch

[1] See Pliny, lib. xxxv. The sea in the Venus Anadyomene is quoted as a proof that *blue* must have been used. But where is there any *blue* in Vandervelde? We do not think that a picture exists with *blue* in his sea.

[2] Raffaelle imitated this in his plague, where a fine youth is putting away an infant from a dying mother's bosom; but the utter want of taste in making the boy hold his nose for fear of infection, renders the sentiment not pathetic but at once disgusting and ridiculous.

[3] See, in Ridolphi, Titian's letter to the emperor.

of Alexander, the most refined, but prophetic of the corruption which followed; then came the subjugation of the Romans, when the noblest works of the Greeks were seized as tribute, or matters of right, and Italy was inundated by the productions of Greek talent.

Effects of the conquest of Greece.

This influx of foreign productions entirely suffocated native Italian genius. Greek productions became matters of property; and dealers sprung up who manufactured originals to supply the market of the rich collector. Galleries were formed to produce genius, which had sprung up from national demand without a single gallery or a single collection of any works, except the productions of their native soil. The most celebrated works were copied and re-copied by the Greeks in all parts of the Mediterranean. Horace alludes to this; and there can be no doubt whatever that the effect was to render all native attempts of the Romans and Etruscans no longer available. For not one great artist is named during the whole period of progressive decay from the Cæsars to Constantine; and the Romans or Latins never produced any talent worth consideration till the revival of art in Italy, after so many ages, in the fifteenth century. Then, the same principle operating, and the church and state demanding art as an assistant, outpoured an abundance of native talent, because there was a vent, as there had been before, in Greece, Egypt, and Chaldæa; and the genius of Rome, Florence, Pisa, and Venice, vindicated their long suppressed claims to originality. Amongst the illustrious Romans, Julius Cæsar seems to have been a magnificent collector; but whether, like Napoleon, he was also a magnificent patron of the talent of his time is not known. He bought Greek pictures, and presented them to Roman temples; but one work of native art, produced by native patronage, is more honour both to patron and to artist than a gallery of foreign pictures be they ever so divine.

Upon the whole, before tracing art from its decay to its revival, we cannot but acknowledge as evident, that a period of dearth in genius has generally succeeded in the world to one of prolific production. In painting and sculpture, secondary causes, such as the nature of the government, or the circumstances of the two arts being required for political purposes, may considerably facilitate the development of genius. But it is not so with the poet. He can give vent to his immortal thoughts in poverty or wretchedness, independently of the taste of the times, or the patronage of the state. Milton, in obscurity and blindness, wrote *Paradise Lost*; and Savage, in poverty and wretchedness, composed his *Bastard* in the streets, begging bits of paper as he walked, when he had more thoughts than his mind could contain, and thus, as effectually preserved them as if he had been bred in a palace, or had sheets of the finest *hot-pressed* to receive his lucubrations.[1]

Inferiority of the Roman school.

After the conquest of Greece, and the removal of art and artists to Rome, the genius of painting seems to have left the world. The Roman school of painting and sculpture is scarcely worth a single thought. In the last years of the republic the art sunk rapidly. Augustus tried to revive it; but though the pupils and descendants of the illustrious dead attempted to second his views, and though the writings of Apelles, Euphranor, and Pamphilus, were all in existence, and their principles known and acted upon, genius was nowhere to be found. That divine spark with its attendant whisper, unseen but not unheard, which ever attends the gifted who are born for great objects, whether it supported Columbus amidst the storms of the Atlantic, Alexander as he plunged into Asia, Napoleon as he rushed into Italy, Wellington at Waterloo, Michel Angelo when he painted the Sistine Chapel, Raffaelle when he entered the Vatican, or Phidias when he adorned the Parthenon; that supernatural, incomprehensible something, which inspires hope, "when the whole world seems adverse to desert," was gone from the earth like the glory which had blazed in the temple. All that the savage, splendid, imperial Romans could do, all the honours and riches they had to confer, were bestowed in vain. Architecture suited their savage vastness of mind better than painting; therefore architecture flourished, and Augustus was said "to have found Rome thatched, and left it marbled."

> Not Babylon
> Nor great Alcairo, such magnificence
> Equalled in all their glories, to enshrine
> Belus or Serapis[2] their gods, or seat
> Their kings, when Egypt with Assyria strove
> In wealth and luxury.

Claudius built a superb aqueduct, and Nero burned[3] and rebuilt a golden palace; but he could not replace the lines of Apelles and Protogenes, or the miracles of Timanthes and Aristides, which perished in the conflagration. Galba, Otho, and Vetellius were hurried through life and empire too rapidly for art; whilst Vespasian and Titus bewildered the Romans with their Cyclopean masses. Hadrian, himself an artist, endeavoured to recover art by indiscriminately encouraging Etruscans, Greeks, and Romans; "but such a medley of principle as their works displayed," says Agincourt,[4] "hastened the decay of art, and rendered the emperor hopeless of reviving it." The art thus went floundering on until Diocletian, with all the gorgeous splendour of an eastern monarch, mingled together Roman, Greek, and oriental art, and corrupting all taste led to its extinction. It was between the reign of Commodus and that of Constantine, that those causes were generated which undermined the empire, and brought art, science, and literature into the chasm. Of forty emperors who, from the second to the fourth century had struggled for the diadem and obtained it, twenty had been murdered by the army and the people. "Ainsi" says Montesquieu "comme la grandeur de la république, fut fatale au gouvernement républicain, la grandeur de l'empire le fut à la vie des empéreurs."[5] Constantine's removal of the seat of empire did not so much begin the destruction of art as complete it; for previous causes, domestic and political, had been preparing the ruin for centuries before.

Age of Constantine.

Agincourt thinks that as far as art is concerned, too much has been attributed to this removal of the empire. But yet the first epoch of what may be called *modern art* in opposition to *ancient*, must date from the introduction of Christianity as a state religion, when the whole moral feelings of Greek and Romans took another turn in painting and sculpture. Although Constantine only grafted Christianity on Paganism, and founded more catholicism than Christianity, by meeting and uniting the prejudices of both Pagans and Christians; yet surely if genius could ever be created by patronage, the age of Constantine, and those of Charlemagne, and Louis XIV. ought to have rivalled those of Pericles and Julius. Such was the rage for splendour in this reign, that the quarries of Phrygian marble and of the isle of Proconnesus, were almost destroyed to furnish palaces for the emperor, his sons, and his ministers. Temples, palaces, forums, triumphal arches, colossal statues, an hippodrome, and eight public baths were built and adorned at once; and in addition, splendid commissions were given to the painters for pictures of Christ, the Virgin, the prophets, and the apostles. Rome, Naples, Capua, Antioch, Tyre, Jerusalem, and even Bethlehem, felt the effects of this mag-

[1] See Johnson's *Lives of the Poets*, art. Savage.

[2] In this beautiful passage, the immortal author has made the penult syllable of *Serapis* short, whereas it is in reality long, *Serāpis*, an error which could scarcely have been expected in one who was a great scholar as well as a great poet.

[3] Tacitus does not seem altogether to believe it. [4] Agincourt, *Histoire de l'Art*, tom. i. [5] *Décadence des Romains.*

Painting.

nificent employment; but what were the results to painting? Nothing, absolutely nothing, to guide anybody except the antiquary; and if any evidence were wanting to show that the genius and the patron must exist together, or the result will be nothing, the end of Constantine's splendour would abundantly supply it.

The moral character of ancient Greece was gone; the instinct of public glory was passed; their olive crowns, the adequate reward of talent on a great principle, were sneered at; and "Lucian," (as the author of the *Discours Historique* observes) "had already ridiculed this tribunal," which had listened with rapture to Herodotus, and crowned Aëtion for a fine picture, and which in its days of Marathonian glory, had done more than ever was done before or since in rousing human effort, mental and bodily, to its highest pitch of excellence. Luxury, indolence, vice, fanaticism, cant, sophistry, intrigue, and imposture, had supplanted the pure aspirations of patriotism and glory. "The great and the opulent," says Pliny and Vitruvius, "were fonder of gold and glitter than purity of design or pathos of expression, or perfection of form; overwhelmed with colours from all the countries of the earth, with double the advantages of Polygnotus, and Zeuxis, and Aristides," who painted with four only, "nulla nobilis pictura est." Of course, this is always the end, when the moral and national importance of painting is undervalued. When native art is despised, and spurious foreign productions are preferred; when connoisseurs of what *is past* abound, and connoisseurs of what *is passing* exist not; when painting is considered as a bauble or a bit of furniture, and painters share dignity with upholsterers and gilders, what wonder if "*nulla pictura*" is the cry?

Gold and vermilion being thus introduced upon the walls of palaces and preferred to beautiful art, in came arabesques. Claudius had before introduced Indian patterns and mosaic pictures, which had hitherto been kept for pavements, till Commodus, for the sake of a new sensation, had a portrait in his palace of Piscennius Niger,[1] painted in mosaic, which may be considered as the first picture of this description. When painting was in this staggering condition, Justinian gave it a final blow by ordering encaustic and distemper designs, as vulgar, to be banished from ceilings and walls, and mosaic, marble, and gold, to be preferred. Though mosaic was perhaps one of the means of preserving art and of introducing it into Italy, yet it should only be used in pavements, or to preserve the works of great masters. The anti-pagan zeal of the early Christians is well known. They used to put ropes round the necks of Apollos and Venuses to try them publicly, like criminals, find them guilty, and pound them to dust. But human nature is always the same. A thousand years afterwards a similar scene was acted in Scotland by John Knox and the reformers, nor had England escaped the fury of iconoclasm. Eusebius[2] informs us that in the empire whole towns rose and destroyed the temples in which they had just worshipped. The air echoed with the noise of hammers, the crashing of pediments, the breaking of pillars, and the shouts of a maddened and frenzied populace. The finest works of Phidias, Scopas, Polycletus, and Praxiteles, and all that was left of Polygnotus, Apelles, Zeuxis, or Euphranor, were demolished or burned, like wretches who had infected religion, and their ashes were danced on with fanatical exultation. So great indeed had been the destruction, that when Arcadius and Honorius issued a fresh edict to go on destroying, they added, as well they might, "Si qua etiam nunc in templis fanisque consistent, "If any pictures or statues are still left." During this frenzy was introduced into art, *painting without nature*, and after producing a race of monsters down to Golzius and Spranger, there began the cant of "nature putting an artist out." What Zeuxis did not dare to do, what Apelles never thought of, what Phidias never permitted to be mentioned in his school, a parcel of painters brought into practice by the very mysticism of their impossible theories. Man was corrupt, being born in sin and vicious in practice; to take him as a model therefore when painting holy subjects, was to act under the influence of Satan. Man was banished, and so was woman, and nature in every thing; till at last all painters painted in one way, and in came *manner* into the great art of nature, and like a "leperous distillment" stained her garment and poisoned her beauty. Yet the traditional maxims of the ancient fathers, on beauty and art, give one a very good idea of what were the maxims of the finer Pagan periods. "Art is nothing but an imitation of nature," says St. Athanasius, (*Orat. contr. Gent.* c. xviii. p. 18.) "Ancient artists sought to surpass each other by faithful imitation," (Arnob. *Advers. Gent.* lib. vi. fol. 68) "Nature is the archetype, art the image; every image has a model, and painters imitate what they see," (Theodoret.) "Imitation is the merit of painting; be not seduced by an illusion," (St. Clement.) "When begging the people not to be seduced by pictures and statues as if they were gods, tell them that pictures and statues are imitations of nature, and therefore cannot be gods." These maxims of the fourth century had clearly descended from a nobler era. Besides the treatises of Apelles, Euphranor, and Pamphilus, were all in existence, and were read by the educated and accomplished; and we see how skilfully the fathers of the church tried to save fine works from destruction, by assuring the people that they were *mere imitations of life*, for such was the principle of artists. Are not these quotations then collateral evidences of the practice of the Greeks, if we had known nothing of the girls of Crotona sitting to Zeuxis?

Influence of Christianity on the arts.

But Christianity was at first the ruin of art, by making purity of heart every thing, and physical ugliness, or deformity, nothing; by teaching that as all beautiful works of art were remnants of idolatry, they ought to be destroyed; and by inculcating that mankind being corrupt and born in sin, no Christian painter ought to look at the naked figure whilst he was painting it. Add to these prejudices, the predilection of eastern nations for gold and silver, the preference of eastern dresses to the simplicity of Greek clothing, the controversies which took place as to whether our Saviour was ugly or handsome, and the vehemence with which Pagans and Christians both entered into them; and no one can wonder at the state into which painting declined.

Representations of Christ.

The division of opinion about the person of Christ, and the dread of the early Fathers to expose the cross to Pagans, who, familiar with golden-locked Apollos and perfumed Venuses, could not comprehend that suffering and majestic pains were founded upon a higher philosophy, so embarrassed the painters, that to avoid collision they painted Christ *as an allegory* thus lingering with their Greek feelings about the form of beauty and of grace. It must be interesting to all readers thus to trace the progress of feeling relating to the head of Christ.[3] In the fourth, fifth, and sixth centuries, beauty and youth still predominated; and he is painted youthful and handsome, crushing the lion under his feet, or as a young shepherd with his flock. With allegory the beauty of our Saviour ended, whilst the Fathers of the church, like the priests of Egypt, interfered, and issued an edict ordering him to be represented in agony on the cross. But here the order was evaded. The Greeks still struggled for the beautiful, and as if it were the never-dying principle of their souls, painted our blessed Saviour dying upon the cross, but smiling with triumphant glory as if re-

1 Spartian, *In Vita Pisc. Nig.* cap. 6.

2 Montesq. *Décadence des Romains*, 133.

3 St. Augustin declares that in his time no faces of Christ or the Virgin were known, and that no pictures were painted of them before the council of Ephesus; yet there are seven reported originals, four of which are by St. Luke's own hand, now in Rome.

Painting.

joicing in his sacrifice. In whatever the Greeks were compelled to do, beauty seemed still to be the basis of their art. By degrees, however, the poor descendants of Apelles and Polygnotus finding no employment except on the conditions prescribed, the person of Christ became gradually degraded in art; and at the separation of the Latin church, to paint him ugly, bloody and agonized, was the settled principle of representation, and has more or less influenced his representation ever since. There seems to be some doubt as to the extent of the devastation committed by the Goths. Alaric stayed but three days in Rome, and Attila had himself painted in one of his Milan palaces seated on a throne, and receiving the homage of a Roman emperor.[1] Theodoric seems to have had a very good feeling for art. He laments, in a letter to Symmachus, the ruins of works of genius, begs their preservation, and concludes with observing that Rome has still a *population* of statues with herds of bronze horses. The expulsion of the Goths and the invasion of the Lombards, again afflicted the art; but it had found its way into France, and the churches of Paris, Tours, Bordeaux and Clermont, were ornamented by native painters.

Epoch of Charlemagne.

Though the popes had begun to adorn the churches, and art in the earliest times had been kept alive with considerable talent in the catacombs in Rome; though Europe had been astonished by the splendour of the ecclesiastical patronage of painters; yet the next great epoch after Constantine originates in the efforts of the illustrious Charlemagne. He formed the plan of renovating art, science and literature; and he would have accomplished his object, if the genius of the age had been worthy of the emperor. The ancient practice of painting churches, kept alive by previous popes, he confirmed by a law; and agents every year visited the provinces to see that the law was observed. If a royal church was to be painted, the bishops and abbots were responsible. If, in the midst of a campaign, an order was issued for a church, one to paint the walls was included; and no church was considered as finished till that was done, the object of the emperor being to obliterate the remembrance of the splendid altars of the Pagans, by still more magnificent Christian ornaments. "Repair your church," says the archbishop of Treves; "you know the decision of the emperor."

Two monkish painters of the time are celebrated; and France and Britain began even at this early period, to take an interest in the arts. Biscop, abbot of Weremouth, had brought pictures from Italy. Charlemagne had invited king Offra to protect painting, with but little effect; yet though the walls of English churches were whitewashed, the English began to adorn the ceilings and the windows, and hung tapestry upon the walls.[2]

In Spain, the Arabians had introduced their art, such as it could be, under the prohibition of Mohammed; and miniatures or manuscripts were so eagerly bought all over Europe, that the artists in France, Germany and Italy, devoted themselves to this production; though here again it was acknowledged by all, that they were beaten by the Greeks. In spite of all this, the art continued to decay; and at the second Council of Nice the members gave evidence of the state to which monks and bishops had reduced it. "How can painters be blamed?" say they; "the painter *invents nothing*. Invention and composition belong to the Fathers;[3] the art alone is the painters'." Inadvertently, too, the emperor injured the art by altering the dress of his cavalry and foot. The women as usual followed the example, and having relinquished the pure taste of the Greeks, dress has in consequence become an annual novelty and change. The Paladin and his horse were covered with iron and mail; angles and straight lines predominated; the naked form was more than ever concealed, and the artist deprived of his materials.

The middle ages.

Though the art suffered at the death of Charlemagne, yet it was kept alive by monks and by bishops. At Rome, at Palermo, and at Milan, religious painters preserved it from decay; they sprung up all over Europe, and even St. Dunstan, Archbishop of Canterbury, is spoken of as a skilful painter and maker of instruments.

It is curious, after all that has been written about oil painting, and the discovery made by John Van Eyk, to find a writer of this period called Eraclius, in a treatise on painting, speaking of oil painting: "De omnibus coloribus cum oleo distemperatis." Another monk wrote a treatise, in which he says, "he will tell the world how the Greeks mixed their colours." Now, as according to Suidas, the writings of Apelles and Euphranor, were in existence in the tenth century, and these people lived about that time, there is reason to believe that they were aware of oil painting having been practised in ancient Greece, and that subsequent discoveries were but different revivals.

Whilst the art feebly struggled on in the west, the court of Constantine Porphyrogenitus was the rendezvous of artists, and in 997 St. Mark was built at Venice by Greeks. In contrasting Greek with Roman art at this time, the Greek is still superior. The Greek composition did not want dignity, whilst in the Roman, all sound principle seemed dead. The most ignorant Greeks shewed taste in their draperies, and their heads have character, and in the arrangement of hair, they remind one of the Panathenaic procession; whilst the Romans, with their large heads and long limbs, evince a gross ignorance of beauty.

In the tenth century, tapestry for a time superseded painting; though in Germany, France, Italy and England, many painters flourished. In England, historical commemorations were in fashion, and the Duchess of Northumberland adorned Ely Cathedral with a series of pictures illustrating the deeds of her distinguished lord.[4] When William the Conqueror came, he introduced a new style of architecture; but both at York and Canterbury, paintings then adorned the walls. In 1013, a head of Christ was executed in mosaic, and is still considered as the wonder of the middle ages.

Symptoms of revival.

After so many vicissitudes of fortune, painting now began to shew symptoms of revival. Frescos had been executed in Rome in 498, and in 795; and there was a head of Christ painted in St. John Lateran, and still to be there seen, which gave evidence of great feeling. But the grand impulse was given in the year 1066, when St. Didier sent for Greek artists to adorn Monte Casino at Subiaco. The example was followed. Pisa, Venice, Amalfi, Genoa, and Milan, all municipal corporations rivalled each other; and when Pisa sent to Greece to collect as many splendid remains of art as could be obtained to adorn the dome of the city, Buschetto, a celebrated Greek architect, was engaged to superintend their embarkation, to accompany them during the voyage, and to land them safely for the purchasers. Buschetto was received with so much enthusiasm, that he founded a school of sculpture, which existed for two hundred years; and ultimately out of this very Greek school, came the great artist Nicolo Pisano, the head of the Italico-Pisan school. From this moment art, after having sunk to the lowest barbarism, went on improving till the taking of Constantinople by Mohammed II., an event which scattered the Greeks collected at that court all over Europe. Hundreds went to Italy as painters, sculptors, chasers, and mosaic painters; and by their struggles for existence, inoculated Italian artists with some remnant of their taste for beauty, decayed as it was. Cimabue was their pupil, and Giotto was his. The Catholic church wanted artists, and genius again began to shew itself. One man of genius appeared after another, till Michel Angelo,

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1 Suidas. 2 William of Malmesbury. 3 Concil. Nic. ii. act. vi. tom. iv. ed. 1714. 4 Strutt.

Painting. Leonardo, Raffaelle, Titian, and Corregio, were the glorious results. And though it cannot be denied that the high aspirations of Christianity, by placing every thing human on its proper level on earth, in comparison with eternal happiness, had justly prostrated the splendid beauty of Pagan art, by exposing its idolatrous tendencies; though the sufferings, and the agonies of its founder and its martyrs had revived its pathos with higher objects than mere beauty of form or face, and saved painting and sculpture from extinction; yet it must be acknowledged, that the beauty of Christian art has never rivalled the indisputable perfection of the Pagans. To their enthusiastic overestimate of the religious value of physical, as emblematic of moral beauty, is their perfection attributable; but if it can only be revived by some similar delusion, the result will in our opinion more than atone for any thing that seems doubtful or questionable in the principle.

The most eminent pictures of the middle ages, setting aside the cemeteries or catacombs, which cannot legitimately be referred to the middle ages, but to the earliest ages of Christianity, are to be found in Rome. The greatest works of the middle ages are the series of Popes, begun in the fifth century, and continued down to the present time. The next, which was executed in the year 1011, is the painting of the church of St. Urbano, where some of the acts of the Apostles are represented on the walls. Though the mosaics of St. Mark's, executed by Greeks, were earlier, and kept art alive, yet, according to Lanzi, nothing in reality appeared which gave symptoms of the approach of any thing extraordinary, till about the thirteenth century; and this revolution of style was entirely owing to sculpture.

Italian schools of painting—The Tuscan. Pisano.

The glory of this art belongs partly to the Tuscans, the legitimate descendants of the ancient Etruscans, but most especially to the Pisans, who first had the courage to burst the yoke which Greek art in its fallen state had imposed upon them, and to go at once to the antique; and this glory belongs to Nicolo Pisano, a pupil of the school originally founded by the Greek Buschetto. There were in Pisa several ancient sarcophagi, but especially one, containing the body of Beatrice, mother of the Countess Matilda, with a bas-relief in good style, which served as the model of Nicolo; on this he formed his style, in which there is something of the antique, especially in his heads and draperies. Many artists who had not done so before, immediately devoted themselves to sculpture; and Nicolo Pisano must be considered as the first Italian, who opened the eyes of his contemporaries to the true principle of using the antique, that is, keeping nature in view at the moment of practice. In 1231 he cut an urn in Bologna, whence he was called "Nicolo of the urn;" and he produced two stories of the last judgment at Orvieto, and another work at Pisa, which convinced the world that he was born to found an epoch. He executed other great works, and was really the head of the illustrious school which produced Orcagna, Donatello, and the famous Lorenzo Ghiberti, who made the beautiful bronze doors of which Michel Angelo said, that they were worthy to be the gates of paradise.

Many other eminent men came from his school. All Italy was more or less affected by Pisano's genius; and though a sculptor, his effect on design was so great, that he must be considered as having had a material influence on painting. Painting remained behind sculpture, and even mosaic; and Vasari exaggerates the effect of Cimabue's appearance in the year 1240; for Lanzi proves that there were Pisan painters of talent before that period, and that the early art does not in the first instance owe so much to the Florentines as Vasari has asserted. At Assisi there is a crucifixion by Guinta Pisano, who, according to an inscription, learned his art from the Greeks in 1210. This was before Cimabue; but Lanzi says that the work is not inferior to Cimabue, and in drapery, colour, light, and shadow, composition and expression, very like the contemporary Greeks. Guinta disappeared and died, nobody knows where or how. Guido di Sienna was another name of this early period. In the Louvre there were some exquisite heads of angels with gilt glories, full of beauty and expression, executed by this artist. Then followed Margaritone, who painted on canvas, covered with size and plaster for a ground; which the Egyptians, Greeks, and Romans, had done long before his time.

During the time that the neighbouring cities had founded a new style, Florence had no painters; but when the authorities called in some Greeks in 1250, it is asserted that there was a painter called Bartolomeo. Vasari wishes of course to infer that Cimabue was the first Italian painter who gave the impulse; but Lanzi proves the contrary. Although there is no city we owe so much to as Florence, yet the Florentines ought not to be allowed to deprive their old enemies of the honour of having produced earlier painters, besides Pisano.

Cimabue.

Cimabue, who was both architect and painter, was honourably descended. That he might have been the scholar of Guinta is probable, because the Italians knew more than the Greeks of that time; but there is every reason to believe that he learnt of those Greeks who had been called to Florence, and whom, according to Vasari, he stood whole days, when a boy, watching as they painted in Santa Maria Novella. From this moment indeed may be dated the excitement which impelled him to become a painter. At Assisi his genius seems to have been put forth with most power. Lanzi concludes the notice of him by saying, that Cimabue was the Michel Angelo, and Giotto the Raffaelle of his age. In the Louvre there were one or two large examples of Virgins, staring and Gothic, and which the French, still more Gothic, were absolutely repainting.[1] Vigorous in his colour, and colossal but ill-proportioned in his figures, Cimabue first gave indications of attempting something new in painting; indeed, his watching the Greeks all day is so like an infatuated youth, that it bears truth on the face of it. Florence was often in commotion when his works appeared; and although he was not actually the oldest painter, he was the first of that series which ended in Raffaelle. His style was meagre, his drapery sharp, and his colour a species of illumination; but though he had no light and shadow or perspective, he was a great man for his time; and in some of his heads there are both character and expression.

Giotto.

Men of genius assist to call forth men of genius. In the neighbourhood of Florence, Cimabue accidentally found a youth tending sheep, and trying to draw one upon a slate. After some conversation with the boy, finding the youth ambitious to become an artist, he consulted his father, took him immediately under his own tuition, and advanced him rapidly. Cimabue was amply repaid for his generous conduct, as the innocent youth was Giotto, afterwards one of the great men of the time. No man can judge of Giotto's genius in England, because fragments of single heads or bits of altar pieces, are no fair criteria of a genius like his. His series of pictures in the Campo Santo are admirable, if allowance be made for the taste and simplicity of the age; but there are many actions and positions of Giotto, as fine as can be conceived, and which other artists by aggrandising in form, have rendered models of imitation. He was the friend of Dante, and painted the portrait of the great poet. He seems to have been a facetious and amiable man as well as a genius, and was indisputably the greatest painter till Massaccio. He

[1] The writer of this article, who saw a Frenchman solidly repainting a large picture of Cimabue in the private rooms of the Louvre, where he was admitted by Denon, asked the Frenchman who it was by: "Monsieur," said he, "je ne suis pas peintre, je suis restaurateur."

Painting.

went about Italy scattering seeds every where, and when the Papal See was moved to Avignon, he went with the court. Giotto was the greatest of the Florentine school. He was the father of painting, as Boccaccio was the father of literature. He was sought for at Ravenna, and at all the great towns of Italy, and was patronised by all the first families. He was an object of study and admiration, until the time of Raffaelle, and that of the Caracci, and is so even at the present time. There are in Giotto instances of pathos and expression, which would do honour to any period. Thus the greater part of the merit belongs to the Florentines, but not the whole. Giotto died in 1336, when painters had increased immensely. In 1290, the first society of artists in Venice was established, under the protection of St. Luke. They were not academies, but associations of artists, composed of engravers, painters, sculptors, and orefici. Their object was to advance design in all arts; and had they always continued to act on this honest and simple principle, we should not now have had to lament in Europe a race who are synonymous with every thing weak, mannered, and absurd in art.

Buffalmaco

The next distinguished artist was Buffalmaco. Although totally independent of Giotto, he was also intimate with Boccaccio. He was very capricious, and worked only when he liked, yet he was inferior to no one. He painted the Crucifixion, Resurrection, Ascension, and Creation of the World in the Campo Santo; in fact, the Campo Santo seems to have been a receptacle for all the distinguished geniuses as they appeared in that age. In it there are things as fine in conception as were ever imagined; and the foundation of some of Raffaelle's best compositions in the Vatican may be there found. Vasari's life of Buffalmaco is exceedingly entertaining, as indeed all his lives are.

The Orcagnas.

The two Orcagnas, Andrea and Bernardo, were the next artists of this early school. Andrea painted the Judgment and the Inferno, in the Campo Santo. He was full of invention, but not equal to the Giotto school, though he first gave evidence of perspective. Lanzi thinks that the art did not advance so quickly after Giotto's death as it ought to have done. Taddeo Gaddi, his best pupil, was to him what Julio Romano was to Raffaelle. Vasari, who saw his pictures in good condition, says, that he excelled his master in fleshiness and colour. Agnolo Gaddi the son of Taddeo, was a humble imitator of Giotto and his father, and had as his pupil Cennino Cennini, whose treatise on the mechanical preparations of the art is very valuable. Fortunate would it have been had the treatises of Apelles and Euphranor also reached us.

Florentine school.

Pisa now began to decline, and the Florentines took possession of that city in 1406. Hated and detested by their conquerors, the spirit of the citizens sunk into the greatest depression; the artists left the city, and the school entirely decayed. The Florentines now rose in the ascendant. The Medici began to appear. Cosmo, the father of his country and the protector of genius, gave fresh energy to art, science, and public affairs. Lorenzo followed, and their house became the refuge and resort of all who were celebrated in painting, poetry, sculpture, architecture, and philosophy. Massaccio, the two Piselli, the two Lippi, Binozzo, Sandro, and Ghirlandaio, received from the Medici protection and employment. The pictures of the time have perpetual portraits of the Medici. The citizens became animated with the same spirit; frescoes covered the churches, and smaller works filled the houses. Up sprung, too, that host of painters, marble-cutters, bronze-casters, and chasers, by which the principles of design passed from Pisa to Florence; and out blazed before the world Donatello, Brunelleschi, Ghiberti. The most exquisite productions of sculpture, marble, and bronze followed. The youth became inoculated; sound design became the first necessity of manufacture; and though the finest works of Italy at this or any period cannot be compared to the finest works of Greece, yet a good style of design was established, but unequal to those refined forms of beauty, so palpable in the merest fragments of the works of the school of Phidias, which have all the look of life without any of its vulgarities, all the essential details, without a single superfluous one. This cannot be said of the naked figures of the period in question, or of any period of Italian art, not even of the art of Michel Angelo and Raffaelle. There was a want which Greek forms only supplied; there was an absence of refinement, and a want of something which the Greeks possessed. Michel Angelo and Raffaelle were educated without system. There was no school in Italy like the schools of Sicyon and Rhodes, Athens, and Corinth, where all the hidden secrets of perfect form were taught, that is, the secret of beauty. Michel Angelo and Raffaelle owed their greatness to their own genius; and their art died with them. There has been nothing in the world like the art of Phidias, except the poetry of Shakespeare. The intellectual powers and perceptive senses of the Greeks must have been several degrees more refined than those of all preceding or subsequent nations.

Painting.

Massaccio.

The followers of Giotto had advanced the art from infancy in colour, composition, and expression; but in perspective, and light and shadow, they left it as they found it. Uccello had given symptoms of perspective, and Massolino da Panicale of light and shadow, until the appearance of Masso di S. Giovanni, a youth so immersed in study, so utterly absorbed in his divine art, that he neglected dress, health, food, sleep, and seemed only to be conscious of life when he touched a pencil. For this entire neglect of the humanities and comforts of life, the Italians, whose satirical turn is ever apparent, added *accio* to Masso (*accio* affixed to any word exciting associations of dirt or ugliness), so that Mass*accio* meant a dirty and neglectful man. Neglectful as he was, however, he was the immediate precursor of Raffaelle; and all the great subsequent painters studied him. Raffaelle borrowed from him Paul in Elymas, the Adam and the Eve in the Loggia, and other entire figures. Like Apollodorus, he opened the doors; and Raffaelle having passed through, never forgot his obligations. Ghiberti and Donatello formed his style; from Brunaleschi he learnt proportion; and though the finest antiques were not known in his time, he improved himself by studying such as were in existence. The airs of his heads are *Raffaellesque*, says Mengs; yet, would it not be more just to say, that Raffaelle's heads are *Massaciesque?* Raffaelle died the favourite of a court, loved, lamented, and in competence. Massaccio so excited the envy of his inferiors, that it is suspected he was poisoned at the age of twenty-eight, before he had fairly taken his ground. Surely, then, when Massaccio is praised for what must have been his own, it is not quite fair to term his excellence, that of a man who came after him, and perhaps owed it to him. His works are at S. Ambrogio and del Carmine in Florence, and St. Catherine in Rome. His heads are full of character, his drapery is beautifully composed, and his composition is unaffected, but his knowledge of the naked form is feeble and vulgar. Some of the heads of del Carmine are full of character like Holbein, with the same look of rigidity in expression; but he was a true genius, benefiting by his predecessors, going beyond them, and enabling those who studied him to carry the art to the highest point it ever reached in Italy. Pietro Perrugino, Leonardo, Raffaelle, and Michel Angelo, all studied and all were benefited by him. In the Palazzo Pitti there is a portrait of a young man who looks alive.

Ghirlandaio

After several names of great merit, we reach one who advanced towards the great era; we mean Domenicho Ghirlandaio, the master of Michel Angelo, a circumstance which alone is a passport to immortality. Fuseli says, that he was the first Florentine who added truth to composition by truth of perspective. The abolition of gold fringes in drapery may

Painting.

be dated from him; though his historical figures are little more than portraits well selected. The last important name of the first epoch of Italian art was that of Luca Signorelli, who had glimpses of real grandeur. His dome at Orvieto, where he painted the Last Judgment, has bold fore-shortening, with absurdities of an earlier date mixed up in it; but Michel Angelo adopted many of his ideas, as well as Dante's; and certainly the absurd assertion that he "disdained to look abroad for foreign help,"[1] is successfully refuted by this fact.

One can see how gradually art sunk after its decay into Gothicism; how gradually it advanced again to nature and common sense, and from common sense to elevation. During this first period the approaches to ideal beauty, imperfect as it was in Italian art, were gradual, and would have been longer in coming had not the discovery of the Apollo, and other ancient works, opened the eyes of all the great men living, and a spring taken place from Perrugino, Ghirlandaio, and the Bellini, which was soon visible in the works of Raffaelle and Michel Angelo. Leonardo seems not to have been smitten by the ancients to the same degree as the other two were. There is less obligation to any nation in him; and unquestionably few as are left of the effusions of his genius, they are more original than the Vatican or Sistine Chapel. What was there in the world to put us in mind of the Standard struggle or Last Supper of Da Vinci?

Oil painting.

But before proceeding, it may be as well to allude to the question of oil painting. It was long a supposition that Van Eyk discovered it, and that it was not known before; whereas, it was used in England in 1230, long before the time of Van Eyk. Cennino Cennini wrote a treatise on the technical practice of the Italian painters; he was a pupil of Agnolo Gaddi, who was a pupil of Taddeo Gaddi, who was a pupil of Giotto, who was a pupil of Cimabue, who was a pupil of the Greeks. There can be no question that from the mixture of oil with punic wax[2] as a varnish, the use of oil was known to the ancient Greeks, and that it was carried on to the tenth century, when the monk Theophilus[3] wrote his treatise. He positively describes how to mix the colour with oil instead of water, and how to boil the oil; and then we can prove its existence by actual documents in the rolls of the Exchequer in England (1239), and by the 23d of Henry III., wherein the king issues an order to "our treasurer Odo the goldsmith and his son, to be paid 117 shillings for *oil, varnish,* and *colors* bought, and for pictures made in the chamber of our Queen at Westminster,"[4] nearly two hundred years before Van Eyk. There can be no doubt that oil painting has never been unknown, even to the Egyptians; it has been forgotten and revived, but none of the periods of revivals are entitled to the honour of discovery. "Chaque nation a ses avantages, et ses désavantages," said a Frenchman to us, whilst shrugging his shoulders as a spout of water from a roof drenched him to the skin in Paris; and "Ogni nazione ha le sue virtù, ha i suoi vizi," says Lanzi. Every nation which confesses its vices, is sure to have justice done to its virtues. There is no Italian school, however good, which has not its errors, and none which has not its excellencies as well as its mistakes.

Florence was distinguished for fresco more than for oil painting. The Florentine style of design, in its best days, was always peculiar; the figures were long in proportion, their feet were small, and so were their knees; there was always a look, in Florentine design, as if the muscles of the body were suffering from a temporary knotted cramp; they were, in design, too circular, too elliptical, or too angular, and never seemed to have hit the exact medium between all three, like Phidias. Their colour was not rich, like the Venetians; their draperies clung too closely to the limb as if they were wet; they made an ostentatious display of the limb underneath; in fact their system degenerated into manner, and beauty seems not to have been a primary object in the Florentine school, any more than in that of their ancestors the Etruscans. At Fontainebleau, though the designs of Primaticcio were full of talent, yet they gave a very good idea of the excess of the Florentine manner.[5] The two great luminaries of Florence were Da Vinci and Michel Angelo. Da Vinci was less of a mannerist than the other great man. He was, in fact, the link between the meagreness of the first period of design, and the vulgar swing of the second.

Leonardo da Vinci.

Leonardo was born in 1452. He was a natural son, and had all the eccentricity, sloth and fire, weakness and energy, idleness and diligence of that class. A poet, a musician, a mathematician, an hydraulist, a mechanic, a modeller, and a painter; he excelled in all. Keen, eager, minute, searching and indefatigable, handsome in face, beautiful in person, tall in figure, athletic and skilled in manly exercises, a graceful dancer, a splendid horseman, and an harmonious singer; he equally delighted the people, infatuated the women, and bewitched the sovereign. And yet with all this vast power, the gift of his Creator, he was so deficient in concentration of mind, that he seemed to have no power of collecting its rays sufficiently long to make discoveries in any thing. He was the scholar of Verocchio, by whom he was infected with a lazy love of design in preference to the vigorous energy of using the brush. He passionately loved geometry, horses, and soldiers; and in his horses he never left nature like Raffaelle, Julio Romano, or Michel Angelo, but gave them their natural characteristics of fleshy nostrils and projecting eyes.

His two greatest works are his Last Supper, and his Battle of the Standard. The beautiful humility of Christ, the tender amiability of St. John, the powerful expressions of all the apostles waving to and fro in their attitudes, as if disturbed in their feelings, by the remark of Christ, that "one of them should betray him," prove the extent of his genius, and the depth of his perceptions. But even here, the bane of his existence, that disposition to experiment, has ruined the work, more from the consequences of his own preparations, than either time or damp. Such men are never regarded as steady lights by posterity; painting was only a portion of his occupations, and not the end of his life. One quarter of the lives of such men is spent in experiments; another quarter in putting them in practice; a third in lamenting their failure; and the last amidst the bitterest remorse, devoting themselves to their real pursuit, to satisfy the cravings of conscience and the reproach of the world. What has Leonardo left us in all his various pursuits to compensate us for the loss which accrued to painting? Geometry was as much a caprice of his extraordinary mind, as any other science. What has he left us in poetry, which poets could look up to? What in mechanics, that Watt could have founded on? What in music, that would have benefited Mozart? What in hydraulics, that would improve our shares in canals? The genius that composed such works as the Standard and Last Supper, need not to have shrunk from competition with Michel Angelo, young as he was. There is no doubt the world is always delighted to pull down an established artist by pushing up a younger rival in his face; but if you become irritable, and desert your

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1 Reynolds' note.

2 Pliny, lib. xxxv. Cera punica cum oleo liquefacta.

3 Lib. i. c. 18. Accipe semen lini et exsicca illud in sartagine super ignem sine aqua, &c. Again, "cum *hoc oleo* tere minium, *super lapidem*;" and again, "accipe colores quos impone volvens, *texens eos* diligenter cum *oleo lini.*" (*De omni Scientia Artis Pingendi.*)

4 Rot. Claus. 23d Henry III. Walpole's *Works*, vol. iii. p. 16.

5 In 1814, the writer saw the remains. There was a naked youth over one of the gateways, which had all the peculiarities of this school.

country from disgust, men only laugh; whereas the sound principle is, Laugh at the world, stay in your country, and work harder than ever.

The fact is, that such men as Leonardo are great geniuses, but not the greatest. The evidence of superior genius is the power of intellectual concentration. Such powers had Newton, Milton, Bacon, Locke, Watt, Michel Angelo, Napoleon, Raffaelle, Titian, Rubens, Vandyke, and our own Reynolds. Such men only are examples, and not beacons; such men only are blessings to their species. As a specimen of his extraordinary caprice of character, his want of perseverance and his notions of the most elaborate finish were at least equal; he took four years in painting one face, and then said it was not done. His children are exquisite; but his women have an air of modesty to conceal meritriciousness, and his oil-works are far from models of excellence, the over-wrought finish being hard. There is always in his expressions an air as if they were set in enamel, and could not relax. The picture, in our national gallery, of Christ and the Doctors, is a celebrated work; but why should Christ, who disputed with the doctors at twelve years of age, be larger in person and head than the doctors who are sixty? And why should Christ be like a woman in men's clothes, and look out of the picture, and talk with his fingers to the spectators, instead of being, as he was, a fine boy of twelve years old, handsome, intellectual and angelic? We should like to have heard Leonardo's reasons, if he had any, for such an apparent absurdity.

In design, and tempera or fresco-painting, Da Vinci was great; but in oil pictures he is false in taste, petty in execution, and unskilful in backgrounds. By his depth of light and shade, and also of colour, which gave an impulse to all Italian art, he had a sense of beauty which greater steadiness might have brought out to perfection. But when a man flies off from painting to make a lion, which will walk by machinery, to meet the king of France who approached Milan, to stand upon his hind legs without human help, to open his own belly, and show the king of France his arms inside it, what could be expected from his talents, great as they were? Nowhere does his character show itself more conspicuously than in his treatise on painting; in fact it is not a treatise, but a collection of separate disjointed thoughts, like the recipes of a cookery book. It is very easy to put down your thoughts as they occur without arrangement; but the difficulty is, to collect them for the illustration of a principle like Fuseli or Reynolds. Every man can put down separate thoughts, but every man has not the power so to arrange them as to throw light upon an art. Leonardo dissected and drew finely; but there was a meagre common-model style in his figures, a want of perfect construction, as if men had never worn clothes. On the whole, this illustrious man cannot be referred to as the head of an epoch. He was a component part of it, but not like Michel Angelo or Raffaelle the great engineer. What he did in painting made one lament that he had not done more. "An artist," says Reynolds in his letter to Barry, "should bring his mind to bear on painting, from the moment he rises till he goes to bed; and if his mind be calm and undisturbed by other objects, he will find it quite enough to fill up life, if it was longer than it is."

Michel Angelo.

No man could be more opposite to Leonardo than his great successor Michel Angelo, patient, laborious, virtuous and indefatigable, painter, architect and sculptor; he left a work in each art that advanced the rank of his country. To turn to such a character, is a relief and a blessing. In him the aspiring youth contemplates the result of conduct totally the reverse of that we have been considering. Solitary, and highly gifted, despising the subterfuges of society, he lived alone; and in addition to his genius he was a great moral being. Brought up by the liberality of Lorenzo de Medici, admitted freely to his table with the illustrious men of the day, Michel Angelo had every advantage in early education. He came, too, when he was wanted; when ancient literature and ancient art were breaking through the obscurity which had overwhelmed them, and the discovery of printing was scattering their beauties throughout Europe. Men's minds were roused up with wonder and delight at every fresh discovery. Painting, architecture, poetry, and science were hailed with a gusto which nothing can account for but the misery of the ages that had passed.

Michel Angelo, after his day's study in the gardens which Lorenzo had opened for the youth of Florence, retired to the coins, cameos, and fragments of the palace. With his acuteness, energy, and perception, it is not wonderful that he soon perceived the inferiority of the forms of his master, in comparison with the full beauty of the form, the result of perfect construction in the antique. He corrected with his boyish hand the narrow meagreness of Ghirlandaio; and announced, thus early, that self-will and vigorous decision, which enabled him subsequently to accomplish whatever he undertook. Here was the germ of that mighty power which placed the Pantheon in the air, as he predicted and realized in the dome of St. Peter's. Here was the embryo fearlessness, that brought him through the vast ceiling of the Sistine Chapel in fresco, though when he began it, he had never painted in fresco before. Michel Angelo was one of those rare beings who are wanted when they come, and have opportunities put in their way adequate to develope the powers with which they are gifted. Julius II. was as wonderful a man as Michel Angelo; and they mutually inspired each other. What Julius willed, Michel Angelo was as ready to perform; and what the inspirations of Michel Angelo's genius suggested, the vigorous pope, whose fine old venerable head a helmet would have suited better than a tiara, had comprehension to value. They were both fierce, both self-willed, both proud and haughty, both independent and ungovernable. If Julius wished what Michel Angelo was in no humour to do, he would not do it; and if Michel Angelo wanted to execute, on sound principles of art, what the aged pontiff did not comprehend, he would do it, in spite of denunciations of banishment, or threats of displeasure. They were made for each other, they understood each other, and they were attached to each other; they quarrelled, became friends, and quarrelled again. "When will the ceiling be finished?" said Julius, as he trod on the scaffolding with a stamp that made the boards tremble, after climbing to the top, where the great artist lay on his back on a mattress, hard at work, painting with vigour. "When I can," said Michel Angelo, irritated at the interruption. "When thou canst," thundered out the pope; "Art thou minded to be hanged?"

This was the man for Michel Angelo. Conscious of his age, conscious that death followed him wherever he went, he began, proceeded with, and finished all he undertook, as if he had not an hour to live. By his perpetual watching, he hurried Michel Angelo through the ceiling of the chapel in twenty months, a time by no means equal to that which ought to have been devoted to it. The hurry is visible in the fierce, rapid execution; and that which was entirely owing to the impetuosity of his old patron, has been attributed as a merit and a principle to the great painter. Such is the infatuation of praise when a man is really great. Of this astonishing work, it seems that enough can never be said; though language has been exhausted to do it justice. Fuseli was the first who cleared up the mystery of the composition, in a style that places the commentator on a level with the inventor. "It exhibits," he says, "the origin, the progress, and the final dispensation of theocracy." But Fuseli's character of Michel Angelo is overdone. It is an effort to express the deepest feelings in the strongest language; and in all such efforts the language invariably becomes inflated and turgid.

In comparing this illustrious sovereign of modern design with Phidias, or the Greeks generally in the naked figure, he must unquestionably yield to them the palm. Michel Angelo often perplexed his limbs with useless anatomy; it must not be denied, and cannot be refuted, that he did not always clear the accidental from the superfluous. If the principle be a sound one, namely, "that any two parts of a body bearing comparison must keep a consistency throughout, similar in essence and similar in development," then is Michel Angelo grossly inconsistent; because if the spine of the ilium in front be covered fully by the muscles around it, so ought the spine of the scapula behind to be equally covered. If the former be, and the latter be not, then the figure is inharmonious and inconsistent, and what Phidias would never have tolerated. Now the figure of Michel Angelo's Christ standing with a cross, has the spine of the scapula prominent and bony, and all the muscles shrinking from it, the characteristics of a thin man; whilst the spine of the ilium of the same figure in front, is entirely covered by the muscles around it, the marks of a muscular and fleshy man. What authority had Michel Angelo in nature or antiquity for such inconsistency? These are the excesses which bring dissection into contempt, and which induce anatomists to doubt whether the Greeks dissected or not, because they were never guilty of such absurdities, and because they had too much self-control to make that an end of art which was but a means of the perfection of art. And yet Vasari calls it "mirabilissima." This figure and the Lazarus in Piombo's, as well as several figures in the Last Judgment, are justifiable grounds for asserting he was not equal to the Greeks in the naked figure; though in the conception and arrangement of a vast whole to illustrate a grand principle, he approaches but does not surpass the Parthenon in its glories. In the form he must not be compared to the Greeks; gigantic as he is, he was decidedly inferior.

Michel Angelo's line is by no means "uniformly grand;" and his women may be "moulds of generation," but certainly not of love. His infants may "teem with the man," but they have nothing of the infant. His men may be a "race of giants," but they are brutal in expression, fierce in action, and distorted in position. It is useless in a rapid and general view of art to go over ground which has been so often gone over before; to talk about the prophets and sibyls, after three hundred years' enthusiasm, is worse than useless. Europe knows the awful grandeur of one or two of them, looking like beings to whom God has spoken, and who have never since ceased meditating on the awful voice.

The style of Michel Angelo has been called the style of the gods; but if majesty without pretension, humility without feebleness, power without exertion, and an awful presence without vulgar assumption, be the characteristics of a god, what figure of Michel Angelo's deserves that appellation? Is it in the bullying defiance of Moses? the twisted tortures of Jonah? the cramped agonies of the sleeping Adam? or the galvanized violence of the ornamental figures at the tombs? It must be admitted, that the *Pensoso-Duca* is majestic and silent; but this is an exception, not an habitual characteristic. "Michel Angelo's mind," says Reynolds, "was so original that he disdained to look abroad for foreign help." Disdained! Why there is not a prophet, a sibyl, or a naked figure in the whole chapel where the torso cannot be traced. And what are the works of both Michel Angelo and Raffaelle, but improved completions of all that their predecessors had done for a thousand years in barbarism and obscurity? Shakespeare's plots are all borrowed; Lady Macbeth is not his own; that hideous expression "know Macduff was from his mother's womb untimely ripped," is Hollingshed's. But what of that? It is the new thoughts he puts into them, which give him claim to the sympathy of the world. Phidias and Raffaelle have one great and decided beauty in their works; their figures, whether in action or expression, always look as the unconscious agents of an impulsion they cannot help. You are never drawn aside from what they are doing by any appearance in them, as if they wished to make you consider how very grand they were, or how very gracefully they were moving. They seem impelled by something they cannot control; their heads, hands, feet, and bodies immediately put themselves into positions the best adapted to execute the intentions wanted; whereas *often* in Michel Angelo, and *always* in his imitators, there is a consciousness as it were in his arms and limbs, which destroys all idea, as if his figures were the unconscious agents of an impulsion they could not help, and which acted by means of the will on the muscular system.

It is an inherent principle of life never to disturb itself for grace, or for any other object either in action or repose, not immediately the natural consequence of the impulsion which moved the body. Style in design is a *result* and not a *cause*. Whatever object is represented in painting or sculpture, the intentions of God in its bodily formation should be ascertained; the means which God has bestowed on it to enable it to execute its only will or gratify its own instincts, should be investigated; and then the aberrations produced by time, accident or disease, or other causes, will be clearly known, so that he who takes upon himself to represent any object in painting, will be able to distinguish accident from essence, and shew the object in its essential properties of body as God first created it. The external form in that body will then be *essential*, and the result of its completion in art will be *style* in design. There are certain inherent principles of our common nature to which all bodies must yield, viz. that compression and extension must have different effects, and so must repose and action. If a great artist represents a figure and makes its parts the same in either case, he must be ignorant of nature or above its simplicity. No doubt, the conception of an idea may be so grand, the beauty of a character may be so angelic, the pathos of an expression may be so deep, that errors or inadequacy in the mode of representation may be overlooked or forgiven; but in order to bring the art to the perfection to which the Greeks brought it, there must be nothing to forgive or to overlook. An idea or conception being the nobler part of the art, we may, in our common conviction of human frailty, *overlook* any inadequacy in the means of imitation; but the very admission proves there must be something to be overlooked and something which, we have a notion, has not been adequately represented.

An art the modes of which to convey thoughts, being the imitation essentially of natural objects, ought surely to have the imitation perfect, because the imperfection of the means has always detracted from the impressions of the thought. Poets are not endured if their grammar is bad, or their language defective; and why should drawing, form, colour, or light, shadow, and surface, the grammar of art, be excused more than the poets'? Because the simplest imitation is at once recognised as the imitation of the prototype, why should facility of imitation be any excuse for defect? Ah, but it's the *grand* style. Yes, the grand style of Europe for the last three hundred years; but was it the grand style of the Greeks? Certainly not; their grand style was nature elevated not violated, with none of her inherent bases of life altered a hair's point, none of her essential details omitted, and none of her essential principles overwhelmed by useless detail.

When you see an outline like iron, that is the grand style. When hands were twisted, heads distorted, one leg up, and the other so far removed from the body, that you may question if it will return, that is the *grand style*. All this absurdity originated with Michel Angelo; and though he is not answerable for the excesses of his admirers, there must be

Painting.

something erroneous if every imitator has led to such extravagance from Goltzius downwards. Michel Angelo was a tremendous genius, and his effect on the art was vital; but he did not like the Greeks suffer the unalterable principles of life to keep in check his anatomical knowledge. This was an error, because we can imagine no beings, and no world where malleable matter is not influenced by the common principles of the solar system, or where any creatures composed of bones, muscles, tendons, and skin, must not yield to the laws which God instituted for their government when he created them.

Thus Michel Angelo often overstepped the modesty of truth, and gave a swaggering air to his figures. Every figure of his looks as if he was insulted and preparing to return a blow. If they sleep they seem as if they would kick; if they move when they are awake, they seem as if all their muscles were cracking. We allude particularly to the naked figures; Jeremiah and the Duke are exceptions, but they are only exceptions. Fuseli observed that Michel Angelo was the *salt of art;* but it would have been more just to have called him the *pepper*, because very little indeed will do for a seasoning. In poetry of sentiment the Medici tombs would perhaps have competed with Phidias; for Michel Angelo being a painter as well as Phidias, he combined in his sculpture a knowledge of effect. In selection of subject and daring execution of hand, perhaps the Sistine Chapel might equal the great works of painting amongst the ancients; but in naked representations *it cannot be compared to it.* The Elgin marbles had not then enlightened the world. The due subordination of all science to nature had not then been so exquisitely seen; the due combination of life without meanness, and of abstraction without losing sight of life, were not so apparent in the great works of ancient art which were found before this period. Had Michel Angelo seen the Theseus and Ilyssus, Jupiter's breast and horse's head, he would have felt the difference between the muscular swing of a blacksmith, and a hero naturally born powerful, without his muscles being distorted by manual labour; and that a hero might be elevated and yet simple, fleshy without fatness, and muscular without being skinny. Michel Angelo has been called the Deity of design; but he was rather the Devil. One can imagine the consternation of Phidias and his pupils, if suddenly at Olympia the galvanized figures of the tombs had been let down through the roof, whilst they were preparing the Olympian Jupiter, with his quiet, solemn, steady, thinking, peaceful, awful look.

Reynolds says he prepared the way for the sweeping outline of Rubens; but how many thousands has he ruined? What is the excellence of the Last Judgment? Is there any evidence of power in arranging a whole, like Rubens, Titian, or Tintoretto? Is there any application of any principle of our nature by the due combination of variety and repose? Is it not a mass of separate groups, vulgar in design, academic in action, and demoniac in expression? Is the Christ worthy of Goltzius? Surely it would have disgraced him; and then what devils! Are these the fallen angels of heaven? they are the legitimate offspring of hell. Are these the beings whose glory was obscured, not extinguished? whose majestic forms existed, though in ruin? whose beauty was only disturbed by passions, not destroyed? who were the same grand, heroic, terrific beings as ever, but scathed by lightning, singed by fire, dingy from darkness, lacerated by thunder, their splendour sparkling through the horrid obscurity, in which they meditated revenge? To give them mouths like wolves, ears like asses, noses like pug-dogs, and tails like monkeys, with feet cloven and misshapen, was not to represent a fallen angel, but a deformed monster. Though evil, they were beautiful.

"—— Their forms had not yet lost
All their original brightness."

"What matter where, if still I be the same?" says Satan. Could such a sentiment have ever been uttered by the wretch who is dragging a figure down to the bottomless pit, in a way delicacy forbids one even to think of, much more to write or to paint? Michel Angelo's demons would not only torture the damned, but feed upon their bodies.

It is clear, however, that there *was* a time when he was not so exaggerated. The holy Family, in sculpture, brought by Sir George Beaumont from Italy, is playful, natural, simple, and beautiful; it is in fact a divine work. Perhaps the violence of Julius in hurrying him through the Sistine Chapel, and the necessity of painting with tremendous exaggeration, on so large a space, got his hand into a fierce power that it never lost. Painting on grand ceilings is like talking in large theatres. He never entirely finished any thing; he left no grand pupils, like Raffaelle; he assisted the humble, but never instructed the gifted. The figure of Lazarus in our national picture, especially the hand and thumb that press the shoulder of the attendant on the left side, is certainly by him; and if it be compared to the timid painting of the Christ, the spectator will be convinced of it. In fine, Michel Angelo was a great genius; but let the students of Europe be assured that his style has been grossly overrated; let them banish his works from their eyes, and substitute the Theseus and Ilyssus, and the real grand natural style of Phidias will soon exclude the satanic Etruscan, and violent anatomical distortions of Michel Angelo. He may be and was a giant in art; but Raffaelle was an angel, and Phidias a god.

Bartolomeo

The next Florentine of power was the monk Bartolomeo. He studied under Rosselli, and Leonardo aroused and excited him; he was grand in colour, light and shadow, and execution, surface, and character. In the Louvre there were works worthy of any hand, any competitor, or any genius. He had the honour of advancing Raffaelle; he invented the lay figure, and made the proper use of it; he never put drapery on it till he had drawn the naked figure first, so that the naked parts affected the forms of his folds; he had great depth, grandeur, and a certain wildness of air; he drew finely, and his tones were solemn and elevated. Wilkie speaks with the highest enthusiasm of his Assumption of the Virgin. It is impossible not to feel the deepest interest in Bartolomeo, and not to be astonished that he did not found a school, and head an epoch. Such things, however, are never done by the mere influence of talent; the character of the man is principally though not wholly the cause. He painted a S. Sebastiano, which was so beautiful, that it became a favourite of Italian ladies. He was ordered to adorn the great hall of council at Florence, as Da Vinci and Michel Angelo had done before; but as if a fatality attended that hall, he died without going further than the designs. This is curious. Da Vinci designed the Standard struggle; Michel Angelo the group of soldiers alarmed by the trumpet, and dressing themselves; and now Bartolomeo began his designs, and died in 1517, without completing them. Bartolomeo was a great artist. His method was first to draw the naked figure, then clothe it, then paint the whole picture in light and shade in oil, and then tone and colour, guided by the tremendous depth of his first impasto painting.

Andrea del Sarto.

Andrea del Sarto is another name enthusiastically overrated by Vasari. He might be called Andrea senza errori; but what genius "senza errori," ever enchanted the world? Give us the vigour of Michel Angelo, with all his violence, the dash of Tintoretto with all his caprice, the colour of Titian with his want of drawing at first, the sweetness of Corregio with his namby-pamby men, the composition of Rubens with his flabby women, the expression of Raffaelle with his hardness of effect; but spare us from that poet, painter, musician, or moral character, who is so perfect that he must be admired without the gusto of finding fault; above all, spare us from the Grandisons of art. Andrea was

one of those to whom talent is more applicable than genius; whatever excellence he attained, he would have never attained to that degree, but for the existence of his superiors. The greater part of the works attributed to him in England, are copies by his pupils which he retouched.

Decline of the Florentine school.

After these great men, it would be useless to detail the decay of the Florentine school; it yielded to the circumstances of the time, and the misfortunes of the Medici. The continual political squabbles turned men's minds from art as in ancient Greece; but the great want of course was the want of genius, which no efforts have since been able to rear. Though the style of the Florentine school was not so pure as that of the Roman, it led the way in a noble manner, and kept side by side with it; they benefited each other. Leonardo gave an impulse to art; and though from the caprice of his character, he did not complete the impulse he had given, and was more the cause of greatness in others, than the man who established his own, yet the art is indebted to this highly-gifted man, who had an effect on Georgione, Bartolomeo, Raffaelle, and Michel Angelo himself; and gratitude is due to his genius. This great school was brought to utter ruin by what Lanzi calls the Cortoneschi, or pupils of Cortona, where art had degenerated into mechanism, and thoughtless, endless, and sprawling groups. The descendants of the Medici breed had more disposition than power to patronise, till Leopold reigned in 1765. The academy was renovated in 1785, and once more in 1804; but these renovations end in nothing. The great men were passed without these conventional distinctions; the little ones who came after, live only by their embellishment. Boys are educated to draw tolerably well, to colour with tolerable harmony, to invent tolerably insipidly, to become intolerable painters, accomplished academicians, to die, be buried, and decay; and thus leave room for another race as intolerably imbecile in art, as their illustrious performers before them. It is quite absurd to read in Lanzi, always at the end of the epochs of a school, "Decadenza dell' arte, e *fondazione dell' academia per avivvarla*;" "decay of art, and foundation of an academy, to give it life." But after a few galvanic twitches it stretches out its feeble legs, gasps with an expiring quickness, gives a trembling of its eyelids, which it opens once more, stares with a fixed look, sighs deeply, and drops its jaw for ever. Then come the vain efforts to restore circulation, then the delusive assurances that it is still living; then doctors and nurses dress up its helpless head with laurel, and put some abracadabra on its cold breast; but all won't do for it's gone and there is no hope. Such have been the results of the academies. Genius fled at their foundation, and left them useless bodies without soul, life, or circulation. The sovereigns of Europe will at last find out that no academies should go further than schools; and till they do, the end of art will be forgotten, in a vain contemptible struggle for its conventional distinctions.

Roman School.

The three leading lights of art as schools, are the Florentine, the Roman, and the Venetian. The Parman must in spite of all the beauty of Corregio, be considered as the beginning of corruption. The other schools, the Modenese, the Cremonese, the Ferarrese, Genoese, and the Piedmontese, are but different branches.

Raffaelle.

The glory of Italian art is Raffaelle. Had he been born in Greece, and qualified by a Greek education, he would have been as great in painting as Phidias was in sculpture; but the education of all the Italian artists was imperfect, and they seemed to be grounding themselves, (even Raffaelle himself,) on the meagre style of the early painters. The discovery of ancient statues in some degree opened their eyes, but they were not, like the ancients, gradually prepared for such perfection, nor was Raffaelle himself ever skilled in those perfect principles of beauty, as applied to the naked figure, which distinguished the Greeks. Wonderful, amiable, and gentle creature as he was, the reverse of Michel Angelo in every way, who proved himself decidedly the inferior man. In all his endless inventions, a single repetition of himself, even in the folds of a drapery, is not to be found; he was not like Titian, an exquisite colourist, but his colour is always agreeable, though not distinguished for light and shade; and his groups are never obtrusive, though not remarkable for aërial perspective. Every object keeps its place; though no face of his can compete with the beauty of the ancients, his women always enchant; his great power was character and expression, and telling a story by human passions and actions; in these he was unrivalled in modern art, and not surpassed by the ancients. His father being a painter, he was bred up in the art; and his master Perrugino, was a great man in his way, though somewhat of a Goth. In style, therefore, Raffaelle lost time with him; but could he have gone in early life to such a school as Sicyon, there is no knowing to what a pitch of perfection he might have carried the art. His latter excellence is entirely owing to his own sense, based on the antique; for most of what he learnt from Perrugino he had afterwards to unlearn. He entered the Vatican at twenty-five, and died at thirty-seven. What then must have been his diligence, his devotion, and his genius. In any history of painting, at this time of day, to talk of the subjects of the Vatican, or the Madonnas, so often copied, so often engraved, so often seen, so often praised, would be trespassing on the temper of the reader. His character, as well as that of his art, was the very converse of Michel Angelo. Michel Angelo envied his equals, was kind to his inferiors, and always insulting to his superiors; whilst Raffaelle was kind to all, and the idol of the society in which he moved. Michel Angelo associated with no men but admirers. The consequence was that his life was written by his flatterers Condivi and Vasari, a great portion, perhaps, delicately insinuated by himself; and, as might be expected, they have sacrificed Raffaelle to the Dagon of their idolatry. Vasari insinuated that Raffaelle was greatly indebted to Michel Angelo; and Reynolds following Vasari and Condivi, goes farther than either, asserting that Raffaelle owed his *existence* to Michel Angelo. Was there ever such gratuitous assumption? If it means any thing, it means that but for Michel Angelo, his genius would never have been developed. Is such an absurdity worthy of Reynolds' understanding? Surely not, and in fact it can be made clear that Raffaelle did not owe his existence to Michel Angelo. If he owed any thing to that great artist, he owed the corruption of his own pure style. After the Capella Sistina was opened, Raffaelle, bit like every body else by its heavy, cumbrous, vulgar, broad, and circular design, immediately tried it; but it did not suit his beautiful nature any more than it would have suited the elliptical beauty of the heroic forms of Greece.

What does Reynolds mean when he says, that "Raffaelle had more taste and fancy, Michel Angelo more genius and imagination?" If genius be nothing more than the ordinary faculties of men carried to a greater pitch of intensity than ordinary men possess them, wherein had Michel Angelo more genius than Raffaelle? Their geniuses were both equal; but the road which each took for the exercise of his genius was different. Raffaelle excelled in expressing the passions; Michel Angelo in sublimity of character, independently of all passion and emotion. Though the materials of Raffaelle's art are generally borrowed, are they more so than Michel Angelo's? Is not Michel Angelo as much indebted to Luca Signorelli and the Campo Santo, for his choice of subjects in the Sistine, as Raffaelle is in the Vatican? This does not invalidate their genius; whilst their predecessors were the root, the stem, the leaves, and the bud, they were the full blown flower. Michel Angelo was a great genius, and so was Raffaelle; but each owed his genius to a power totally independent of the other. Their geniuses were equal, their temperaments different. Raffaelle was at the mercy of pleasure; Michel Angelo disdained it:

Raffaelle was made for society; Michel Angelo despised it. In Raffaelle's works there is a geniality of soul with which every man's and woman's heart beats in sympathy; whilst we have no sympathy with the characters of Michel Angelo who overwhelms our imaginations, but never touches our hearts. We are awed by his sibyls, but we could never think of loving them; and his demons are surely unworthy of the fiery solitudes of hell. How could Ariosto say of him,

"Michel, piu che mortel,
Angel divino;"

and then herd up Raffaelle with Sebastian and inferior men; Michel Angelo was perhaps the more moral man of the two, but not the greater painter.

Vasari and Condivi would never have been allowed to publish their falsehoods, as Lanzi says, had Raffaelle been living; but where were Julio Romano, Luca Penni, and Polidoro, whom Raffaelle had raised from a mason's boy to a great painter? Where were they? where were his "dear pupils?" "Let no man," says Johnson, "look for influence beyond his grave." Vasari asserts that Michel Angelo, in flying to Florence, when he quarrelled with Pope Julius II., left the keys of the Sistine Chapel, which he was then painting, to Bramante, Raffaelle's uncle, who dishonourably let in Raffaelle; and that the latter, on seeing the grand design of the prophets, changed his whole style. This absurdity was current in Europe for two hundred and fifty years, till Lanzi, with his usual acuteness, opened the eyes of the world. Would any one believe, that when Michel Angelo fled to Florence, it was in 1506, years before Raffaelle ever entered Rome, and four or five before the chapel was ever begun or painted? It may be presumed that Raffaelle did not surreptitiously derive any advantage from works four years before they were conceived or painted; and we conceive that Bramante could not give Raffaelle the keys to open a door which was never locked, especially as Michel Angelo did not leave any keys, if ever he left them at all, till four years after the time Vasari dates as the period. The prophet Esaias which Vasari says shewed an alteration of style in consequence of the stolen views of works which were not in existence, was painted one or two years before Michel Angelo touched this very chapel. So much for Vasari's sacrifice of Raffaelle to the great Dagon of his idolatry; and so much for Reynolds' absurd and unthinking assertion, that "but for Michel Angelo, Raffaelle would never have existed." Vasari's is a delightful book, and all his principles of art are sound, for they are the result of conversations with the greatest men; he was most intimate with Michel Angelo, and Titian, and all the great artists of the day, and constantly in their painting-rooms, at their tables, and in their society.

In the first years of Raffaelle, his feeling was so completely Perrugino's, that it was almost impossible to distinguish their works; though there is a difference in feeling, and that difference is in favour of the pupil. In the Louvre were three of his early works of cabinet size. The Annunciation was one of these; and more grace, innocence, or sweetness, were never put on canvas. Raffaelle's pencil seemed always to melt when he approached a woman or an angel. What an age of genius this was, and how nearly all the great men seemed to come together. Da Vinci was born in 1452, Bartolomeo in 1469, Michel Angelo in 1474, Titian in 1480, and Raffaelle in 1483.

In a rapid and concise history of art to detail the inferior names, who gradually by little and little, conduce to the ultimate expansion of genius, is impossible. A historian of this description has only time for leading points, or headlands in the voyage; he has not leisure to dive into every little cape, bay, and projection, which by degrees, push the mainland into the ocean. The older painters of the Roman school will not add much to the interest of the art; and a fair estimation of Raffaelle and his glorious school, is much more likely to benefit the student, and instruct the general reader. It is not, on the whole, morally just; but many eminent men become thus swallowed up in the blaze of their successors. As Shakespeare nearly deadens all feeling for previous excellence, so does Raffaelle, though Shakespeare, Michel Angelo, Raffaelle, and Titian were all indebted to their predecessors.

If Julius was adapted for Michel Angelo, Leo X. was peculiarly so for Raffaelle; though Mengs says that the honours and indulgences he received from Leo, made him luxurious and idle, and that he was not so industrious as during the short reign of his first patron Julius. Yet his rapid advance from the first picture he painted in the Vatican, to the Heliodorus, is extraordinary; and, as according to Vasari, he sent artists to draw for him in Greece, there is no doubt that he had a sketch of the pediment of the Parthenon, before it was blown up, and that the Heliodorus is but a skilful adaptation of the Ilyssus. He was so much overwhelmed by employment and honours, that his latter works in the Vatican were wholly placed in the hands of his pupils, and carried on with the spirit of a manufactory. He was then appointed architect to St. Peter's at the death of St. Gallo, which distracted his thoughts. Incessant application, and incessant thinking of course weakened his delicate frame, nor did the capricious and harrassing attendances on such a court increase his strength; added to which the maddening love of women for one so highly gifted and so handsome, his own devoted passion for Fornarina, and the endless demands on his brain, brought him to the grave at thirty-seven, absolutely borne down, like Byron, by excitement of every description, nervous, bodily and mental. This is the way with the world; they kill a favourite by kindness, and an offender by cruelty.

In some life of him an attempt was made to prove that he caught cold by hurrying from his work to the palace at the Pope's order, and standing while in a profuse perspiration in a draught. But that is no refutation of the previous causes; the question is, what prepared him to be killed by such a cause? Incessant work and dissipation; no painter can do both. Of course princes must be obeyed at any expense; they seem to feel little for their dependants, as if in revenge for being themselves deprived of so many enjoyments by ceremony and etiquette. Napoleon used to take great delight in never suffering old German maids of honour with fifty quarters in their arms to sit in his presence.

His last work, according to Mengs, was his Transfiguration in oil, a work deficient in masterly execution, and having a laboured look of smoothness. In drapery, in character, and in expression it was fine; but in the Louvre it looked small. By the side of Corregio, it seemed hard; by that of Titian, raw; by that of Tintoretto, tame; and the Christ's head was not equal to Corregio's at the National Gallery. It was not an example to hold forth to a young man as faultless. The Cartoons at Hampton are finer in point of execution alone; they are his finest works for all the requisites of art. He was not restrained by designing for tapestry; his genius was put forth with a Venetian power of brush; and there are heads equal to any, especially the frightened woman's head in the Ananias, in these wonderful works.

In beauty he was far inferior to the Greeks; in form he could not approach them; in composition he was perfect; in expression, deep; and in telling a story, without a rival. Taking into consideration all the great men in modern art, this young man, not highly educated like Rubens, must be placed on the throne, till one arises who shall have what he had not, in addition to his own perfections; and that young man will probably arise in Britain. He was an extraordinary creature; modest, timid, and amiable; affectionate to his equals, and gentle to the highly-born, his premature death gave a shock to Rome, which those only

can estimate, who know the depth of Italian sensibilities. But did he die too young? Not at all. He might have decayed, or he might have become more luxurious and more neglectful. No man dies too young who dies with all the sympathies of the world unexhausted about him. The *furor Raphaelis* is the best species of fury that can seize a young student. He has no manner, no affectation, no vice, no grand style; all is simple, natural, and unaffected. His women are creatures of gentleness and love, though none are perfectly handsome. Perhaps he was more adapted for the characteristic heads of apostles than the naked forms of Greece; in fact he was a great Christian painter, and seemed born to extend the influence of Christianity by his art.

His father being a painter, he began early of course, and at sixteen, had painted a picture at Castello, the composition of which was in advance of the age. At seventeen he painted another of the Virgin and Child. In the Sacristy, at Sienna, he assisted Pinturichio with designs; in 1504, he went to Florence, where Michel Angelo and Da Vinci were making a great noise with their cartoons for the hall; he studied both, and improved his perspective and colour, in connexion with Bartolomeo. When Bramante, his uncle, who was architect to the Pope, advised his Holiness to send for Raffaelle, the pope consented; and in April 1508, Raffaelle entered Rome, and was admitted into the Vatican.

From the continual occupations of Raffaelle in his art from boyhood upwards, he could not have had a classical education to any great extent. He knew a little Latin, as all Catholics did; but he was intimate with Bembo, Castiglione, Ariosto, and Aretino; and these men must have helped him in historical or philosophical knowledge, or moral allegory, for the completion of his great works. Raffaelle left a noble school; and as soon as grief for the loss of their master had subsided, his pupils set about completing the works he left unfinished. The battle of Constantine was done by Julio Romano and Perino del Vaga. As Raffaelle lay in state, the Transfiguration was placed at the head of his coffin.

Julio Romano.

Julio Romano was the most eminent of his pupils. With vast poetry of mind, he did things in a style of execution, which renders him the purest poet in his art. His sun setting, and moon rising over our heads, in the Palazzo del T, is nowhere equalled or approached. Though he put forth his genius at Mantua, he was a Roman in practice, and to Raffaelle owed the elements of his art. His colour was crude and his execution harsh; yet no one can fail to see in his works, the real poetry of painting.

Polidoro.

Polidoro was another great man of the same school. He was originally a mason's boy, and used to prepare the walls for fresco; but he got interested in seeing the young men at work, tried to draw himself, and Raffaelle having assisted him, he became an eminent painter.

It is interesting to reflect on the affection with which Raffaelle was surrounded. He never went to court without being attended by fifty gallant artists. Little must he have made others feel his superiority; and for once a man of genius seems to have made envy smile. Though there is an instinct in the world, the moment a man of genius appears, yet it depends upon himself whether he is received as a blessing or an annoyance. Mankind will assault the man who attempts to command by superiority, instead of leading by courtesy; but they will hail him let his superiority be what it may, who seems willing to help his inferiors with kindness, or supply their want of knowledge, as if they were doing him a favour to listen. The whole of this is based on goodness of heart, tender sympathies, and a consciousness without the appearance of conceit.

Decline of the Roman school.

The glory seems to have gone from the Eternal City after Raffaelle's death. In 1527, Rome was stormed and taken by foreign soldiers. The savages bivouacked in the Vatican, and injured the frescoes by their smoking and fires. Sebastian del Piombo attempted to repair them after the soldiers were gone; and Titian, when in Rome, not knowing Sebastian, actually asked him who had been spoiling those beautiful heads? The art went on sinking rapidly till 1595. Raffaelle had been dead seventy-five years; Giorgione, eighty-four; Corregio, sixty; Michel Angelo, thirty; and Titian, nineteen. When the usual apprehensions of getting on a lee-shore seized the patrons and the artists, and the usual signal of distress was hoisted, Muziano, a pupil of Titian, founded St. Luke's Academy in order to raise a new batch of Raffaelles and Corregios, and save the noble vessel. The only man who since dazzled for a moment, was Michel Angelo Caravaggio. He had great and original talent, though founded on common nature, without any abstract notion of form, any conception of beauty of women, or any refinement in anything. With a sledge-hammer for a pencil, he seemed resolved to batter down all opposition; and by fierce extremes of light and shade, bearded men, dead Christs, and Transteverine beggars for apostles, he founded a school, got a character, and raised a name, which cannot be forgotten in the art of Europe.

Lanzi seems to class in the Roman school every body who practised there for the last three hundred years, but that is not fair. On this principle, all the Flemings, Dutch, Germans, Russians, Spaniards, and English, may be of the school, because they studied there; and Rubens, Vandyke, Velasquez, the Caracci and their pupils, as well as our Reynolds, were, on the same principle, of the Roman school. About the seventeenth century, this eminent school, in spite of the academy of St. Luke, went on declining. Birth, destruction, and reproduction seems to be the principle of every thing physical, but not of moral or mental powers. Lanzi attributes this decay to any cause but the right one; namely, the *absence of genius*, the great primary cause, and which no academy can ever supply.

Cortona, Bernini, and Sacchi.

Cortona, Bernini, and Sacchi, were the heroes of this day; and at a later period appeared Carlo Maratta. Raffaelle became to him a substitute for nature; though in 1689, he gave sufficient tone to art, to induce Clement XI. to employ him. But here, as well as elsewhere, genius was wanting. Carlo was as heavy as the lumbering folds of his own drapery; and so insipid are his large pictures, that it is a question whether they did not generate in Europe a contempt for large scripture subjects, which has lasted ever since. However, imbecility had not done spawning; and in a faint struggle for offspring against nature, out came Pompio Battone, and Raphael Mengs. To complete the farce, academies began to be founded in France and in the rest of Europe; and Pompeo Battoni, and Raphael Mengs may be looked upon as a very fair sample of what academies can produce, have produced, and will probably produce to the end of time. Mengs was every thing but a man of genius. He was a bad painter and a deep critic; and his predicting that we had not the works which the ancients esteemed the most, was verified, in a most astonishing manner, by the discovery of the Elgin marbles. The prediction does honour to the sagacity of Mengs. Thus end two great schools of form, conception, expression and composition; the Florentine and the Roman. But of these the Roman was unquestionably the greater.

Venetian school.

We now come to the Venetian, a great school of colour, light and shadow, impasto, and execution, completing the imitation of reality; and in summing up the character of Italian and Greek art, we shall see that these components of imitation, each of which characterised an Italian school, were combined in all schools, as a necessary requisite in the perfection of Grecian imitation.

The most ancient work of Venetian art known, is in Verona, in the cellar of a monastery, (Santi Nazario a Celso). It is inaccessible to the public, but can be seen in the woodcuts of Dionisi. In the part which formed the oratorio of the faithful, has been painted the mystery of redemption; it is a

work of 1070, when the Doge Silvo invited Grecian mosaic painters to adorn St. Mark; men who though rude in art, could nevertheless paint. Thus commenced the art in Venice, whither, after Constantinople was taken by the Venetians in 1204, Greek painters and sculptors, as well as orefici, flocked in crowds.

In the thirteenth century, painters had increased so much, that a company was formed, like the English constituent body to which Hogarth belonged, and laws and constitutions were made. Things were proceeding in this train when Giotto, returning from Avignon, painted at Verona and Padua. Nothing of his, however, is left in Verona; but at Padua the remains of his works are still quite fresh in fresco, and full of grace and vigour. Such was the early beginning of this great school, in which it will be seen that Greeks, as usual, had the first hand. Various names sprung up in this period, but the Bellinis are the most important. One of them was engaged by Mohammed II. and by his talents upheld the honour of the Venetian name; another was the master of Titian and Giorgione, two of the greatest names of the Venetian school.

Giorgione.

Giorgione was a great genius; and his execution was entirely above vulgar prejudices. He saw and seized the leading points of leading objects, and hit them with a touch and an impasto, of which he had no previous example even in Leonardo. His breadth and tone were beautiful; and he first opened the eyes of Titian to the superior value of breadth and touch, as compared with over-wrought labour and smooth finish. Giorgione died in the vigour of his life, to the great loss of the art; for there is no knowing how much farther he would have carried his principles, or how successfully he would have disputed the crown with Titian. Lord Carlisle has a small picture by this eminent man, of a youth buckling on the armour of a knight, which is exquisite in tone, brilliancy, depth, and feeling; and had he not been cut off by the plague, there is no knowing how far he might have gone. He certainly first opened Titian's eyes to the value of breadth, and that comprehension of mind required to seize the leading characteristics of objects by a touch, leaving the atmosphere to finish at a given distance. After his death, Titian was without a rival. This great painter began, of course, like all Venetians, to paint directly from nature, without having previously dissected or drawn; nor was he sensible of this error of the Venetian school, till coming to Rome and seeing the works of Michel Angelo, Raffaelle, and the antique, he, like a great genius, set about remedying his deficiency; and the perfection of this union of form and colour is seen in his greatest work, Pietro Martyre, any attempt to move which from Venice, the Venetian senate decreed should be punished with death. This picture occupied him eight years; and eight years were well spent in such a production. The terrific gasping energy of the assassin, who has cut down the monk; the awful prostration of the monk, wounded, and imploring heaven; the flight of his companion, striding away in terror, with his dark mantle against a blue sky; the towering and waving trees, the entrance, as it were, to a dreadful forest; the embrowned tone of the whole picture, with its dark azure and evening sky, the distant mountains below, and splendid glory above, contrasting with the gloomy horrors of the murder; its perfect, though not refined drawing, its sublime expression, dreadful light and shadow, and exquisite colour; all united, render this the most perfect picture in Italian art. Why does not one perfect work entitle a man to rank as highly as a series of imperfect works, like the Capella Sistina? The answer is, because there is greater range of capacity shewn in a series of conceptions to illustrate a theory, than in the completion of one work alone, although all the component parts may be perfect; and Raffaelle, and Michel Angelo, will ever rank higher than Titian, as Polygnotus will rank higher than Protogenes or Apelles. Prolific thinking, is surely of more value than intensity of imitation, though intensity of imitation must be added to realize the idea of a perfect painter.

Titian.

Titian began in the style of his master Bellini, with the most minute finish; a capital basis for future practice, if a man have comprehension to know when to leave it, as Titian did. To shew the young artist that it is never too late to improve, let him compare the Bacchus and Ariadne in our National Gallery, when he could not draw finely, with the Pietro Martyre when he could. In modern art, he was the only painter who hit the characteristic of flesh. Every great painter's flesh is paint; Titian's had real circulation of blood under the skin. On comparing the Ganymede, in our National Gallery, fine as it came from Titian's pencil, with the Theodosius by Vandyke, which is close to it, as fine a specimen of Vandyke's fire of brush as can be seen, the heavy leathern look of Vandyke's colour excited astonishment. In the flesh of Ganymede, colour, oil, brush, and canvas, were all entirely forgotten; it quivered, it moved with the action of the limbs. In Vandyke, the materials of art are uppermost; you think of them, you wonder at the touch, you forget the subject, the expressions as it were scenting of the painter's room and the easel. And so you do with all the Flemings, but never with Titian. Though we have fine Titians in England, the Diana being at Lord Egerton's, and a head at the Duke of Sutherland's; yet it must be confessed, that the Louvre possesses Titians more perfect, especially the entombing of Christ. In Josephine's collection at Malmaison, there were a Venus and Cupid, as perfect as our Ganymede, and not injured by *restoring*, the fatal propensity of the French. In Titian whenever you see the blues sober and in harmony, the picture is uninjured; whenever you see them harsh and too brilliant, they have been rubbed, and the last tone has been taken off.

In colour, he was never equalled; in execution of the brush, he was quite perfect; and in character and expression of portrait he was like Reynolds elevated and sublime; but the dullness which portrait, if perpetually practised, engenders in the capacity to idealise and elevate, rendered his conception of poetical characters defective. Nothing can exceed his Aretino, his senators, and his popes; nothing can exceed Sir Joshua's Lord Heathfield and Mrs. Siddons; but nothing can be meaner than some of Titian's attempts, like Raffaelle, at high poetical expression, except some of Reynolds' heads in the Beaufort. The nerve and beauty of the colour in Diana and Acteon are so touching, that one can almost fancy one hears the water ripple and the leaves wave. Glazing was the great feature in his tone, as it was in that of Apelles; and there is no perfect colour without it.

The first requisite in fine colour is the ground or preparation spread over the canvas to receive the colours. It is either of a nature to absorb the oil, or to resist the absorption. If it resist the absorption of the oil out of the colour put on it, it is an oil-ground; if it absorb the oil, it is a water-ground. And it has long been an interesting question, whether the Venetians used an oil-ground or an absorbent ground; whether, like the Greeks, they worked in tempera, and varnished out, or whether they judiciously mingled both oil and tempera together. One would think that Vasari, living as he did with all the great painters, could not be ignorant of their various methods of practice. In 1567 or 1568, he called on Titian, saw him, stayed with him, was in his painting-room, and must have talked on art, and perhaps dined or supped with him.[1] But Vasari distinctly says, in a sort of recipe-introduction to his lives (edition 1568) "that the ground on wood was *gesso*, plaster of Paris; that

[1] All the great painters seemed to prefer *supper*. In Tichozzi, Titian seems to have been a sociable man, and there are extracts from Titian's and Aretino's letters, alluding to pheasants, and presents of birds for the *next supper*.

then they mixed three colours, white, yellow, and amber, and spread them equally over the white ground; and that after tracing their cartoons, they painted their pictures." A more abominable ground never was mixed; to those who have an organ of colour it is an absolute emetic; and though it might have been Vasari's and the Florentines' ground, it never could have been endured by the eye of a Venetian. "This was the method," says Vasari, "for pictures on wood; but when canvas became the fashion, gesso being likely to crack in ceiling, they made a ground of flour (*farina*), white lead, and nut-oil, after the canvas had been smoothed by size."[1]

Now when this was published, Titian, Tintoretto, and Paolo Veronese were alive and all at work; and it is but common sense to conclude, that had it been false, they would have contradicted it. Vasari concludes with saying, "So are painted all the great works in St. Mark's Place, Venice." In that place was the Miracle of the Slave, by Tintoretto, afterwards seen by every body in the Louvre. Lanzi says, that the Venetians preferred canvas, but that at first they painted in tempera, and then came oil-painting, which the Venetians first adopted. On the arrival of the Bacchus and Ariadne in England, a little bit chipped off at the corner showed the ground underneath to be of the purest white. Now, if a white ground is absorbent, it sucks the oil out of the oil colours, and becomes the colour of oil. Sir Humphry Davy said to the author of this article in 1823, that in process of time oils become varnishes; and it is not impossible that the white ground of Titian may have been absorbent, and though it had sucked out the oil in the course of three hundred years, it may have recovered its original whiteness. The author's experience extends only to thirty years, and in that period an absorbent ground which sucked out oil has never recovered its whiteness.

But, if the Venetians painted first in tempera upon the white ground, and finished in oil, the tempera intervening between the last painting and the ground would preserve the ground white; and as Titian's method of proceeding was gradual and progressive in successive layers, like that of Protogenes, so that each layer became a help to the succeeding one, there is no reason to doubt that tempera might have been the first impasto. In parts of the Pietro Martyre, there certainly was the crude look of tempera preparation, softened by a glaze, especially about the projecting leg of the assassin. That the basis of Venetian pictures was a white ground, there can be no doubt; like the intonacos of Apelles, and the plaster-grounds of the painted mummy-coffins of Egypt. Tintoretto and Bassano used dark grounds to save trouble; but they are ruinous. They come through the thin half-tints of the picture, and render it distinct masses of dark and light, like most of the Lombard school. Many of the works of Paul Veronese, who painted one hundred years before, were in perfect preservation in the Louvre, whilst a number of the Lombard pictures were gone. The white ground was the "luce de dentro" of the Italians, "the light within." Upon this beautiful white ground they placed their colours purely and crudely, and then by spreading thin transparent tones, took down the rawness, without losing the force of the tint. This was the practice of the Greeks, and is also the present practice of the British school. When Cicognara, the president of the Venetian academy, was in England, he remarked to the author on the singular fact, that the British was the only school of colour left in the world, though our climate was the worst; and such was the state of Venice some years since, that an English consul could get nobody to paint the king's arms for him, and being the son of a painter, he was actually obliged to paint them himself.

As an example for the student, Titian is perfect. His execution never attracts by itself alone, but as the vehicle of the object it imitates. In colour he is never gaudy, never black in light and shadow, never forced or affected, and in drawing, latterly, grand. In composition he was not so perfect nor so fertile as Raffaelle; but in the imitation of flesh, no other artist in the world, except Apelles perhaps, could rival him. As a painter of portrait and landscape, no one has surpassed him. He did not grace his senatorial heads with the beauty of the backgrounds of Reynolds or Vandyke; but the absence of all gaiety behind the heads, perhaps added to the sublimity of their expression. It is curious to read in Boschini's little work, that young Palma, who had it from old Palma, a pupil of Titian, told him that Titian very often finished with his thumb. Palma distinctly says, that he has seen Titian put on with his thumb and fingers masses of colour which gave life to a picture.

In a word, neither of the great Italian schools showed the sense of the ancients. The Romans omitted colour and imitation from sheer accident; the Venetians drawing and form; and Reynolds, without going into the causes of these mutual deficiencies, laid it down as a principle, that colour and reality were incompatible with high art; whereas, when each school found out its deficiency, each endeavoured to correct its peculiar defect.

Tintoretto.

The giant of Titian's school was Tintoretto, who gave such early indications of self-will and genius, that Titian, mean and jealous, turned him out of the house. Raffaelle would not have done this; he did not turn out Julio Romano. But Tintoretto was not to be crushed by the bad passions of his envious master; and took it very properly as an evidence of his talent. And what did Titian get by his paltry meanness? Nothing but pity. Tintoretto, young as he was, immediately formed a plan of his own, for combining the drawing of Michel Angelo with the colour of Titian. He devoted the day to the one, and many parts of many nights, and often whole ones, to the other. In a few years, the result was the Miracle of the Slave and the Crucifixion. Although the execution of Tintoretto looked daring and impudent by the side of the modest, senatorial dignity of Titian, yet there was a grand, defined dash about it. The original sketch of the Miracle of the Slave, formerly in the possession of Rogers the poet, is a very fine thing. Everybody speaks of the Crucifixion as a wonderful instance of power. But in colour it is lurid and awful; in expression, character, and delicacy of feeling, discordant and offensive. His pictures seem to be a mass of fore-shortenings, affected twistings, dashing darks, and splashing lights, with a hundred horse-power of execution; bearded heads, Venetian armour, silks, satins, angels, horses, architecture, dogs, water, and brawny-armed and butcher-legged gondoliers, without pathos, passion, or refinement. He used to put little models in boxes, and light them in different holes, for effect. Like all Italians, he was accustomed to model and hang up his models by threads for fore-shortening. His style of form was a mixture of the pulpiness of the Venetian, and the long, anotomical, bony look of the Florentine school. He cannot be depended upon for correctness of proportions, but he was a grand and daring genius; and his conduct, when oppressed by Titian, should ever be held up as an example for the aspiring youth, when trodden upon by his elders.

Paul Veronese.

Whilst Tintoretto was astonishing the Venetians by his daring, which made even Titian tremble, Paul Veronese, the other great contemporary, was mildly pursuing his azure and beautiful course. Of a nature the reverse of Tintoretto, and not equal to him in sublimity or terror of conception, he yet gave equal evidence of being run away with by his brush. Ceilings, canvas, halls, walls, and palaces, were so many proofs of his power. His greatest work is at Paris. It is the Marriage of Cana, a wonderful instance of executive power;

[1] This is Vasari's account, pp. 51, 52, 53, Firenze, volume i. 1568.

but here all story, sentiment, and pathos, are buried in the noise, bustle, eating, drinking, and fiddling of a Venetian city feast. Paul Veronese was certainly the most corrupt painter of the time.

Cannaletti, &c.

After these great men, the art began to decay; and Paul Veronese and Tintoretto gave symptoms of a conventional mode, which, when taken up by inferior men, hastened its ruin. Down to the present age, with the exception of two or three mannerists, no name occurs worthy of eminence or selection Cannaletti was a genius in his way. Sebastian Ricci, and Marco Ricci, were much employed in England to disfigure ceilings and palaces by wholesale, with gods and goddesses. in subjects allegorical, poetical, mythological, and nonsensical, to understand which it required pages of explanation, and to see which a nine-feet telescope by Dolland. Montague, Burlington, and Bulstrode houses, are signs of the infatuation of the English nobility at that time; an infatuation, however, which shewed a disposition to employ art as it had been employed in Italy, and if the genius had been equal to the opportunity, the result would have been different.

Lombard and Parman school.

The next school of any importance is the Lombard school, which comprehends the Mantuan, the Modenese, the Cremonese, and the Milanese. Andrea Mantegna is the hero of the Mantuan school, and Vasari says, that his master-pieces are the tempera designs which we have at Hampton Court. They are fine things; Rubens used them; and they are a mine of costume, though the forms have too much the look of the model. Julio Romano's great work is at Mantua, yet he must be considered as a Roman. The works of Mantegna were, as Lanzi says, the greatest effort of the last style before Leonardo da Vinci introduced a new one, which overturned the Gothic. After Julio Romano, the art decayed, and then of course came the old story, "Una accademia per avvivarla." This academy has been splendidly kept up by Austria, and, as usual, has not produced a single man of great genius in three hundred years.

Corregio.

Contiguous to the Modenese school is the Parman; and now we come to the most unaccountable and delightful of all painters, Corregio. When it had been determined to ornament the great cupola of St. John, Corregio, though then a young man, was selected to paint it; and, like Raffaelle, his genius expanded with the opportunity. After Raffaelle, Titian, Michel Angelo, Da Vinci, and Bartolomeo, who would have thought that another style, independent of either, and unlike any thing else in the world, could have burst out? But so it was. Of all the painters that ever lived in the world, there is no accounting for Corregio. Unlike Greeks, Romans, and Italians, out he came into the world, in colour, drawing, light and shadow, composition, expression, and form, like nature, and unlike every body else, who ever studied nature at all. Michel Angelo, Raffaelle, Titian, we can trace; we see upon whom they were grafted, when they budded and burst forth. But who is Corregio? Nobody is certain. One swears he was poor, another that he was well off; another says he died in consequence of a fever which he caught by carrying all his money in copper, the price of a picture; another protests it was no such thing. Mengs' account is the best; and Vasari's mostly without authority.

There is no certainty that his portrait is in existence; in fact there is as much dispute about it as there is about Shakespeare's; and here are his beautiful works, his Notte, his Catherine, his Christ in the Garden, his Magdalene, his Venus and Mercury, and his *Ecce Homo* in the National Gallery, the only head of Christ in the world. This head of Christ ought to be reverenced as the identification of the character, as much as the head of Jupiter by Phidias was in the Pagan world. There is no Christ's head by Raffaelle which at all approaches it, either in the Transfiguration or in any other work; and the head by Leonardo da Vinci in the gallery cannot be endured after it. Of all painters, he astonishes one the most. If any fault is to be found with him, his men have a touch too effeminate. His colour is exquisite; his light and shadow are enchanting, but his forms defective; his composition is simple and infantine; his expression unimpassioned, but sweetness itself; and when sorrow or suffering was to be represented, who ever did it more tenderly than Corregio? Let any man who doubts this, dwell for a moment on the gentle suffering, and the feminine yet manly beauty of the Christ above mentioned. It is the very Christ who commanded by submission; without weakness beautiful, without effeminacy tender; without taint the personification of love. His hands, his shoulders, his beard, his hair, belong to that divine being who vanquished sin, by yielding to torture. It does not seem painted, but as it were spread upon the canvas by an angel's breath. His men look as innocent as girls; his women as guileless as infants; and his infants as if they had just come from the skies.

In the cupola at Parma, the great wonder is the fore-shortening; and in the mouths of the vulgar this is technical perfection; whereas there is nothing more purely mechanical, nothing in fact you can so easily teach. One single smile of Corregio's angels, one touching look of Raffaelle's apostles, the sentiment of the Duke de Lorenzo by Michel Angelo, one crimson tone by Titian, are worth all the fore-shortening on earth. The greatest excellencies of Signorelli, Buonarotti, and Corregio, are said to be their fore-shortenings; whereas the greatest excellencies of Buonarotti and Corregio are not their fore-shortening at all.

In spite of the perfections of this wonderful man, he founded as it were the decay, "le commencement de la fin." His breadth in fresco produced Lanfranco, Cortona, and Giordano, who covered Italian palaces with the *sweeping* brush of our patent chimney-cleansers, beginning it in the morning, finishing it by the evening, standing on the floor, and disdaining a scaffold, previous study, or previous thinking; and others came who bedaubed the palaces of Europe with clouds like feather-beds, cornucopias and Jupiters, till one's brain aches in thinking of them.

Reynolds was immensely indebted to Corregio; for Rembrandt and Corregio are certainly the bases of his style. One of the most beautiful works in the Louvre was the Marriage of St. Catherine, which when once seen haunts us in after life in dreams. In a word, Corregio was an angel that passing this earth in its flight, drooped its wings and dropped upon it, to give us a foretaste of the smiles which welcome a happy spirit in a purer sphere.

Parmegiano.

Parmegiano is the next important name in this school, who grafted the grace of Corregio on the affectations of Michel Angelo. His greatest work is in our National Gallery; the Vision of St. Jerome. The Christ is a beautiful boy, but affected; the Virgin is Michel-Angelesque, having the *Glumdalclitch* look of his Brobdignagian women. St. John is finely drawn, but not unexceptionable; and the St. Jerome is sleeping in a position as if he had got into a cramp in the first part of the vision, and could not get out till it was over. It is raw in colour, skinned in construction, and spoils the composition altogether. His small pictures are beautiful but long in proportion. His fingers seem always to move to music; and his limbs to be conscious how gracefully they are disposed. He has often been a fatal example to the young. Nor is his Moses, whatever Gray may say of it, an instance of the sublime. The expression is mean, and the form overdone. Parmegiano died, like Raffaelle at the age of thirty-seven, when all that was expected of him had not been realised, and when, if he had lived longer, perhaps he would have done worse.

School of Bologna.

In 1570, the best Corregieschi were grown old or dead, and the school of Parma began to give way to that of Bologna, the truly great academical school. This was not an academy in the modern sense of the word; it was a school, and nothing but a school, without distinctions, and managed

by directors; and it is the only academy which has ever produced any genius. Dominichino, Guido, and other names of the second period, came between unrivalled excellence and approaching destruction, and stopped for a little time the decay of the art.

Of the Cremona school, there is no great name. In the Milanese school, Da Vinci seems the hero; he founded an academy which, according to Lanzi, was the first in Europe that reduced art to rules, the works of Leonardo being the canon. His great work is in the refectory. But fifty years afterwards Aramini says that it was spoiled; in 1642 Scannelli writes, that it was with difficulty made out; and Barry ultimately saw it destroyed by a *restorer*. When Eugene Beauharnois was viceroy of Italy, he drained the refectory and had it paved with tiles; and it is said in a report, that the colours began to revive. Da Vinci's academy having produced no talent, Maria Theresa founded another, which, though full of casts of every description, has nevertheless proved equally unsuccessful.

The Caracci and their pupils were the last crop of genius which Italy threw up, and though they were second-rate, they came of the breed of the great who were no more. The style of Michel Angelo seems to have taken early root in Bologna, perhaps from his executing in that place the statue of Julius II. Giotto, in the first instance, excited emulation by flying about Italy; but he seems to have scattered everywhere the seeds of art, and Tibaldi, after having studied in Rome, certainly founded this style at Bologna. The first school formed was by Bagna Cavallo, and Primaticcio. It failed in 1564; upon which Primaticcio went to France, and Tibaldi to Spain, and the art was of course neglected.

The Caracci succeeded them and were extraordinary men; but what would they have done if Raffaelle, Michel Angelo, Titian, and Corregio had never lived? They saw nature only by the help of their great predecessors. Whatever the Caracci did had the appearance of labour; whilst whatever was done by their great predecessors, had an air as if there was something that no labour could attain. Ludovico had more feeling than his brothers, and had the honour of being instructed by Tintoretto. They were the sons of a tailor, and founded an academy in their own house. Agostino principally engraved, and Annibale principally painted; but they each contributed instruction to the school in which were formed Dominichino, Guido, Lanfranco, Guercino, and Albano.

Guido, Guercino, and Albano.

The greatest genius of the school was Guido; but he was envied by the Caracci; and even in this school the vices of an academy began to appear. We did not find Raffaelle sowing discord amongst his pupils by putting one against the other. Albano was opposed to Guido. Dominichino was an eminent but heavy genius; and his communion of St. Jerome is a fine thing though dull. There was a vulgar grandeur about Guercino, and an insipidity about Albano. The great work of Annibale Caracci is the Farnese gallery, which is excellent in every thing, but nerve and genius. Say what you will about the Caracci, there is a want in their art, which affects the pen of him who is attempting to do them justice. They lived together, did not marry, and were ill paid and ill-tempered; like all old bachelors they were discontented, they did not know why, and fidgety, they did not know for what; they envied the talents they were desirous of bringing forward, called the art their "wife," and were never satisfied, living in a perpetual fret of teaching, and painting, and complaining. Annibale became dissipated and died early. It is an extraordinary feature in the moral character of the Italian artists, that the greater part did not marry, and hence came the cant "of the art being their wife," with the natural consequence, that girls who had been models generally ended by being mistresses.

The Caracci kept up this affectation, they said the art was their "cara sposa;" and to all the confusion of a bachelor's house, added the slang of a mere painter's habits. At the dinner-table, crayon and paper were always at hand to catch attitudes, actions, and expressions, and groups; as if expressions and attitudes could not have been remembered in the solitude of the study, and kept till wanted with just as much effect as this vulgar intrusion on the usages of society. A great artist is always a man of the world; an inferior one a man of the palette. Raffaelle, Titian, Angelo, Rubens, and Reynolds, would have passed a twelvemonth in any society without being discovered to be artists; but the Caracci would have talked of tone and touching during the first half-hour. A genteel woman, accidentally travelling in a coach with three artists who were *palette-men*, expressed afterwards her wonder and suspicion as to the state of their intellects. For after the usual dead silence, one of them said, with an air of vast profundity: "How finely the white sheet in the hedge carries off the colour in the sky." "And look at that old woman's cloak taking up the brick-wall," said another. "Yes," said the oldest of the set, "how finely it was done yesterday by a red night-cap in a pretty bit of Sir George." Johnson used to say, "Sir, we were reduced to talk of the weather." But even the weather is preferable to this detestable affectation. Though the deepest principle of the ancients was the preservation of beauty in everything, they never sacrificed beauty to expression, but always combined the two; whereas Guido, by an eternal repetition of the expression of the Niobe in Christs and Virgins rendered the preservation of beauty at such an expense insipid. The beauty of the Helen and Paris was truly exquisite; but hundreds of Herodias's daughters with St. John's heads, "have a look," as Lord Byron says, "of bread and butter." His grace was the grace of theatres; his pencil light, airy, and beautiful, though rather careless than masterly. Dominichino, on the other hand, obedient, slow, and timid, imitated everybody and fell short of all. But Guercino was the most original of the school; his finest manner is his candlelight manner, yet still there is a vulgarity in his forms.

None of the Caracci or their school, had they been born at an earlier period, would have advanced the art one iota beyond their predecessors, so entirely dependent were they upon the great who had gone before. "Such was the state of art," says Fuseli, "when the spirit of machinery destroyed what was yet left of meaning;" when contrast and grouping meant composition and thinking, and a mass of rapid, thoughtless, empty, impudent frescos disgraced the walls, palaces, and churches of Italy. Pietro of Cortona and Luca Giordano are the heroes of this inundation of splashiness; and yet what artists they were! The decay which it announced, was the decay of the giant Italian fresco hand that still struggled to do its duty, whilst the head was fast approaching imbecility in thought. The meanest pupil of the meanest machinist would have swept the first-rate British artist that has ever yet existed into the earth, with his tiptoes and exhibition-glare.

Decline of Italian art.

Thus, with the Caracci and their school, ended the greatness of Italian art; nor has there been one single painter of such genius since, from Andrea Sacchi to Cammucini the present hero of the Romans. Rubens, Vandyke, and Rembrandt turned it into a new channel in Flanders; Velasquez and Murillo kept it alive in Spain; Teniers, Ostade, and Jan Steen preserved it from extinction in Holland; the Poussins, Claude, and Salvator, meanwhile revived it in Italy; whilst the old Gothic masters in Germany, with their colour, and most of them with great invention but in bad taste, were an absolute dung-hill of diamonds and pearls, which everybody has considered himself as having a right to plunder, not even excepting Raffaelle himself. Whilst the art was sunk to the lowest depths in Europe, Reynolds in England broke forth with a brilliancy of colour which

Painting. has rendered it no longer a hopeless attempt to rival the gorgeousness of Venetian splendour. If ever there was a refutation of Reynolds' own theory, that "genius was the child of circumstances," he was a living one; in spite of all circumstances, in spite of the utter want of all education as a painter, in spite of all the apathy of the nation, and the extinction of art in Europe, out he came with a vigour and beauty which have ever since defied rivalship in portrait and children.

German school. The Germans are an extraordinary nation, but always more or less under the influence of a wrong taste. Their early painters are full of thought; and as a proof of what Raffaelle's estimation of them must have been, he adopted almost to the letter, in his famous Spasimo in Spain, Shoengaer's magnificent composition of Christ bearing the cross. The hand leaning on the stone, with the momentary action of the drapery, is in Shoengaer. The brute pulling Christ, in an old German dress, Raffaelle has taken and improved; and he has also placed the Marys in the fore-ground which Shoengaer placed in the back-ground; but the whole of the composition is Shoengaer's, though Raffaelle of course has added to it his own perfections.

Albert Dürer. Albert Dürer is considered as the greatest man of the German school; but there is nothing which he has ever done that can compete, in expression and composition, with this fine production of Shoengaer's. Fuseli says, "Albert Dürer was a man of great ingenuity, but not of genius. His proportions of the human figure are on a comprehensive principle founded on nature, and the result of deep thinking." He had sometimes a glimpse of the sublime, but it was only a glimpse. The expanded agony of Christ on the Mount of Olives, and the mystic conception of his figure of Melancholy, are thoughts of sublimity, though the expression of the latter is weakened by the rubbish he has thrown about her. His Knight, attended by Death and the Fiend, is more capricious than terrible; and his Adam and Eve are two common models shut up in a rocky dungeon. "If he approached genius in any part of his art, it was in colour; his colour went beyond his age, and as far excelled in truth, and breadth, and handling, the oil colour of Raffaelle, as Raffaelle excelled him in every other quality. I speak of his easel-pictures; his drapery is broad though much too angular, and rather snapt than folded. Albert is called the father of the German school, though he neither reared scholars nor was imitated by the German artists of his or the succeeding century. That the exportation of his works to Italy should have effected a temporary change in the principles of some Tuscans who had studied Michel Angelo, as Andrea del Sarto, and Jacopo da Pontorino, is a fact which proves that minds as well as bodies may be at certain times subject to epidemic influences."

Flemish school. Von Leyden. Lucas von Leyden was the Dutch caricature of Albert Dürer; and ere long the style of Michel Angelo was adopted in the same way as by Pelegrino Tibaldi, and being spread by the graver of Giorgio Mantuano, provoked those caravans of German, Dutch, and Flemish students, who, on their return from Italy, introduced at the courts of Prague and Munich, in Flanders and the Netherlands, that preposterous manner, that bloated excrescence of swampy brains, which in the form of man left nothing human, distorted action and gesture with insane affectation, and dressed the gewgaws of children in colossal shapes, in the style of Golzius and Spranger. But though content to feed upon the husks of Tuscan design, they imbibed the colour of Venice, and spread the elements of that excellence which distinguished the succeeding schools of Flanders and of Holland. At this moment out blazed upon the world that giant of execution and brute violence of brush, and brilliant colour, and daring composition, Rubens; and another mysterious and extraordinary being, Rembrandt, who seemed born to confound all theory but that of innate genius, confirmed it for ever. Rubens gloried in the splendour of the rainbow, whilst Rembrandt enjoyed only the poetry and solemnity of twilight; when the evening star glittered, and the sun was down, then was the hour of his inspiration.

Rubens. The scholar of Otho Venius, Rubens, imbibed from his master an emblematical taste; he spent eight years in Italy, hurried back at the death of his mother, and painted that wonder of art the Elevation of the Cross, before he was thirty. It is the perfection of a fearless hand and daring brush, conscious of its principle; and though the sweep of Michel Angelo's contours, applied to butchers' backs and coal-heavers' legs, rather increased their vulgarity than added to their refinement, yet the dashing power of that astonishing picture, in spite of its Flemish, pallid, and ugly wretches for women, renders it the bloom of his powers. Rubens was a man of such general knowledge, that the Marquis of Spinosa said, that painting was his least qualification. He was ambassador to Spain and England, and adorned the banqueting ceiling at Whitehall, the centre portion forming an amazing picture. Educated classically, he carried classical feeling into every thing but his art; and after spouting Virgil with enthusiasm, he turned to his canvas and painted a Flemish butcher with bandy legs (if he happened to have such) for Æneas. How extraordinary it is that, relishing as he did, Homer, Virgil, and Livy, he should give Dutch Helens, Flemish Junos, and German Diomeds, for classic art. His greatest work is the Luxembourg Gallery; and for once he hit a sweet female expression in the mother of Mary de' Medicis, after accouchment. One of his finest pieces, the Rape of Proserpine, is at Blenheim, where the Arethusa, as a water nymph, is putting up her hand, with her back towards you. That a man who could occasionally paint with such delicacy, should so often disgust us with his flabby vulgarity, is not to be accounted for. He painted portrait finely, landscape sweetly, and animals with great power, except the lion, whose straight shaggy mane he always curled like the ancients, and lost its noble look. He was a great man, and painted wherever he went. He was diligent and religious; he rose at four, heard mass, and went to his painting-room, where, with little intermission, he painted till five; he then rode, and returned to his friends, many of them the most celebrated men of the day, who were assembled to meet him at supper; at eleven he retired, and again proceeded to work at day-break. It is interesting to contrast this virtuous course of so great a man, with the vulgar infidelity which alone distinguishes the most incompetent in the art; and it is impossible not to conclude, that those whom God has most endowed with gifts, are the most sensible of their own imperfections. Rubens was thrice married, and educated his children highly; one of them wrote a very learned work, *De lato Clavo*, which shews research and learning.

Nowhere did Rubens shine so effectually as in the Louvre. In all the world, perhaps, there never was such a splendid opportunity for studying to perfection the principles of the great men in the art, as was afforded in the Louvre in its full glory; and injurious as the formation of that collection had proved to the cities of Italy, yet Napoleon gave a dignity and an importance to the art, which it has not since lost, by making the productions of its great men subjects of treaty, and receiving them as equivalent to territory or treasure. There you rushed from the Romans to the Venetians, from the Flemings to the Spaniards, from Titian to Raffaelle, from Rembrandt to Rubens, and settled principles in half an hour, which it took others months, perhaps years, to accomplish. It cannot be denied, that in force of effect, Rubens bore down all opposition, from his breadth, brightness, and depth; and let every painter be assured, that if he keep these three qualities of effect, the leading qualities in the imitation of nature, he will defy rivalship in the contest of exhibition.

Rembrandt, with all his magic, painting on too confined a principle, lost in power, and looked spotty and individual. Paul Veronese and Tintoretto had not that solidity, which is the characteristic of Rubens; Titian seemed above contest, and relying on his native majesty of colour, exhibited a senatorial repose, which gave to Rubens a look almost of impertinence; but still you could not keep your eyes off the seducer, and even if you turned your back, you kept peeping over your shoulder. Here all peculiarity suffered. The silvery beauty of Guido looked grey; the correctness of Raffaelle looked hard; Rembrandt failed most by the brightness of Rubens, the magic of Corregio, or the sunny splendour of Titian; and after wandering about for days, you decided that *he* suffered most who had most peculiarity. With all his grossness, want of beauty, and artificial style, Rubens' brightness and breadth carried the day, as far as arresting the eye, and forcing you to look at him, hate as you might his vulgarity, and his Flemish women, and his Flanders breed of horses.

Rembrandt

Rembrandt van Rhyn, was next to Rubens, in point of art, and more than equal to him in originality. Whether in portrait, landscape, or historical pictures large and small, he was like nobody; as wonderful as any, and sometimes superior to all. His bistre-drawings are exquisite, his etchings unrivalled; his colour, light and shadow, and surface, solemn, deep, and without example; but in the naked form, male or female, he was an Esquimaux. His notions of the delicate form of women, would have frightened an Arctic bear. Let the reader fancy a Billingsgate fish-woman, descending to a bath at a moment's notice, with hideous feet, large knees and bony legs, a black eye, and a dirty night-cap,—and he will have a perfect idea of Rembrandt's conception of female beauty. Though his historical pictures are often remarkable for pathos and expression, his characters are sometimes absolutely ridiculous. His Abrahams are Dutch old clothesmen; and yet his Jacob's Dream is sublime beyond expression. Whatever he painted, he enriched; his surface was a mass of genius, and his colour a rainbow, darkened by the gloom of twilight. In portrait, sometimes, his dignity was equal to Titian; but the characters he painted were inferior.

These two wonderful men, each a perfect contrast to the other, revived art; Rubens on the principles of the Venetians, and Rembrandt in defiance of all principles. But the latter sacrificed too much to a peculiarity, and he was punished for it in the Louvre by the side of others.

Vandyke, &c.

Rubens produced Vandyke, Snyders, and Jordaens, and a whole host of pupils. Vandyke had more elegance, but not so much imagination; Jordaens more vulgarity, with equal power. Snyders was a mere animal painter, and he carried the touch necessary to execute the hairy skin of an animal, into every thing he did. Vandyke by his splendid portraits, certainly generated a love of art in England, which has never left us, after the destruction of historical painting at the Reformation.

Teniers, &c.

Rembrandt had pupils, who were by no means equal to himself. David Teniers the elder was a pupil of Rubens. These two extraordinary men were certainly the founders of the Dutch school; and the great principles of their works were carried by David Teniers the younger, Jan Steen, Ostade, and Cuyp, into smaller and more delicate productions. A man of the highest ambition and noblest views in art can study with the greatest benefit the dead fish and bunches of turnips, servant girls and drunken boors, for beauty of handling and effects in art. He who looks down on the excellencies of the Dutch school, does so from a narrowness of understanding, and not an enlargement of views; and if an historical painter can see nothing to learn in their little beautiful works, he will not learn much from the greater productions of Titian.

Spanish school.

Directly after the Flemish comes the Spanish school, which, not so vulgar as the former, was equally unideal. The Spaniards painted the people about them for all sorts of subjects and all sorts of characters; and they are only more refined than the Flemings because the Spaniards are a more cultivated people. The long possession of the Moors prevented the Spaniards from advancing as soon as Italy. The great schools in Spain have been those of Madrid, Seville, and Valencia. In 1446 Antonio Rincon abandoned the Gothic of the European artists; in 1475 Gallegos was so like Albert Dürer, that he is suspected to have been a pupil; in the sixteenth century riches flowed in, patronage was liberal, and, what is most important of all, genius existed in Spain. Becerra de Baeza, pupil of Michel Angelo, painted in fresco, at Madrid, Salamanca, and Valladolid; and in the Trinità del Monte in Rome, there is also a picture of his. Various painters follow of course in all the schools, till the coming of the real hero of Spanish art.

Velasquez.

Velasquez was born at Seville in 1599. He became a pupil of Herrera, and left Seville in 1622, to seek his fortune in the metropolis; where he succeeded so completely as a portrait painter, that he got to court, and having become acquainted with Rubens, often visited his painting-room. Rubens must have been of the greatest use to him. Velasquez then visited Italy, but could not bear the Roman school after the Venetian. In masterly execution and life he surpassed Rubens and Vandyke. Of all the great painters, he seems to have despised the most the vulgar appetite for what is called *finish*, that is, polished smoothness. Every touch from Velasquez is a *thought* calculated to express the leading points of the *thing* intended to convey it. Masterly beyond description, and delightful beyond belief, he conveyed the impressions of life as exquisitely as if his imitation breathed. But so utterly decayed is the present Spanish school, with its pompous academy, that Spaniards when asked how they can reconcile their hideous polish with the freedom of Velasquez, have answered that *Velasquez was always in a hurry.*

Murillo.

After Velasquez ranks Murillo, a man of a tenderer genius, but equally alive to life. He has the surface of Corregio and colour peculiarly his own; and he was what the Italians call a *Naturaliste*, indeed, the whole school was of that species. Like Rembrandt and Rubens, the heroes of history are always the countrymen of the Spanish painter. The Prodigal Son is one of the finest works in the Duke of Sutherland's collection; it is beautiful in execution, light and shadow, and colour, but Spanish in character and expression. They never got beyond their model or their country; and this may in a great measure be owing to their masters having been Venetians, though Tibaldi and Torrigiano had visited Spain. Murillo was an exquisite painter, and if he had been soundly educated like the Greeks, would have been as refined in character and form as he is now in colour and handling. He first got an insight into painting from Moya, a pupil of Vandyke. Having sold his pictures to hawkers for what they would bring, he saved money and went to Madrid, and, with the frankness of genius, at once introduced himself to Velasquez, who received him like another Raffaelle. After three years of continued kindness, he returned to Seville, founded an Academy, and for his great work of St. Antony at Padua, he received ten thousand reals. It is said that he covered more canvas than any body else; but after the acres of Rubens in the Louvre, that assertion is questionable. Velasquez and Murillo, of course, came like the rest, *before* academies. One now exists in Madrid, and no genius has appeared since its institution. It is quite ridiculous to see the same results all over the world; and it is still more ridiculous, to find the kings of Europe still continuing to found and embellish these useless establishments.

French school.

In France, throughout all the middle ages, the art of design was never extinct, either in mosaic, glass, tapestry, fresco, miniature, or tempera. Though the learned author of the "Discours Historique" says, that the French were the first who presumed to personify the Almighty in the form of

Painting.

man; yet nothing worth remembering occurred till the death of Leonardo, in the arms of Francis I. in 1518, and the employment of Primaticcio, Rosso, and Nicolo del Abbate. Jean Cousin in 1462, and Vouet in 1582, were the first French painters of any importance in this latter period. Simon Vouet, the younger, was the master of Le Sueur, Le Brun, Mignard, and Dufresnoy; he lived in 1600, and the best period of French art was from that time until 1665, the beginning of the reign of Louis XIV. They, as usual, founded an academy, ten years before Poussin's death; and Coypel, Jouvenet, and Rigaud, were the produce of the institution; whilst Poussin, Le Sueur, and Le Brun, had flourished and obtained their reputation before it was founded. Van Loo and Boucher succeeded Jouvenet and Rigaud, and gave additional evidence of the utter incompetence of the academic system. About 1770, flourished Greuze, who began to evince a better taste, and was persecuted by the Royal Academy for his independence, till the Revolution of 1790 put an end for the time to all imposture. Down went the Royal Academy in an instant; and all the conventional distinctions in art, which are generally the cloak of imbecility, were fluttered off in the whirlwind. The people, long prevented from seeing fine works in the great galleries, now broke into these galleries with brutal exultation. Bloody and dreadful as were the consequences of the first burst of the French Revolution, one of its most beneficial effects consisted in throwing open all matters of art and science to the people. Naigeon, the conservator of the Luxembourg, said, in 1814, that nothing was opened to the people before the Revolution; and we ourselves in England are now enjoying our Museums, entirely in consequence of the effect produced upon Mr. Fox and the English, who visited Paris in the year 1802, and who were astonished at the noble frankness with which the Louvre was exposed.

The academy being swallowed up in the whirlpool of political revolution, the Institute supplied its place. Napoleon, on becoming first consul, sent immediately for David, who had been a furious republican during "le temps de la terreur;" a man of great talent, but of abominable taste. Napoleon made him his court-painter, and gave such preponderance to his influence, that the detestable style of David became everywhere but in England the style of European art. Gros, Prudhom, Guérin, deviated from the rigidity of David's style. Prudhom was a man of genius. Hideous as was the style of David, in fact painted Roman sculpture, it had some foundation in reason. This was, if possible, to bring the French back to classical art, after the flutter of Boucher, and the pomposity of Coypel; but, like all reformers, he went to excess.

The materials for assisting them are so deficient, that the greatest artists have arrived at any thing like an imitation of nature only by the greatest science and skill. It is much easier to paint a button and a chair, than a human face; therefore the great artists dwelt upon the face with all their dexterity, and touched off the button and chair with less anxiety and care. The French used to say, that *theirs* was the system of the ancient Greeks, and that it was *our* prejudice to disapprove of it. But before we have done, we shall show that it was not the system of the ancient Greeks; and as we pay all due deference to the Italians, Flemings, Dutch, Spaniards, and Greeks, and to their own Poussin and Claude, they have no right to accuse us of prejudice because we disapprove of David. We do not deny David's talent, because it must have required talent to mislead the continent of Europe. In art David's expression was taken from the theatre, and his actions were borrowed from the opera house; his forms were Roman and not Grecian, and his colour was hideous enough to produce ophthalmia. If he and his pictures, with all he ever designed, and all he ever invented, had not appeared in the world, or having appeared, had been utterly rooted out of it, the atmosphere would be purer. He is a plague-spot, a whitened leprosy in painting, that haunts the imagination with disgust. This he had the impudence to say of Rubens. But since the peace, and from the connection with England, a better school of colour has sprung up in France; and La Roche gives evidence of having in some degree got rid of the furniture look of David, though it still poisons a French pencil.

Painting.

Horace Vernet is a distinguished name; indeed, he may be called the first light-infantry grenadier of European art. He paints a head in five minutes, a whole imperial family in ten minutes, and an historical picture in twenty; and he paints all three with talent and skill. Though the French are not yet *sound* in art, they are the best educated artists in Europe; and if the English would combine their own colour with the careful habits of French early study, and if each school could supply the deficiencies of the other, they would make out a very good school between them.

In thus suffering ourselves to be led away to the modern state of the French school, we have omitted to do justice to the great men of former times; Poussin, Sebastian, Bourdon, and Le Sueur. Poussin is the hero of French art. His Death of Germanicus is very fine, as a specimen of history; and his Polyphemus sitting on the top of a mountain, and playing his pipe, with his back towards you, is a pure specimen of the poetic. He studied the ancient Romans so much, that he became Roman in his faces, drapery, and figures; and in his naked forms, the common model is too apparent. His finest works are in England; but though distinguished for expression, there is always an antique heartlessness, as if copied from the masks of an ancient theatre.

Bourdon's Return of the Ark is a high proof of his conception; and Le Sueur's St. Bruno is pure in taste, but bad in colour. The Battles of Alexander by Le Brun show the latter to have been of the family of machinists. His colour is bronzed and disagreeable. Le Brun was a court-favourite, and his Greeks, as well as barbarians, have an air of the opera at Versailles. His composition is artificial; and he is not a fit example for youth. The only man who coloured with exquisite feeling was Watteau, whose touch and delicacy of tint may be studied with great profit by any artist.

In a word, it is extraordinary that the French as a nation, have never been right in art. Poussin was the only man who could have set them right, and they persecuted him so, that he settled in Rome. Claude Lorraine can hardly belong to them; and though Louis Philippe employed them by hundreds, nothing very eminent appears to have proceeded from such encouragement.

Progress of the Germans.

The Germans are taking higher ground than any other nation, and are making rapid advances, particularly at Munich. They have begun again fresco painting; and the liberality of their king has rendered Munich the most flourishing city in Europe for arts and artists; but as Canova said when he was in England, there is very little grand art left in the world. It is extraordinary to reflect on the little original thinking that is to be found. This was more apparent in the Louvre than any where else; and one could not help being amused at seeing the way in which Rubens, who, like Michel Angelo, is supposed to have never looked out of himself, had plundered the old Gothic painters; the Fall of the Damned, by an old German, being the complete basis of the same subject by Rubens.

When incessant demands are made on the genius of a favourite, every aid to thinking is grasped at and improved. Raffaelle did this; so did Rubens; and even Reynolds used to have portfolios brought him to look over at breakfast, and select what would help him, saying, "It will save me the trouble of thinking." This involves a very serious question in art. The utmost merit that can be allowed is that of *skilful adaptation*. "Nihil tetigit quod non ornavit" may be said of all these; and surely a good thought badly done is justifiable food for a superior mind to render it better.

Painting.

British school.

We come now to the British School, which, though the last founded in Europe, is inferior to none in variety of power. There is no doubt that the art[1] would have advanced in Britain side by side with the continental nations, if we had continued Catholics; in fact, we were doing so, when Wickliffe's opposition to the Catholic priests roused up the people to hate and detest every thing connected with their system. Painting of course came under this furious denunciation, and through successive ages went on till the period of the Reformation.

Historical notices of British art.

In Edward the Confessor's time, there were executed bas-reliefs as good as any thing done at that time in Europe, and by no means deficient in grace, though disproportioned, and unskilful in composition. In one of these there is a king in bed, and leaning upon his hand; which in an improved style might be made a fine thing. In Alfred's reign and before, York and Canterbury were adorned with pictures and tapestry; and in the tenth century, Ethelrida adorned Ely Cathedral with a series of historical pictures in memory of her famous husband Birthwood. As this is recorded, says Strutt, the practice must have existed before; and that it continued to exist and be the fashion down to the Edwards and Henrys, there is good evidence; for in the time of Henry III. mention is made of the immortal Master Walker's painting in Westminster, the no less renowned John Thornton of Coventry, painter there, and the east window of York.[2] In the reign of Henry VIII. there was a chartered society of painters; and in the seventeenth of Elizabeth it was moved in the House by Sir G. Moore, "that a bill to redress certain grievances in painting be let sleep, and be referred to the Lord Mayor, as it concerned a controversy between *painters and plaisterers;*" and Sir Stephen Jones stood up and desired that the Lord Mayor "might not be troubled, and *it seemed to go against the painters.*"

The painters who complained that the plaisterers used their colours, and took the bread out of their mouths, go on to say, that in the nineteenth of Edward IV., that is in 1480, there were orders issued "for the use of *oil* and *size,*" and that the "painters' only mixture was *oil* and *size,* which the plaisterers do now usurp and intrude upon." In their petition they observe with the greatest simplicity: "Workmanship and skill is the gift of God, and not one in ten proveth a workman, and that those who cannot attain excellence must live by the baser part of the science." They add that "painting on cloth is *decayed;* that this art is a curious art, and requireth a good eye, and a stedfast hand, which the infirmity of age decayeth, and then *painters go a-begging;*" and then they conclude the petition to the House by this remarkable passage: "*These walls thus curiously painted in former ages the images so perfectly done, do witness our forefathers' care in cherishing this art of painting.*" "This bill," said Sir Stephen Jones, "is very reasonable and fit to pass," and so it did.[3]

Painting.

The above extract, proves that in Elizabeth's reign the historical attempts were alluded to, *as belonging to former ages*, viz. from the tenth century downwards; that the House of Commons praised the wisdom of those times in cherishing painting; and that this wisdom the Reformation had obviously discarded.

In 1538, Henry issued an order against the use of pictures and statues to impose on the people; yet pictures are called "bokes for unlearned people." In 1542, in his letter to Cranmer, the king tries to restrain the destruction of pictures; but it was too late. In the reign of Edward VI. the Duke of Somerset fined and imprisoned all those who possessed pictures of religious subjects. To such excess had the fury of the people been excited, that the recorder of Salisbury, Mr. Henry Sherfield, was fined L.500, and imprisoned in the Fleet for not breaking a painted window in Salisbury Cathedral. Walpole says that one Bleese was employed at 2s. 6d. a-day to break windows at Croydon; and in Charles I.'s reign it was ordered,[4] that all pictures having the second person of the Trinity should be burnt, and that all pictures having the Virgin should share the same fate. Cromwell stopped this barbarity, and it was owing to the self-will of this extraordinary man that the Cartoons of Raffaelle were bought in for L.300, at the sale of Charles's effects.

Thus it is clear the art was stopped by the Reformation. In St. Stephen's Chapel, before the alterations made some years since, there were figures painted on the walls, as excellent as any figures in the Campo Santo, and perhaps executed about the same period. In Elizabeth's reign, as we have seen, historical art is referred to with sorrow in the House, as a thing past but which had existed; and in the same reign, says Hillier, "men induced by nature," to pursue high art, "have been made poorer, like the most *rare English drawers of story works.*" Now, Hillier would not have said this, if it had not been true that the drawers of *story works* were principally *natives*.

In Henry VII.'s time, Torrigiano, the same youth who had felled Michel Angelo to the ground in the gardens of Lorenzo and shattered his nose, was in England, and executed important works. In the time of Henry VIII., commissions for high art being over, Holbein devoted himself to court portrait-painting, though in the city he painted some large pictures. Rubens' and Vandyke's visit excited Dobson, a capital painter of a head; but although Oliver was distinguished as a miniature painter, and although there are designs at Oxford, by English painters, no one genius seemed to arise till after Lely and Kneller had succeeded Vandyke. Cooper was the first English painter employed in foreign courts as a miniature painter. Thornhill, a man of talent,

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[1] It is a curious fact, that the art seems to have been in an advanced state in England, while it is doubtful whether there was a painter in Florence in 1236. In 1250 the authorities in Florence sent for some Greeks because there was no painter; yet at that period in England, and long before, historical painting seemed quite the fashion amongst the upper classes. All the king's rooms, as well as his chapel, were painted. In the 25th of Edward III. in the rolls of the Exchequer, 26th September 1351, there is a charge to "William of Padryngton, for making twenty angels to stand in the tabernacles by task-work, at 6s. 8d. for each image, L.6, 13s. 4d." In 1530, were begun the beautiful pictures and designs in St. Stephen's Chapel; and it is curious to see, in all the accounts, the continual allusions to oil-painting. The artists employed must certainly have been men of distinguished talent, who had the power of ordering inferior artists to assist them. The most celebrated of their number appears to have been Hugh de St. Alban's, who was appointed by the king as his principal painter. The following document, dated 18th March, 1350, contains his appointment. "The king to all and singular, the sheriffs, mayors, bailiffs, officers, and his other lieges, as well within liberties as without, to whom be greeting, Know ye, that we have appointed our beloved Hugh de St. Alban's, master of the painters assigned for the works to be executed in our chapel, at our palace at Westminster, to take and choose as many painters and other workmen as may be required for performing those works, in any places where it may seem expedient, either within liberties or without, in the counties of Kent, Middlesex, Essex, Surrey, and Sussex, and to cause those workmen to come to our palace aforesaid, there to remain in our service, at our wages, as long as it may be necessary. And therefore we command you to be counselling and assisting this Hugh, and completing what has been stated, as often and in such manner as the said Hugh may require." (See Britton's *West. Pal.* p. 170.) The illustrious Hugh seems to have been a designer; for in the books (25 Edward III. April 30), is the following entry, "to H. de St. Albans, ordering or *designing* the drawings for the painters, one day, 1s."

[2] See Carter's *Etchings.*

[3] See Sir W. Monson's *Account of the Acts of Elizabeth,* 1632, British Museum.

[4] See Journals of the House, 23d July 1645.

and a member of the House, forms the link between one race and another; and then sprung up Hogarth, Gainsborough, Wilson, West, and Barry. As usual, when Reynolds and Hogarth had for ever rescued Britain from all doubt as to her genius, without an academy of any description, a royal academy was founded to produce more genius, just as had been done all over Europe; and no man equal to Reynolds and Hogarth has since appeared. After the academy was founded at Milan by Leonardo, no genius like his appeared. After that of St. Luke was founded at Rome, Raffaelle and all being dead, no one came forth. After an academy had been founded at Parma, Corregio being gone, nobody appeared. After a national academy was founded at Venice, and royally endowed, genius fled. The same thing happened in Ferrara, Modena, Florence, and Naples; and also in France, Spain, and England. Need further evidence be sought of the uselessness of such institutions?

The Academy.

In 1711, there existed a school, of which Kneller was the head, whilst Vertue the engraver drew in it. After 1724, Sir James Thornhill opened a school in his own home Covent Garden, and so did the Duke of Richmond at Whitehall Privy Gardens. Sir James proposed to Lord Halifax to found a royal academy, but without success. At Sir James' death, the school was broken up, and the artists were again left without instruction; when, for the purpose of studying the living model, they hired a room in Greyhound Court, Arundel Street, and Michael Moses was the conductor of it. Here they were visited by Hogarth, who was so well pleased, that a union of the whole body took place, and they removed to Peter's Court, St. Martin's Lane. The number of members amounted to a hundred and forty-one, each paying an annual subscription. There was at the time a great deal of happy fellowship amongst the artists. Reynolds, who was a member, with Hogarth and others, adorned the Foundling Hospital; and the public were so interested, that the society thought they might venture on a charter, which was obtained, and there was established by law a government of twenty-four directors, annually elected, including the president, by the whole body and out of it. An united exhibition having begun (the constant source of irritation, for every man cannot have his works in the best places), squabbles arose; and the directors finding the benefit of being able to hang their own works and those of their friends in the best situations, intrigued to keep their places another year. This was foolishly granted; and every subsequent year finding themselves becoming a match for the constituency, they kept their places for eight years, in defiance of law; so that at last it was found that the men elected to preserve order and law, had been the grossest violators of both. With the feelings of independent freemen, the constituencies resolved to endure this no longer; when, to prevent collision, it was agreed to refer the point to the Attorney-General, De Grey, both parties pledging themselves to abide by his decision. De Grey gave it against the directors, and these honourable men then refused to keep their word. The constituency met, and violently expelled sixteen of them; but before resigning, these gentlemen met secretly, and fearing exposure, tore out and destroyed the minutes from the 19th November 1764, to the 11th March 1765, and from the 17th of June 1765, to the 21st of March 1766. They then went to the king, George III., whom they persuaded that the chartered body was republican; and that there was no hope unless a royal academy was founded, with the number of members and voters limited to forty. The king, without inquiry, foolishly yielded to their cunning suggestions, and founded an academy with forty members; the other eight directors resigned directly, and the whole twenty-four were made R.A's. Thus by this limited number were framed the present exclusive law and constitution, and all the obnoxious regulations passed, which had been checked by the sense of a constituency; and thus the art of England received a blow more fatal than at the Reformation. The weakness of the nation has been gratified to an excess by this interested assembly, to the ruin of their taste and judgment; high art has gone back, and is going back further every year, by the struggles of these men to keep up their monopoly, in defiance of the increasing intelligence of the people, which they fear, and which will yet be their utter destruction. In this affair Reynolds behaved with great meanness. He promised to stand by the constituency; yielded at the offer of a knighthood; was afterwards justly punished, by being compelled to resign; and foolishly complained of ingratitude which he had deserved.

In order that the state of art in Great Britain may be rightly understood, this authentic detail, taken from pamphlets published at the time, especially that of Sir Robert Strange,[1] has been thought necessary; and it will not appear tedious, if it be considered that, for the sake of the art of our own country, it is but just that particulars should be ascertained. The effect of the academy has been pernicious. Imitating the example, all the eminent provincial towns have established exhibitions instead of schools; and every year the annual exhibition in the metropolis is repeated in the provinces, with but little addition to that which proved unsaleable in the London show. Hogarth opposed such a conclusion, and from the beginning predicted its effect, which has happened to the very letter; and when Reynolds began to perceive the truth, he acknowledged his error, and said to Sir George Beaumont, that "a party was gaining ground which would ruin the art."[2] If the detail of every other academy in Europe could be thus laid open, the same intrigues, the same despotism, the same injustice, and the same want of principle would be found at the bottom; and Europe would no longer wonder that academies never have produced a Raffaelle.

Reynolds.

The honest and straight forward constituency being thus left as it were unprotected by the king, it was soon deserted by the nobility and the public, and shortly escaped notice altogether; though such a man as Hogarth had improved his knowledge by drawing in its schools. The literary splendour with which Reynolds was surrounded, gave a glory to the Academy which it has not yet lost; and the genius of Reynolds spread a halo around it, which the artists still fancy they see, though it vanished the moment he expired. Reynolds was really a great artist; gorgeous in tone and colour, unimpeachable in composition, deep in light and shadow, beautiful in character, and the purest painter of children and women that ever lived in the art, Greek or Italian. His ignorance belonged to the period; his beauties were entirely his own; and though he overrated Michel Angelo, and has done injury to taste, by his sincere conviction that he was right, yet had he lived to see the Theseus or Ilyssus, he would have been equally candid in saying he was in error. Lord Heathfield is a portrait that need not fear any work of Titian's for men, and Mrs. Parker, a tender, sweet picture of a woman, was never equalled in sentiment or delicacy by any work of the Venetian and Roman schools. Where were children ever so completely hit as in the Infant Academy? who surpassed the propriety of his back-grounds as well as their splendour? His eye, or rather his organ for colour, was exquisite; nor is there in the whole of his works a heated and offensive tint. He did not combine essential detail and breadth so beautifully as

[1] See Sir Robert Strange's pamphlet, and another published in the year 1771, by Dixwell, St. Martin's Lane, entitled "On the Conduct of the Royal Academicians," in the British Museum.

[2] This was told the author by Sir George; and has since been confirmed by his pamphlet, "Concise Vindication," &c. in British Museum.

Painting

Titian; but place one of his finest portraits by the side of any picture of Titian's, see them at the proper distance, and Reynolds would keep his station. Here, however, the praise must stop. Reynolds could have no more painted Pietro Martyre than he could have revived the martyr after he was dead. He was not so great a man as Titian, because he did not like him remedy his ignorance, when he found it out at a much earlier age. He was always talking of what he would do if he began the world again. Sir Joshua loved society; he was the deity of his coterie; he liked a glass of wine and a game at whist; and he never lost his temper because he was successful in the world, but the first time he was thwarted he got in a passion. Reynolds was a great genius in painting, but not a great man. He raised English art from the dust, and gave English artists an *aplomb* in society which they never had before, and he first reduced the art to something like system by his discourses; but not having moral courage to resist the formation of an academy, which *he* could have done by his influence and his genius, he compromised the art, and was indirectly the means of throwing it off its balance, which it will yet take half a century more to remedy, as Hogarth predicted.

Hogarth.

As an inventor, Hogarth is by far the greatest of the British school; although in aim and object, colour, surface, and all the requisites of a great painter, infinitely below Reynolds. It would be useless to detail the perfections of a man so admired all over the earth, and who will only cease to be a delight with its existence. It is astonishing how hereditary is the hatred of academies. The painters in revenge for Hogarth's opposition, swore that he was no painter, and swear so to this hour. The absurdity of this criticism can be proved by the Marriage à la Mode, whilst the picture of the husband and wife after a rout, is as beautifully touched as any in that class of art can be. He has not the clearness of Teniers, nor the sharpness of Wilkie; his touch is blunt, and his colour deficient in richness; but you feel not the want whilst looking at him; and although his expression is often caricature, yet in the above picture it is perfection. Hogarth unfortunately believed himself infallible; but his wretched beauty of Drury Lane for Pharaoh's daughter at the Foundling, his miserable Sigismunda, and his Paul before Felix, we hope convinced him of his forte. If he was *serious* in these pictures, which we very much doubt, he deserved a strait waistcoat and a low diet as the only treatment for his hallucination.

Gainsborough and Wilson.

Gainsborough was another painter of great genius in portrait and landscape; but Wilson was a greater. His touch and feeling were comprehensive, though too abstracted for the vulgar, who always like polish and to put up their fingers. He used to say to Sir George Beaumont, "When somebody is dead somebody's pictures will sell better." From neglect he got into foolish habits of drinking and died librarian to the academy. A miserable dauber called Lambert was the fashion, and his character as a landscape painter was hit by poor Wilson. He said "his trees and foliage were eggs and spinach, and nothing more;" yet Lambert got hundreds when Wilson could hardly get shillings. But where are now the immortal Lambert's works? Making fire-screens for garrets, whilst "*somebody's* pictures" adorn the houses of the great. Gainsborough was a great portrait painter and ran Reynolds hard. West's Wolf and La Hogue are the triumphs of his talent; but his great sacred subjects are inferior works. The writer of this observed to Canova in England, "Au moins, il compose bien." "Monsieur," replied the Italian, "il ne compose pas; il met des figures en groupe." He was a skilful machinist; and though there are bits of colour in his small works, rich and harmonious, his portraits are detestable, his handling unfeeling, his drawing meagre and common. He was deeply versed in nothing, though possessing great acquired knowledge of his art without being an educated man. With respect to his being the greatest man since the Caracci. with Rembrandt, Rubens, Vandyke, and Dominichino, Guido, and Guercino since, or a little after, the idea is ridiculous and absurd. The king hated Reynolds on account of his devotion to Burke and Fox, and puffed West from sheer irritability. The king said to Hopner, "Why does Reynolds paint his trees *red* and *yellow?* who ever saw trees that colour?" Hopner, who said what he pleased, replied, "Then your majesty never saw trees in autumn."

West.

Barry.

Romney, a second-rate man, had great patronage, whilst Barry, a man of great grasp of mind, had none whatever. Barry joined the Academy to oblige Reynolds, against his own convictions; was soon at issue with its selfish monopoly; opposed it; urged the propriety of devoting a portion of its funds to establish a school of colour; exasperated the intriguers by his fearless attacks; and was expelled of course as an obnoxious man, the king having been persuaded to sanction it, under the deadly hint that Barry was a radical. Barry was the protégé of Burke, and his Adelphi pictures, shewing the progress of society, though deficient in drawing, colour, and delicacy of touch, were the first work in England on the comprehensive principle of the ancients. Having neglected Burke's repeated entreaties to dissect, he suffered the consequence. His forms at the Adelphi are such as can be got by general drawings from the antique, but there is no refined knowledge of construction in them.

Fuseli.

As a man of genius, however, Barry is not to be compared to Henry Fuseli, the friend of Reynolds and Lavater, and one of the most distinguished and accomplished men of his time. Fuseli was undoubtedly the greatest genius of that day. His Milton gallery shewed a range of imagination equal to the poet's; his Satan bridging Chaos, his Uriel watching Satan, his Shepherd's Dream, his Fairies from Shakespeare, and his Ghost in Hamlet, announce him as having conceived, like Theon, φαντασιας, and as being the greatest inventor in art since Julio Romano. But in the modes of conveying his thoughts by form, colour, light, and shadow, and above all, nature, he was a monster in design; his women are all strumpets, and his men all banditti, with the action of galvanized frogs, the dress of mountebanks, and the hue of pestilential putridity. No man had the power like Fuzeli of rousing the dormant spirit of youth; and there issued from his inspirations a nucleus of painters, who have been the firmest supporters of the British school.

But Fuseli, as a painter, must be a warning to all. Had he taken the trouble to convey his thoughts like the great masters, his pictures would have risen as time advanced; yet as time advances, his pictures, from having no hold on our feelings like the simplicity of nature, must sink. His conceptions however poetical, are not enough to satisfy the mind in an art, the elements of which are laid in lovely nature; and great as his genius was in fancy and conception, inventor as he was in art of fairies and ghosts, he will never be an object to imitate, but always to avoid by young men, who are more likely to lay hold of his defects than his beauties. The finest conception of a ghost that was ever painted, was the Ghost in Hamlet on the battlements. There it quivered with martial stride, pointing to a place of meeting with Hamlet; and round its vizored head was a halo of light that looked sulphureous, and made one feel as if one actually smelt hell, burning, cindery, and suffocating. The dim moon glittered behind; the sea roared in the distance, as if agitated by the presence of a supernatural spirit; and the ghost looked at Hamlet, with eyes that glared like the light in the eyes of a lion, which is savagely growling over his bloody food. But still it was a German ghost, and not the ghost of Shakespeare. There was nothing in it to touch human sympathies combined with the infernal; there was nothing at all of "his sable, silvered beard," or his countenance more "in sorrow than in anger;" it was a fierce, demoniacal, armed fiend reeking from hell, who had not

yet expiated "the crimes done in his days of nature," to qualify him for heaven. His next finest works were the two fairy pictures in the Shakespeare gallery, some diving into harebells, some sailing in Bottom's shoe; but beautiful as they were, indeed the only fairies ever painted, still your heart longed for nature in colour, form, action, and expression. Such an union had the Greeks, and no art in the world will be perfect until it appears again. These pictures are evidences of the highest conception of the fanciful and supernatural. His Lazar House is an evidence of his power of pathos; his Uriel and Satan of the poetical; his Puck putting on a girdle, of the humorous and mischievous. But when Fuzeli attempted the domestic, as in the illustrations of Cowper, his total want of nature stares one in the face, like the eyes of his own ghosts. Never were the consequences of disdaining the daily life before your eyes, or of affecting to be above it, so fatally developed as in this series of design; though in comparing with him another eminent artist, namely, Stothard, who, in sweetness and innocence, was his decided superior, Fuzeli surpassed him in elevation and reach of mind. In the pictures of Stothard, who painted equally well without life before him, there is not the same extravagance, yet there is almost equal want of nature in another way. Flaxman, Stothard, and Fuzeli, are the three legitimate designers of our school, and yet not one of them was perfect master of the figure.

Flaxman.

Flaxman's designs from the Iliad and the Greek tragedies are his finest works; and when first they appeared in Italy, they were denied to be the invention of an Englishman, as it was supposed to be impossible that any Englishman could have an imagination. But yet of some of these designs it really may be said, "Il n'y a qu'un pas du sublime au ridicule." It is extremely difficult to say whether they are in the highest degree sublime or extremely absurd. In all attempts to express the passions, you will perceive extravagance; but in comparing him with Canova, in this part of the art, Canova must yield the palm as much as Flaxman was inferior in the perfection of working up a single and beautiful figure. Though this eminent man talks pompously of Greek form and anatomical knowledge, he in reality knew very little of either; and though there is a great deal of useful matter of fact in his lectures, yet on the whole they display a wretched poverty of thinking. His book of Anatomy for students is not deep enough on the separation of muscle, bone, and tendon, and can help a young man a very little way to correct notions. The value of Fuseli's and Opie's lectures in comparison with Flaxman's or Barry's is evident; and the superiority of Reynolds to all, except Fuseli in his lecture on Greek art, needs not to be dwelt on.

Stothard.

Stothard, as an inventor in composition, was equal to all, but as a painter, certainly inferior to all. In fact he could not paint; he had no identity of imitation; he did not and could not tell a story by human passions; and his style of design showed great ignorance of the constituent parts of the figure. But there was a beautiful and angelic spirit that breathed on every thing he did. He seems in early life to have dreamed of an angel, and to have passed the remainder of his days in trying to endow every figure he designed, with something of the sweetness that he had seen in his sleep. Peace to his mild and tender spirit. It was impossible to be in Stothard's painting-room for ten minutes without being influenced by his angelic mind. He seemed to us always as if he had been born in the wrong planet. He had a son whose etchings from our ancient tombs are an honour to the country. He fell from a great height, in pursuing his designs from some tomb in a country church, and was killed. This ill-fated artist was in every respect worthy of his father.

Never were there four men so essentially different as West, Fuseli, Flaxman, and Stothard. Fuseli was undoubtedly the man of the largest capacity and the most acquired knowledge; West was an eminent artist in the second rank; Flaxman and Stothard were purer designers than either; Barry and Reynolds were before all the others. In Barry's Adelphi there is a grasp of mind, as Johnson said; yet as a painter he was inferior to all. Though Fuseli had more imagination and conception than Reynolds, though West put things together with more facility, and Flaxman and Stothard did what Reynolds could not do; yet as a sound, great, and practical artist, in which all the others were deficient, Reynolds must be considered the head of the British school as a painter and handler of his brush.

Opie, Northcote, Wilkie.

Opie must not be omitted, nor Northcote his imitator and contemporary, both of them men of talent. Opie, a man of great and powerful genius, issued from Cornwall at once on the town. Northcote was six years with Reynolds; and his Arthur and Hubert, and Children in the Tower, are fair specimens of his talents. He was a malicious man, and tried to injure his greatest protector, Reynolds, and Dr. Mudge who introduced him, by allowing Hazlitt to print his (Northcote's) Conversations. There never was a deeper scheme for malignant defamation. Northcote always said that *he* did not print them, and Hazlitt that *he* did not talk them; and each vented his spite on a mutual friend, and shifted the blame to the other. Reynolds was succeeded by West, and the art sunk to the lowest depth, containing only Sir Joshua's humble imitators, when a genius broke forth, David Wilkie, who rendered our domestic school, the first in Europe; and the feeling for art has been rapidly advancing amongst the people ever since. This many circumstances unite to prove.

Parliamentary inquiry.

In consequence of the perpetual complaints from the great body of artists, the government granted a committee in 1836, to examine the cause of the superiority of France in manufacturing design, as well as the condition of high art, and to ascertain if the accusations against the Royal Academy were true or false. Never in the world were the consequences of a monopoly on the perceptions of respectable men so ludicrously developed. The president and body first denied the right of the House of Commons to examine them at all; and when the persuasions of their friends showed them their folly, their appearance before the committee presented a scene never to be forgotten in the history of English painting. On all questions of finance, they proved satisfactorily the honour of their transactions; but on all questions of art more was proved against them than ever had been suspected.[1] The resignation of Reynolds, and the expulsion of Barry; the loss of a million of money to the art on the Waterloo monument, in consequence of their not replying to Lord Castlereagh's committee; their refusal to let the artists also support their exhibition, and have the same opportunities of fitting their works for the public as at the British Gallery; and, to crown all, their rendering the school of design lately established of no avail to the mechanic, by establishing a law, that the study of the figure is not necessary for his education, though it was proved that this study at the Lyons academy for mechanics, was the real cause of their superiority to us; are such indisputable evidence against their protestations of sincerity, that it has rendered the nobility and the nation more than suspicious of the truth of all the accusations which have been made against them.[2]

Scottish art.

In Scotland the art is in a promising condition, and the Scottish school in purer taste than the English. Living as

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[1] See *Report on Arts and Manufactures*. In this Report the important subjects of Art and Manufacture are both considered; and no one with any pretensions to taste should be without it.

[2] For a continuation of the history of Painting down to the present time, see the appendix to this article.

Painting.

the artists do, in the most magnificent city in Europe, surrounded by a country pregnant with historical recollections, and guided by their own shrewd understandings, the school in Edinburgh will, before many years, take a very high rank in the art. But there is some cause to apprehend that it will be checked at its most critical period, from the usual cause, the foundation of the old curse of Europe, an academy. After having produced Runciman, Raeburn, Wilkie, and the other eminent men Scotland can boast of in art, they have been persuaded to found conventional distinctions, in favour of a select few; and, as elsewhere, the result will be the same. No Wilkie, no Runciman, no Raeburn will come from it; for the best men they now possess were eminent before it was thought of. The art has no business with any aristocracy of talent. Conventional distinctions, which are not hereditary, are laughable and absurd; and distinctions which are, ought to be reserved for high descent, heroic actions, landed property, or vast political genius. Such an aristocracy produces heart-burnings and injustice; for it places power in the hands of men, who are not amenable to justice for tyranny, and who cannot be reached by law, for calumny or insinuation. "Of all hatreds," said the *Edinburgh Review*, "there are none to equal the hatreds weak men in power bear to the man of genius without it." It is a curious evidence of the sagacity of the Scotch, that whilst the English portrait painters, since the death of Reynolds, were all placing kings and queens on their toes, from sheer ignorance of perspective, Raeburn, Wilkie, and Gordon have never made that mistake.

In a word, it is our decided and unprejudiced conviction, that the genius of the British people, will never have fair play or be soundly advanced, till the Royal Academy is removed, or effectually remodelled; and this will be effected either by the positive interference of the queen or the government, or by the rapidly increasing knowledge of the people. If the capital and the provinces were freed from the predominance of those men; if the honours were abolished and the constituencies restored; if the whole national galleries were turned into a great school, with branch schools in the great towns; if the Cartoons were removed to London for the occasional sight of the people, as they might be inclined to drop in; and if a Native Gallery were arranged for the best productions to be purchased as they appeared, and the House of Lords adorned with a series of grand works referring to the British constitution; then would the government do a real good to taste, refined pleasures, and design for manufactures, such as would entitle them to the everlasting gratitude of the nation.

On the other hand, if all the ancient boroughs of the land have been obliged to bend to the call for reform; if the crown itself has been obliged to yield up the old House of Commons; if the salaries of our great officers of state have been cut down without complaint; if pensions bestowed equally for merit or for vice, are to be rigorously sifted; if the queen herself has been obliged to permit her expenditure to be questioned; are a set of men without a lease of their House, or charter for their existence, without any one legal claim to be considered as a constitutional body—are *they* alone to brave the Commons and the Lords, are *they* alone to defy and deny reformation, taking their stand upon their utter insignificance? If so, it will be an anomaly in the character of the British Legislature, which, in after times, will only be remembered as a proof of imbecility and folly, if not of something still worse than either.

General deductions.

We have now gone through the great leading schools of Italy, France, Germany, Flanders, Holland, Spain, and Britain, and we have taken those names only, which may be considered as leading an epoch; so that, in such a system, many eminent men must of necessity have been omitted. From the Petersburg, Copenhagen, Berlin, or Stockholm academies, no great genius except Thorwaldsen has yet appeared.

Was Italian art equal to Greek art? Certainly not. In the finest Italian there is a want of beauty in form and face, which Greek art could only supply. Poussin said, that Raffaelle was an angel in comparison with the moderns, but in comparison with the ancients he was an ass. Though this is vulgar, it is in our opinion true. The ancients combined the Venetian and Roman schools; they considered form, colour, light and shadow, surface, expression, and execution, as all equally component parts of imitation, and all necessary to perfect that imitation which was to be employed as an instrument to convey thought. They combined the drawing and the colouring of the two great Italian schools; as these illustrious schools tried to do when they found out their error, in pursuing one at the expense of the other.

Reynolds, from the defective practice of each school, laid it down that colour was incompatible with high art; and he also laid it down that the ancients could not be great painters in a *whole*, though they might be in a *solo*, from the pictures on the walls of Pompeii. We do not wonder at any man so concluding before the Elgin marbles arrived; but we do marvel at Reynolds taking the works in the private rooms of a provincial Roman city as justifiable grounds on which to estimate the extent of genius in Greek art at its finest period, five hundred years before. But after all, what are the pictures of Pompeii? Very probably the designs in Pompeii would rank about as high in ancient art, as the designs of our paper-stainers in Bond Street would in British art. The pictures at Pompeii are no more criteria of what the art of Apelles and Polygnotus really was, than any sculpture dug up there would be a criterion of what the art of Phidias was. Reynolds undervalues contemporary praise; but Quintilian, Cicero, Horace, Juvenal, Strabo, Polybius, and Pausanias, Valerius Maximus, Ælian, and Pliny, were not contemporary; and, therefore, the praises of Aristotle or of Plato who were, justify the enthusiasm of those who were not.

Since the works of Phidias arrived in England, we have positive evidence that the Greeks knew the great principles of composition and grouping, as applied to painting; because the metopes are instances of arrangement of line, that will do exactly in a picture, if the Laocoon had not shown it before. Having now seen the Elgin marbles, which the Greeks estimated as their finest work, and having found all the enthusiasm of the ancients more than borne out, have we not a justifiable ground to argue from what we *do* see in one art, that what we do *not* see in another was equally excellent? Will any man, after seeing the Theseus and Ilyssus, doubt that the ivory Minerva and Olympian Jupiter were equally, if not more beautiful? Why should the ancient critics have faith placed in all their decisions except those on painting? Why should they lose their perspicacity of understanding only when they talked of this art? After Aristotle and Plato had admired the Minerva inside the Parthenon and the sculpture outside, they might admire the pictures; and nobody will deny them the power of making comparisons. Had the Elgin marbles and the old antique never been seen, would not the same sophistry have been put forth to question the merit of their sculpture as well as to deny that of their painting? "Nothing can be more perfect than Phidias," says Cicero. "You cannot praise him enough," exclaims Pliny. "He made gods better than men," says Quintilian. "He was skilful in beauty," says Plato. You believe all this, because you cannot contradict it; but the moment Quintilian says, "Zeuxis discovered light and shade; Parrhasius was exquisite for subtlety of line; Apelles for grace; Theon for poetical conceptions (φαντασιας); Pamphilus for mathematical principle; Polygnotus for simplicity of epic arrangement in colour and form; Protogenes for finish;"—when Pliny commends Aristides for expression, and Amphion for composition, and speaks of the grand assemblage of the gods by Zeuxis, as well as the single figures of Apelles, Reynolds

replies, "Admiration often proceeds from ignorance of higher excellence, I will not believe contemporaneous praise." We answer, that admiration oftener proceeds from knowledge of superior excellence; that the most enthusiastic admirers of Greek painting were not contemporary; and that Reynolds' conclusions against Greek art are founded upon data which are altogether erroneous.

Taking the Elgin marbles as a standard, we cannot but suppose that the finest great works of Greek art had the finest drawing, the most wonderful knowledge of form, the finest grouping, and the finest expression. To this may be added, colour from Pliny, light and shadow from Quintilian; perspective from Vitruvius; fore-shortening, dwelling on the leading points, like Vandyke, and touching off the inferior parts from Plutarch; and, what was never suspected, execution with the brush from Horace, on the leading principles of the Venetians. The French used to affirm, that David's principle was the same as that of the Greeks, namely, obtruding on the attention all the superior parts, and neglecting the inferior ones. In Plutarch's life of Alexander, at the very beginning, he describes to his readers his plan of writing his lives, and concludes with this extraordinary passage: "Like painters that paint portraits, who dwell on the face, caring little about the remaining parts."[1] His meaning is, that he would, like painters, dwell upon the leading points in the history of great men and lightly touch off the inferior parts. Could he have made such an allusion for the general reader, if this had not been the practice of the great Greek painters? Again, Horace says in the art of poetry,

> Ut pictura poesis erit; quæ si *propius* stes,
> Te capiat magis; quædam si *longius* abstes.

That is, some pictures are painted for a close, others for a distant inspection. The former, of course, are wrought up; but in the latter, the leading points are seized by a touch, leaving the atmosphere to unite. As to mere handling of the brush, this is conclusive, and shows that it was done on the same system as by Titian, Tintoretto, and Velasquez. Reynolds has quoted Pliny's description of glazing, that is, spreading a thin transparent tint over the crude colours to bring them into harmony, which was the practice of the Venetians. Another passage completes the conviction: "Adjectus est *splendor*, alius hic quam lumen, quem quia inter hoc et umbram esset, appellaverunt *tonon*." (Lib. xxxv. c. 5.) "Now was added *splendor*, a different thing from light, and which splendor, because it was between light and dark, was called *tone*." To the mind of an artist this is exquisite in distinction; first, the colours on the tablet were fresh, unmixed, and raw; then was spread over a transparent glaze to take off the crudeness; then this crudeness being reduced, it was called *splendor*, glowing, rich, and deep, but different from *light*, which is cold and white; and this splendor the Greeks called *tone*, as both the Venetians and the British denominate it. But the circumstance of tone being the characteristic of any school, is proof of an age for colour.

As to their perspective, let any man consult Vitruvius, (lib. vii.). Agatharcus composed a treatise on the subject; and from this hint, Democritus and Anaxagoras wrote on perspective, explaining in what manner we should, in appearances agreeable to nature, from a *central point* make the lines to correspond with the eye and the direction of the visual rays, and render the scene a true representation of buildings, that those objects which are drawn on a perpendicular plane, may appear some retiring from the eye, and some advancing towards it. From a passage in Plato, it is clear, that the Greeks carried the illusions of theatrical perspective to a much greater extent than, in consequence of some bad landscape discovered in Herculaneum has been supposed."[2] That they foreshortened is clear, from Pliny's description of a bull coming out of a picture frontways.

The inferences to be drawn from all this, are, first, from Plutarch and Horace, that the Greeks had execution like Titian and Vandyke; secondly, from Pliny, that they must have had fine colour (lib. xxxv.); thirdly, from Quintilian, that the principles of light and shadow were understood (lib. xii.); fourthly, from Vitruvius (lib. vii.), that they had sufficient perspective to make objects recede and advance; and fifthly, from the Elgin marbles, executed by and in the school of Phidias, who was first a painter, that they had expression, form, and composition. If the three most important can be proved, as they can, and colour, light and shadow, and execution, more than inferred; what right has an eminent English portrait-painter, grossly deficient as a painter of high art, to assert, that they could not be great in extensive compositions, because the painted walls of a provincial city gave no evidence of such excellence in their private houses? forgetting that these were executed five hundred years after the eras of Greek perfection, when Greece was a Roman province, when her cities had been sacked, and her art was talked of as a wonder that had passed away.

Conclusion.

The principle laid down for high art has been, that the lower addresses the eye and the higher the mind, and that the union of the two was incompatible; whereas, the true principle surely is, that both styles address the mind through the eye, but in different ways; the lower walk making the imitation of the actual substance the great object of pleasure only; and the higher walk making imitation the means of conveying a beautiful thought, a fine expression, or a grand form with greater power. The imitation though more abstracted must not be less real or effective. Sir Joshua Reynolds affirmed, that the look of truth which fine colour, light and shadow, and reality gave, distracted the eye from the poetry of the conception or the depth of the expression. But it may be maintained, that in an art, the elements of which are laid in imitation, the beauty of an expression, the grace of a motion, and the sublimity of a conception, will be *increased* in proportion to the look of *reality* in the objects; and the practice of all the great Greek painters, and of Raffaelle and Titian in their latter works (the Transfiguration, and Pietro Martyre), proves that they had come to the same conclusions. Yet Reynolds, with his usual sagacious policy, appears to waver lest he should be wrong. "There is no reason," says he, "why the great painters might not have availed themselves with caution and selection of many excellencies in the Venetian, Flemish, and Dutch schools; there are some not in contradiction to any style, a happy disposition of light and shade, breadth in masses of colour, the union of these with their grounds, and the harmony arising from a due mixture of hot and cold tints, with many other excellencies which would surely not counteract the grand style." And then he concludes that "a subdued attention to these excellencies must be added to complete a perfect painter." This is all that is contended for. So far from these excellencies being incompatible with grandeur of style, they are essential to it, they are the elements and the basis of it, they cannot be left out, or if they are, the style is deficient, absurd, and not founded in nature. There is not the least doubt that the Greek painters considered the power of imitating natural objects by colour, and light and shadow, as necessary and requisite in preparatory study as drawing or composition; and the greatest painters in the grand style in ancient Greece, were

[1] —— ὠσπερ ουν οι ζωγραφοι τας ὁμοιότητας ἀπο του προσωπου, ἀναλαμβανουσιν, ἐλαχιστα των λοιπῶν μερων φροντιζοντες. ΑΛΕΞΑΝΔΡΟΣ.

[2] *Theatre of the Greeks*, p. 262, 3d edition, Cambridge.

just as capable of imitating still life as the possessors of it now.

It may, therefore, be fairly deduced, that the Greeks possessed all parts of the art, and none particularly to the exclusion of others; that, therefore, all parts of the art, in due subordination, may be considered as essential to an artist of the highest walk, as also in the more humble department; and that the system of Reynolds, which excludes identity and power of reality from judicious imitation of the objects painted, combining colour and light and shadow, as well as expression and form, is *false*, and should be exploded from all systems where art is considered as a matter of importance to the dignity or glory of a nation. (B. R. H.)

Supplemental remarks.

Since the foregoing article was written not more than twelve years have passed, but in that short space the art of painting has undergone such changes in theory and practice that many opinions then unhesitatingly proclaimed, and received without a doubt, if propounded now, would be thought ridiculous; for, while it may be confidently stated as an admitted fact, that modern art in this country is at present much more generally appreciated, and receives far higher encouragement than it ever did at any former time, it is equally true that this favourable state of matters has arisen under a system founded on principles in many respects directly opposed to those that not many years ago were generally laid down as indisputable. In place, then, of altering the foregoing article by striking out or modifying such statements as were based on notions formerly held regarding art, but which are now untenable according to those now entertained, it has been thought a preferable course to endeavour to point out some of these changes, and to show how they have operated; and so, to some extent, the soundness of the opinions given in the first portion of this article will be tested by an examination of the practical results of the art of painting at the present day.

Within these few years several questions that agitated the British school from its commencement have received a trial, and to a considerable extent may be considered as settled. Art, therefore, having greater freedom of action, has assimilated itself more to natural tastes, and opened resources of pleasure and enjoyment that at one time, from notions now deemed false and pedantic, were not thought to be within its proper province. The invention and rapid development of photography within this period has also operated powerfully in the settlement of these questions.

The following were the chief points so long and so vehemently put forward:—1. It was maintained that art would never reach a high position in this country till it was patronized by the church and the state; that our art was crushed by the Reformation; that pictures were excluded from churches by bigotry and ignorance, for as they tended greatly to excite devotional feeling, they might be beneficially employed in religious services; that the old masters of Italy, Germany, and Spain were always engaged on Scripture subjects; and that the British school of art never would rival or approach the schools these great painters founded till its artists received similar employment. 2. It was pointed out that little or nothing was done publicly for the encouragement of art; and it was said that the only way in which this could be carried out was by government ordering the execution of large works illustrating the history of the country, such works to be placed in palaces and national buildings, to which access should be afforded to the public. 3. Fine-art academies, of which the Royal Academy is the exemplar, were strongly condemned. The opponents of academies declaimed loudly against such bodies asking and receiving grants from government in the shape of money or accommodation for their schools and exhibitions. "Are they not," they said, "close corporations for accumulating funds with which they pension aged members or the families of deceased members? while in their exhibitions they appropriate the chief places, favourably to display their own works, and give only inferior situations to the works of artists who have not had the good fortune to have been elected into their body. Academies and exhibitions ought to be put down."

As before stated, all these questions may now be considered as in a great measure set at rest. At the present day paintings for churches used by Protestants are rarely commissioned; and though the decoration of churches engrosses much attention, painting, except in the limited and conventional mode as applied to glass for windows, is never resorted to; the unsatisfactory result of the efforts lately made by government to encourage art by competitions for frescoes and historical paintings has set at rest the point of government patronage of art; and academies and exhibitions never were so popular and flourishing as they are at present.

Government patronage of high art.

Glancing hurriedly over the pages of the history of the British school from its commencement, one cannot fail to notice how much the founders deemed it an almost incontrovertible principle, that encouragement of art by the church or by government was necessary for the growth of a national school in Britain. Sir Joshua Reynolds spent much valuable time in inculcating this principle and in trying to prove it practically. Barry devoted his whole life to what has been styled high art; and from his time till within a few years of the present period, this has formed the theme of numerous writers on art, and has guided the practice of various British artists, the chief among whom were Benjamin West, Stothard, Hilton, and Haydon. The last of these saw accorded in some measure what they, and he himself, the most eloquent and energetic of them all, had so long contended for,—namely, a trial (with reference to the Houses of Parliament) given by the government to their cherished notions, that church or state employment was the only true patronage for art; and he, the only remaining representative of these opinions, was at last borne down by bitter disappointment at finding that the benefits to art so long and so confidently predicted were not realised by that trial.

It is manifest that the result of this trial has been beneficial to art. The slavish adherence to rules and precedents founded on what has been done in former ages, without consideration of the important fact, that the wants and the enjoyments of the people of these past ages were very different from those of the public now, has been abandoned; and art now flows for the use of the public in its natural course, unobstructed by those impediments to the vigour and originality of a national school.

No doubt it was natural that at the foundation of a new school the rules and precedents of celebrated schools in former times should be greatly relied on; childhood requires support, and youth needs guidance and restraint. And this accounts for what is often noted as extraordinary conduct on the part of Reynolds,—namely, his having constantly impressed on artists the necessity of attending to the rules of the old painters, and having held up the style of the Caracci, and of Ludovico in particular, as a safe model for the artist to study. He formed this notion from the consideration that the style of the Caracci was based on rules and precedents; and therefore he reckoned their works as well fitted to exemplify what he reverenced. It has been most unjustly alleged that Sir Joshua strongly urged his brother artists and his pupils to follow out historical painting on a grand scale, or on what were called high-art principles, not from his having any faith in those notions himself, but from the unworthy motive of diverting their attention from the field of portrait-painting, where he gathered riches and

fame. This is absurd; he is entitled to full credit for the sincerity of his opinions. As a member of a school at that time in its infancy, when lecturing and theorizing on art, he was to a great extent trammelled by being obliged to refer to the maxims and examples of ancient schools; for it was by reference to the works produced in them that he was to direct theoretically the members and pupils of the rising school. In this respect he was not able, or had not confidence enough, to go much beyond the opinions of his day. And we cannot doubt his sincerity; because he misspent much valuable time in trying to put these very theories into practice in the form of large historical compositions and allegorical figures,—for example, those executed for the windows of New College, Oxford;—and he freely offered still further to waste his talents, and paint a Scripture subject to be placed in St Paul's. As a writer or lecturer on art, Sir Joshua was no doubt the first in his time; but his theories were just the theories adopted generally by the world at that period,—clearly and elegantly given forth, and mixed here and there with such opinions bearing on the practice of art as only an able artist could enunciate. But it was by his pictures that he gained a name for himself, and contributed so greatly to the glory of the English school. The opinions in his time inclined to a certain style of art as alone worthy of notice; he was carried along by these notions to the extent, not only of theorizing on them, but of wasting time in practising them; but his genius, as it were, in spite of himself, carried him beyond what, walking by rule and measure, he thought the proper line, and he executed works which, though then little esteemed in comparison with what were called his historical compositions, are those on which his fame now chiefly rests. What the public now prize are his portraits,—admirable embodiments of distinguished men and lovely women,—and his simple and natural representations of the freshness and purity of childhood. His laborious efforts to emulate the Caracci in depicting the "Death of Dido," or the "Continence of Scipio," attract but little sympathy now; and, as property, would be valued far lower than his portraits of Lord Heathfield or Nelly O'Brien, or his "Girl with a Mousetrap," "Strawberry Girl," or "Shepherd Boy." It is recorded that the former works cost him many months of toil and trouble; that the latter were hit off with little effort. The same rules that hampered but could not restrain the genius of Reynolds, operated, however, very differently on men like Barry and others, who were gifted with considerable talent, but not genius to give them courage to step out of what they looked on as the circle of established art. Barry was ardent, and had high aspirations and much determination and self-will. His friends, and he himself, mistook these for the elements of great genius; but what was the result?—works that, looked on in the most favourable way, must be pronounced to be merely imitations or reflections, or as got up on the model of those executed in countries at former periods by painters who very probably responded to, or worked in unison with, the feelings of their own age and country, but whose productions are chiefly to be distinguished by qualities which were not cared for, and elicited no sympathy from the English public in Barry's time. The dilettanti and the writers on art of the period vehemently maintained the necessity of working as the old masters worked; and the English school, being then but recently instituted, and most of the artists of the time having been indoctrinated with these notions, could not at once cast them off. Indeed, men like Reynolds and Gainsborough, and even Hogarth, with all his originality, could not entirely free themselves from such influences; but their genius eventually, by the works they executed, carried them beyond every such bias. Since then the English school has been getting gradually out of these trammels, and assimilating itself more and more to the tastes and feelings of the times. Wilkie, Turner, Raeburn, Bonington, Constable, Etty, and many others, and their successors, the artists of our own time, are producing, and have produced, works of such importance that the artists of the British school, in place of looking on the works of the old masters as unapproachable examples, can show works, some rivalling those of the old masters in many of their best qualities, and others executed in successful opposition to rules and principles formerly considered as beyond dispute.

It is remarked in Cunningham's *Lives of the British Painters*, that Reynolds "had amassed a fortune, and obtained high fame in abiding by the lucrative branch of the profession, whilst he (Barry) had perched upon the unproductive bough of historical composition, and had not been rewarded with bread." But it is needless to occupy more time in showing that Reynolds, when he talked learnedly on high art, did so honestly and sincerely, from convictions formed in his mind by education and imbibing the opinions of those with whom he came in contact, and not for the purpose of leading Barry away from that road along which he himself was impelled by his genius, in spite of all conventional theories. What had he to fear in competition with Barry? In his own proper walk he ranks with the greatest artists the world has produced. Among the *chefs d'ouvré* in the Manchester Exhibition by Titian, Rubens, Vandyck, and Velasquez, were there any superior to Sir Joshua's "Nelly O'Brien?" In his day poor Barry, perched on his "unproductive bough," doubtless looked down with great contempt on such works as Sir Joshua's "Nelly O'Brien" or "Robinetta," and consoled himself with the reflection, that posterity would do justice to his claims, and confirm the plaudits of the scanty knot of dilettanti admirers who gazed up at him. And all the painters since Barry's time who have perched on the same bough have experienced similar treatment, varied merely in degree. West had a larger number of admirers than Barry; among these was George IV., who commissioned him to execute various works; and the artist acquired considerable riches and a certain temporary popularity, but this barely lasted his lifetime. His works are held in little estimation now. Some of Fuseli's fanciful compositions, when transmitted through the medium of engraving, attracted for a time a degree of notoriety. Stothard's fame will rest entirely on his designs and small compositions. Etty can scarcely be classed among those who maintained the claims of high art; his fame rests on other grounds,—namely, his having most powerfully aided in increasing the strength of the English school in an art element that has always entered largely into it; and his works now rank with those of the greatest colourists. Haydon may truly be considered the man who, by his paintings, and especially by his writings and lectures on art, made the chief efforts to uphold those notions as to art, and government patronage of art, which led to the trial and settlement of the question. There can be no doubt that his energetic appeals had great influence. The extraordinary facilities afforded by the erection of so vast and magnificent a pile as Westminster Palace and the Houses of Parliament were taken advantage of by government, and a fair trial was given to the artists of the country. But though there was no lac' of talent displayed, the results have not justified expec' tions. It is now seen that all that government will do, or can ever be reasonably expected to do, must weigh as nothing in comparison with the encouragement annually given by the public, which is patronage of the healthiest kind, and rapidly increasing year by year; that painting on walls does not suit the style of the buildings in this country, being often at variance with those notions of comfort and convenience which prevail in our arrangements; that fresco-paintings encounter great risk of damage, from their surface affording so slight a resistance to anything coming it contact with it,—those on the walls of the

arcades of the public gardens at Munich, for instance, require so often to be patched up with tempera colours, that, though only executed about twenty years ago, they can scarcely be called fresco-paintings now. Besides, paintings are objects which bear great value; and in a mercantile community like ours, when money is invested in that way, facilities for disposing of such property are necessary. Few would think of laying out ten or twenty thousand pounds on pictures attached immoveably to the walls of a mansion, while many invest such sums in pictures that are portable; and these investments are often very profitable, while the capital employed may speedily be realized by sale or transfer. The chief arguments in favour of large pictures for public buildings were drawn from the example of foreign states, particularly France. But public taste in this country does not run in a channel similar to that in which it flows in France. With us art is to a great extent domesticated; in France it is government, on whom the people rely for many of their enjoyments, that has generally made use of its services. But now, even in France private employment is preferred by the principal artists to government patronage; they find that they are better remunerated by private purchasers or by publishers than by government. Artists like Vernet, Scheffer, Delacroix, and others, now see that their works of moderate size are eagerly sought after; and it is a great loss to them, not only in money, but in fame, to engage on large government works. Although great numbers go to look at their pictures in public buildings, those executed for private individuals are seen by many more, for they are exhibited all over the world. That the remuneration is greater for pictures of moderate dimensions is proved every day: for example, at the sale of the Duchess of Orleans' collection of modern works of art, a cabinet picture by Delaroche, about 3½ feet by 2 feet, brought L.2300,—more than double the sum paid to him for two years' labour on cartoons for pictures for the church of the Madeline. Government patronage, too, often involves elements distasteful to a high-minded man conscious of the position his talents entitle him to. For instance, when Delaroche was labouring in Rome at his cartoons for the Madeline, by court influence another painter was associated with him in painting this church, although there had been an understanding that the whole work was confided to Delaroche. Indignant at such treatment, he threw up the commission, and returned the money that had been advanced to him when he was engaged on the cartoons. Thus was the labour of two years of a man of high talent entirely lost. In that time he might have executed several works of great importance, which, exhibited in various countries, and circulated by engraving, would have yielded him money and reputation, besides spreading the taste for art. Even in France it seems likely that art will soon rely very little on government support.

The notions of Haydon and others, that the future of art in England depends on government employment for artists, and that if pictures are painted for private patrons only, they will sink to the level of mere decoration, will be assented to when it is admitted that no artist can be a great painter who does not paint subjects from Scripture, heathen mythology, or Greek and Roman history—the figures either nude or in conventional drapery, and at least 7 feet in height; and that the only competent tribunal for deciding on works of art is a committee, the members of which are selected on account of their rank, official status, or reputed dilettantism.

Academies and exhibitions.

The cry against academies, and against exhibitions, which are the chief features and supports of academies, has, of course, in a great measure gone down with the one that was simultaneously raised,—namely, government patronage and high art. Can anything better be devised than the open arena of an exhibition, on which every artist competes before, and is judged by, the public? No doubt, it may be said, this would be all very well if every one had the same chance; but some works are hung where they are seen to great advantage, while others are so placed that they cannot be fairly appreciated. But really, is there any human institution that is perfect? Every work cannot be put in an equally good place, and some sort of classification is necessary. Of course, the best works should have the best places; but difference of opinion may arise here. The works of artists who have attained a reputation will naturally first be attended to; that is but fair. These artists, in their early days, were obliged to struggle for their position. But is it not evident, that to the rising artist the opportunity of having his works in a public exhibition is an advantage of the highest kind; while to the more advanced artist it must operate as a spur to continued exertion. If the works of the former evince improvement, they will gradually make way; if those of the latter become less attractive, they must give place. In exhibitions public opinion is a ruling element. In one of his lectures Haydon gave a graphic account of a meeting in Wilkie's apartment on the morning of the day on which the exhibition of the Royal Academy was opened. On the previous day, at the private view, Wilkie's picture of the "Village Politicians" had been very much noticed; large offers were made for it; and a most favourable criticism had appeared in the newspapers. Haydon had seen the criticism, and had rushed to Wilkie's to inform him of his success. The road to fame and fortune was now opened to the hitherto unknown artist; and how? By means of the exhibition. Wilkie's picture had been commissioned by a noble patron; when nearly finished, it had been shown to this patron, but he had demurred to the price. If there had been no exhibition to which Wilkie could send his picture, he probably would have been obliged to have lowered his price; at all events, he would only have been paid grudgingly the very low sum he asked; and though he had been fully commissioned to go on continually at similar prices, he would barely have made enough to maintain himself in the small lodging he then occupied. But by the exhibition he was enabled to bring his productions before the public, contrasted with the works of established artists who were handsomely remunerated for their pictures; and by this comparison the high qualities of Wilkie's picture were fairly estimated, and a much higher value put on and offered for it than he had ventured even to think of. In opposition to all Haydon's objections to academies and exhibitions, could any argument stronger be brought forward than the simple narrative of the above anecdote? In truth, it is by our annual exhibitions of modern works that art is maintained in force in this country; for they are in every way calculated to lead to the best of all results—originality, variety, and adaptation to the feelings and requirements of the age.

But though it cannot be denied that art is in a prosperous condition, and that this state of matters has arisen just at a time when public exhibitions and academies are more encouraged than they ever were; yet by some people academies and exhibitions of modern art are opposed and decried. It is not very likely that these institutions will be at all damaged by such assaults; they will probably be benefited by them. Their strength and importance will thus be made still more evident; and by those who conduct them reforms and improvements will be adopted to make assurance doubly sure. Haydon, and objectors of his class and time, denounced academies and exhibitions because they interfered with their favourite plan of government patronage; but when it came to be seen that government commissions were as nothing compared with what was expended on art by the public, these objections fell to the ground. They also opposed the Royal Academy for reasons of a personal kind. They felt sore that they were not elected members of that body. No doubt Haydon, John Martin, and some others of that time,

possessed higher qualities as artists than many who shared the honours and privileges of academicians; yet, on the other hand, there were many other members of the Academy, who, as artists, ranked much above Haydon and Martin, who submitted to the ordeal of election, and did not get up a feeling of indignation because they were not elected on their first application. It is scarcely to be expected that the academicians, who are the electors, are never to err in their judgment. Judges and juries sometimes err; but, with all its drawbacks, to this mode of election most of the greatest artists of this country have submitted. No better mode has yet been devised,—at least none better has been successfully practised; at all events, it is a preferable mode to that of allowing a competitor to be the judge of his own claim, which, in plain words, is just what the objectors demanded.

Cognoscenti.

Objections now-a-days are raised chiefly by cognoscenti,—namely, such as consider themselves, by education and taste, better qualified than artists to decide on art, and all matters that bear on it; but the flimsy attacks of such can cause but slight annoyance. The elements necessary to give a title to be classed as an art-connoisseur in the days of good old Sir George Beaumont seem to have been various and important. He painted landscapes, he had formed a collection of ancient pictures, and he commissioned modern works. But now-a-days the title of connoisseur is assumed on very slight qualifications. There are few amateur painters now. The uselessness of such an occupation is demonstrated by photography, for since that discovery, no sketchy or conventional mode will be tolerated as a representation of nature. If a man is to paint, he must devote his life to it. An hour snatched from business or pleasure for such a purpose is just so much time thrown away. Hence many who have that sort of liking for art that impels them to dabble in it,—pushed aside by the photographer, have no vent for their tastes and feelings but in criticising artists and telling them how to paint. And as a glance at some of the continental collections, and a few months' residence in Rome, are thought undoubted qualifications, this class of connoisseurs is large, and supplies most of the objectors to modern art and modern exhibitions. Again, touching the title to connoisseurship on the ground of possessing a collection of ancient pictures, the acquisition of genuine works of celebrated painters of former schools is within the reach of few. When such occur for sale, they are purchased for public galleries, and nations compete for them. A sum exceeding L.20,000 was lately given for one specimen of Murillo for the Louvre, and more than L.13,000 for a work by Veronese (a purchase that has received the full approval of the public) for the National Gallery of London. The ridiculous notion that possesses some people of a chance of purchasing at sales Correggios, Rubenses, &c., of marvellous value, at marvellously small prices,—in truth, a species of gambling,—is fast going out; and the facility with which picture-dealers can supply the most extensive demands for works of the old masters has led purchasers, by making a very simple calculation with reference to the average ages of painters, the time necessary to paint a picture, and the number of works ascribed to every artist of name, to arrive at the conclusion that not one in a hundred—in some instances, perhaps, not one in a thousand—of the pictures ascribed to old painters could have been executed by them. Hence, in these times of practical men and measures, the possessor of a collection of the old masters is not, without considerable scrutiny and hesitation, admitted to rank as a connoisseur.

Estimation of art by the public.

The patronage that Sir George Beaumont and other kindred spirits bestowed upon British art, though highly honourable to them, was very different from that now accorded by our merchant princes. In the early days of art in this country our artists scarcely knew their own powers. If they ventured to compose works in any way differing from those of the old masters, they were not only accused of heresy, but took guilt to themselves. Sir Joshua Reynolds held up Ludovico Caracci as a model, though he himself was a much superior painter. Wilson constantly referred to Claud; and before he died the name of Vandyck was among the last words Gainsborough uttered. At the beginning of the century this feeling still prevailed. Patronage of modern art was only hesitatingly given, and occasionally the patron accompanied the commission with directions how to execute the work required by him. It is recorded that Sir George Beaumont deemed no landscape completed till a brown tree, in the manner of the ancients, was introduced, and could scarcely preserve his equanimity when Constable bluntly questioned the soundness of the maxim. Now, however, the extent and value of the various collections of modern art in London and the other emporiums of manufacture and merchandise is quite marvellous. The collections of Wells of Readleaf; Barnard; Arden; Bicknell; Ditton of London; Miller of Preston; Eden of Leatham; Newsham, Preston; Fairbairn, Hull; Ashton, Manchester; Naylor, Houldsworth, and J. Miller, Liverpool; Gillot, Birmingham; Houldsworth and Dennistoun, Glasgow; Graham, Lancefield; Wilson, Banknock; Caird, Greenock, are all very important, several of them of immense value. And these and similar collections for the most part have been formed, not with the view of qualifying their possessors to be ranked as connoisseurs,—though certainly the frequent exercise of judgment must lead to knowledge,—but on the sound principle of making art the means of imparting to themselves and their friends pleasure of a highly intellectual kind; while from the exercise of those large but keen views that enter so much into the mercantile character, the sums invested on art-property are in most cases at any time capable of being turned to good account. Thus the great vigour displayed by art in this country, and the enormous patronage bestowed on it by the public within these few years, must be set down to the circumstance of its being now admitted by artists, and the public generally, to be a settled principle, that in a community socially and politically constituted like ours, art cannot and ought not to depend for encouragement on government patronage. Freed from the notions of government employment that obstructed so many of our painters some years ago, the artist can now give his whole attention to produce a work that will interest the public, from its attracting sympathy by touching the feelings, or by recalling and illustrating past events of importance, or by perpetuating momentous occurrences of the times, or by placing before the eye scenes of beauty or grandeur; and when this is done, he knows his efforts will not pass unnoticed, for in the exhibitions now opened in all our large cities, his productions, if up to a certain standard, will be admitted and brought before an assemblage eager to find out works evincing talent, and, by praising and purchasing them, to reward the artists by whom they are executed.

Pre-Raphaelitism.

What is called the pre-Raphaelite movement is one of the results of the change in the notions of our artists regarding the study of the old masters and high art, though it must be admitted that the invention and development of the science of photography greatly aided it.

The question so frequently put,—namely, What is it that distinguishes the style of art called pre-Raphaelitism from other styles of art?—is answered in so many different ways that it is manifest the ideas of most people regarding it are quite undefined. Some say that it is a style of art modelled on that of the artists who painted before the period of Raphael, in whose time the classic element which shortly before had been superinduced on the Gothic, had entirely superseded it; that though by this, art gained many high qualities, it lost several of greater importance, particularly truth

and simplicity; and that pre-Raphaelitism aims at returning to the purity and simplicity of the style of these old painters. Others allege that it is an attempt to represent nature as truly and faithfully as the means employed will allow, neither omitting, nor adding, nor changing anything. But the explanation oftenest given is, that it means a style of painting involving great labour and careful and minute execution, or what, technically speaking, is called *finish*.

Now, though in each of these attempts to define what pre-Raphaelitism is, some of the elements that enter into it are pointed out, yet by none of them is a complete explanation given of it, while a combination of all these definitions would involve contradiction. For instance, the very name the followers of this style have adopted implies an assimilation to the style of the art before Raphael's time; but though in the works of many of these old painters we find several high qualities, a very close resemblance to nature assuredly is not one of them. We no doubt see that an effort is made to attain it, and that may be pointed at as a sufficient motive; but again, these old painters knew nothing of breadth, and not much of light and shadow; and pre-Raphaelites constantly aim at these qualities (particularly the latter) in their works. Then, as to its being merely a faithful representation of what the artist sees, that would be putting his work on a level with one produced by machinery; this notion is evidently based on exaggerated ideas raised by too much reliance on photography, which, though extremely useful, is only an auxiliary to art. While to make minute finish the distinguishing feature of pre-Raphaelitism would be assigning to it by no means a high position; and, indeed, in the works of several painters we find many of the faults which pre-Raphaelites strongly censure united to very high finish.

But, indeed, pre-Raphaelite art has even already undergone modification; and what has lately drawn forth bitter ridicule from some, and inflated praise from others, is rather an excrescence on a style which is entitled to high praise as one of the many vigorous efforts by which British art, emancipated from the notions and prejudices that so long have clogged it, has established its claim to originality and power.

On reviewing the state of painting in Great Britain, it may be truly said that our artists, freed from conventional rules, having cast aside vain notions of government patronage, and aided by those appliances (photography chiefly) that science has put within their reach, now study nature with the greatest earnestness and success. And the numerous opportunities afforded by exhibitions, of bringing their efforts before the public, rapidly improving in taste and in ability to appreciate and reward art,—has led to such results, that many of the works of the British school, even in our own day, will compete successfully with those of the most celebrated ancient schools that have conferred honour on the countries where they flourished. (W. B. J.)

PAISIELLO,[1] GIOVANNI, a very distinguished Italian musician, was born at Taranto, in the Neapolitan States, on the 9th of May 1741. His aptitude for music having been early remarked, he was admitted, in May 1754, as a pupil of the Conservatory of St Onofrio at Naples. There he received lessons from Durante, and afterwards from Cotunni and Abos. In 1759 he obtained the place of assistant master. He finished his studies in 1763, and the fame of an intermezzo which he then composed, obtained for him an immediate engagement to write two operas for Bologna. The success of these was so great that his reputation at once spread through all Italy. In 1777 he was, at the same moment, offered engagements at Vienna, at London, and at St Petersburg. In June 1777 his opera *Dal finto al vero* was represented at Naples; and on the 25th of July following he set out for Russia. He resided eight years at St Petersburg, where he received a large salary, and composed some of his finest works; among others, his opera *Il Barbiere di Seviglia*. On his way back to Italy, he stopped at Vienna, and composed there twelve symphonies for a large orchestra, and the opera-buffa *Il Re Teodoro*, which contains a septuor that became celebrated throughout Europe. During his stay at St Petersburg, Paisiello had made some changes in his style of composition; and at Rome, in 1785, when he brought out his opera *L'Amor ingegnoso*, he found that his countrymen loudly disapproved of these changes. He then settled at Naples, where he had no rival, Guglielmi and Cimarosa being absent. For the next thirteen years he composed for the Neapolitan theatres, and produced, during that time, some of his best operas. Ferdinand IV. appointed him his chapel-master, with a salary of twelve hundred ducats per annum. In 1788 the King of Prussia invited Paisiello to visit Berlin; but this invitation was declined, as well as a second one to St Petersburg, and a first one to London. In 1797 General Bonaparte opened to competitors the composition of a funeral march in honour of General Hoche. Paisiello and Cherubini each sent a march; and Bonaparte, very unjustly, decided in favour of Paisiello. In consequence of the revolution at Naples in 1799, and of his own political tergiversation, Paisiello lost his royal appointments for two years. Soon after their being restored, Bonaparte, then First Consul, requested the King of Naples to send Paisiello to Paris, in order to direct the consular chapel; and he was accordingly sent thither in September 1802. His treatment by Bonaparte was munificent, while Cherubini was quite neglected. (See the article CHERUBINI.) The opera of *Proserpine*, composed by Paisiello in 1803, was ill received by the Parisians; and this check, and his failing imagination, induced him to request leave to retire, under pretext of his wife's ill health. Bonaparte unwillingly granted the request, and Paisiello returned to Naples and to his former service. Afterwards, under Joseph Bonaparte and Murat, Paisiello retained his appointments until a new revolution reduced him to indigence. He died on the 5th of June, 1816, aged seventy-five years. He was a member of the French Institute, and of the Royal Society of Arts and Sciences at Naples, and was president of the directors of the new Neapolitan Conservatory of Music. It appears that he was excessively jealous of all musical rivals, and that he used unworthy means of intrigue to injure Guglielmi and Cimarosa, and also Rossini, when the latter began his brilliant career. The charm of Paisiello's style consists in sweet and graceful melody, and great simplicity of structure. His compositions were very numerous. He himself believed them to amount to two hundred. In published lists of his works we find ninety operas and four cantatas; an oratorio (*La Passione*), and eighteen masses, requiems, &c.; eighteen instrumental quartets; two volumes of harpsichord sonatas, &c.; six pianoforte concertos; funeral march for General Hoche; a collection of figured basses for the study of accompaniment. (G. F. G.)

PAISLEY, the principal town of Renfrewshire, Scotland, is finely situated on the banks of the White Cart, about 3 miles S. of the River Clyde. The ancient and principal part of the town occupies the summit and slopes of a beautiful declivity, the eastern base of which is washed by the

[1] Dr Burney, in his *Tour* and *History*, Signor Perotti, in his *Dissertazione*, and some other writers, spell the name "Paesiello."

river, which divides the burgh into two parts, that on the east side being styled the New Town, from its more recent erection. Paisley is generally considered as the ancient *Vanduara* of Ptolemy, and as having been a Roman town or station during the presence of these invaders in the northern part of Scotland. As late as the beginning of the last century, considerable vestiges remained of a Roman camp on the western side of the hill on which Paisley is built; but these have long since been obliterated by the progressive extension and improvement of the town. The latitude of Paisley is 55. 51. N., and the longitude 4. 26. W. The climate is temperate, but humid. In former times infectious diseases were of rather frequent occurrence. In 1645 a pestilence committed great ravages in this place; and in 1765 dysentery prevailed to an alarming extent. In 1771 pleurisy carried off numbers of the inhabitants; and virulent influenza has visited it at various times. Paisley, however, has never been considered unhealthy; and the registrar-general's returns for the years 1855, 1856, and 1857, show, that in regard to mortality it occupies a medium position among the large towns of Scotland. During these years the rate of mortality in Paisley has not been so high as in Greenock or Glasgow; it has been very nearly the same as in Dundee, and it has been higher than in Aberdeen or Edinburgh.

Whether the Roman town or station called Vanduara was a place of any size or importance is unknown. A cloud overhangs the history of Paisley till about the year 1163, when Walter, the first Stewart, founded a monastery on the eastern bank of the Cart, opposite to what is now termed the Old Town of Paisley. At this period there does not appear to have been a village or hamlet, however small, in existence; but the protection which the monastery afforded in those rude times, and the multitude of pilgrims, travellers, and persons of distinction who frequented it, gradually induced a population to assemble in its vicinity; and a village of some extent made its appearance on the western bank of the river, and began slowly to clamber up the gentle slope of the hill on that side. In 1220 the monastery was elevated to the dignity of an abbey, and many valuable privileges were subsequently conferred upon it by the Pope, and by its founder and successive patrons. Its jurisdiction and revenues were very extensive, extending to, and being derived from, localities at a great distance; its abbots were commonly men of the highest family connections, and appear frequently as prominent actors on the stage of Scottish civil and ecclesiastical history. After the Reformation, the revenues and privileges of this ecclesiastical establishment were bestowed upon Lord Claud Hamilton, and have since become the property, though greatly reduced, of the noble family of Abercorn. A considerable part of the ancient abbey still remains, and is in excellent preservation. The skeleton of a beautiful window, 35 feet in height by 18 in breadth, almost the only fragment of the more ancient part of the building, has been much admired for its size, lightness, and fine proportions. The external architecture of the remaining portion is perhaps scarcely equal to that of some other ecclesiastical edifices in Scotland; but the appearance of the nave, which is occupied as a parish church, is grand and striking in no ordinary degree; and some few fragmentary remains of the old monastery exhibit fine specimens of the purest Gothic. Before the accession of the Stuart family to the throne of Scotland, their burying-place was in the abbey; and even after that event two of its members were interred there, viz., the queen of Robert II., in 1387, and Robert III., in 1406. The tomb of Marjory Bruce, daughter of Robert I., is still to be seen in the famous sounding aisle, now occupied as a burial-vault by the Abercorn family.

Notwithstanding the wealth and manufacturing importance of Paisley, it is only a burgh of barony; but its privileges are so very considerable as almost to equal those of a royal burgh. Previously to 1770 the burgh had a voice in the election of a member of Parliament for the county. Now, by the Scottish Reform Act, Paisley sends a member to represent it in Parliament. The constituency in 1857 was 1349. Formerly the government of the town was vested in a provost, three bailies, and seventeen councillors; but by the Scottish Burgh Reform Act there are now a provost, four bailies, a treasurer, and ten councillors.

In 1553 John Hamilton, the last abbot, conveyed by a deed the revenues and privileges of the abbacy to Lord Claud Hamilton, then a child of ten years of age. He was afterwards deprived of the latter on account of his adherence to the fortunes of Queen Mary; but in 1591 they were restored, with the title of Lord Paisley. In 1653 the second Earl of Abercorn disposed of his interest in the abbacy to the Dundonald family; and in 1658 the magistrates and council purchased this superiority. Since that time Paisley has held directly of the crown. In 1857 the real annual rent of all the property within the burgh was L.99,628.

The topography of Paisley and its vicinity is not very remarkable. Previously to the year 1736 the whole of this district was included in one parish, known by the name of the parish of Paisley; but since that time the burgh has been divided into three parishes—the High, the Middle, and the Low. The Abbey parish now comprehends the New Town, which, with a trifling exception, is separated from the burgh by the River Cart, and the populous villages of Johnstone, Elderslie, Thorn, Quarrelton, Nitshill, Hurlet, and Dovecot Hall, with the country districts. To the north, and affording a noble view from the eminence on which Old Paisley is chiefly built, extends the great plain of the lower valley of the Clyde, anciently called *Strathgryffe*. On the south the Gleniffer, or Paisley Braes, distant about 3 miles, swell gently up to the height of 760 feet above the surface of the Cart. The soil is of a mixed character, but in many places rich and fertile. From the heights just mentioned descend a variety of minor streams, of great utility to the agriculturist and manufacturer, and adding to the richness and beauty of the scenery. The surface of the country in the neighbourhood, with the exception of that to the north, which is flat, is agreeably diversified, and broken into gentle swells and soft declivities, which, with the mixture of gentlemen's seats, farm-houses, bleaching-fields, and other public works, confers a picturesque and animated character upon the entire vicinage. Valuable minerals abound in the parish, such as coal, limestone of the coal formation, and ironstone. In the strath to the north-west of the town, extending towards Linwood, valuable blackband ironstone has recently been discovered, and is now being extensively worked by Messrs Merry and Cunningham, and others. A great mining population is rapidly collecting in that district. There are also very extensive coal-pits wrought in the neighbourhood, chiefly at Johnstone; and in that vicinity, and at Hurlet, the chemical works of the Messrs Wilson and others are on a very large scale. Very fine freestone is also obtained in the neighbourhood.

As it is chiefly, however, to its being one of the principal manufacturing stations in the kingdom that Paisley owes its celebrity, we shall now present a brief sketch of the history, progressive improvement and increase, and present extent of its principal manufactures. There is no certain account as to the precise period when the art of weaving was introduced. It appears, however, that the manufacture of linen was carried on to a considerable extent during the last century. Shortly after the Union the spirit of manufacturing enterprise sprang up in the west of Scotland, and Paisley was not slow in availing itself of the general impulse. Craufurd, describing the state of Paisley in 1710,

Paisley. observes:—"That which renders this place considerable is its trade of linen and muslin, where there is a great weekly sale in its markets of those sorts of cloth, many of the inhabitants being chiefly employed in that sort of manufactory." From 1744 to 1784 the linen manufacture increased in amount from L.18,886, 15s. 10d. to no less than L.184,385, 16s. 6½d. About the year 1722 the manufacture of linen thread was introduced into Paisley, and carried on to a large extent. For several years it reached the amount of L.100,000 annually. Cotton thread, having superseded that made from linen yarn, is manufactured to a very considerable extent, and forms one of the principal manufactures of the place. Besides the establishment of the Messrs Coats, which is said to be the most extensive, the most valuable, and the most magnificent of the kind in the world, there are now about ten others, some of which are very extensive. The value of the thread annually manufactured in Paisley at the beginning of the present century was estimated at L.60,000. It is now about L.400,000. In 1760 silk gauze began to be manufactured in Paisley; and in a short time the skill and ability with which this manufacture was prosecuted caused its abandonment by the manufacturers of Spittalfields, the original seat of the silk manufacture in Great Britain. This manufacture flourished extensively until near the close of the last century. From 1772 there existed also a considerable manufacture of ribbons and other articles in silk. In 1744 the value of the manufactures of Paisley was L.579,185, and in 1769 it amounted to L.660,385. In 1744 only 867 looms were employed in the weaving of linen; and forty years afterwards no fewer than 5000 looms were engaged in the manufacture of silk, the produce of which amounted to L.350,000.

Towards the end of last century the making of silk goods declined rapidly; but a new species of manufacture sprang up, which has since been carried to a much greater extent. The manufacture of shawls, of cotton, silk, and fancy woollen fabrics, has now become the staple trade of Paisley. In little more than forty years after its introduction (in 1834) this manufacture produced about a million sterling; and since then it has increased considerably.

Previously to the present century fine shawls had been manufactured in this country chiefly at Norwich and Stockport in England, where they were made in imitation of the rich India shawls. The latter, from their high price, were beyond the reach of all but a few wealthy individuals, when the manufacturing skill and enterprise of Paisley embarked in the manufacture, and, by successive inventions and improvements in the loom, and in the kind and quality of the materials, prosecuted for a long series of years, succeeded in realizing a nearly perfect imitation of those oriental fabrics in colours, texture, and design, and at a mere fraction of the cost. Besides the extraordinary cheapness, the variety of new and beautiful fabrics and designs which have been introduced into the shawl manufacture have largely contributed to its extent and success. The manufacture of shawls is almost wholly confined to Paisley; but a considerable proportion of these find their way to the Glasgow markets for home and foreign sale. The kinds produced are various in quality and cost, and there is a great variety in the styles and fabrics. Some are wholly made of silk, but these are not now much in demand; others of silk and cotton, and a great many of Persian and fancy wools mixed with both or either. Thibet cloth shawls, a very rich and fanciful fabric; Chenille shawls, a beautiful imitation of silk velvet; Canton crape shawls; and various other and newer kinds, of every possible variety in size, texture, pattern, and price, are produced from the looms of Paisley, with a rapidity and abundance which, whilst it tends occasionally to overload the market, affords satisfactory evidence of the manufacturing skill and resources of Paisley. The present annual amount of the trade and manufactures of Paisley has been roughly calculated at nearly two millions sterling. To give anything like a view of the various inventions and improvements in the art of weaving, by means of which Paisley has attained its present eminence as a chief seat of the silk and cotton manufactures in Scotland, would swell this article beyond all due bounds. The hasty sketch which we have supplied affords some general data to the reader, who may consult, if he wishes for more minute information, Wilson's *Survey of Renfrewshire;* Craufurd's *Description of the Shire of Renfrew*, with Robertson's continuation; and the *New Statistical Account of Scotland.* The spinning of cotton yarn is also extensively carried on by Paisley manufacturers in the town and parish, but there are no data to be relied on for ascertaining its annual amount. Bleaching and dyeing, as might be expected, are prosecuted to a very considerable extent. Soap-making is a trade of some antiquity and importance; and malting, the distillation of raw spirits, and silk-throwing, have also a considerable capital embarked in them. Owing to the frequent and severe depressions that have recently occurred in connection with the weaving trade of Paisley, a considerable number of those formerly engaged in that line have transferred their industry to other employments. By this means some branches of business, formerly existing in the town, have been very much extended, and others entirely new have been introduced. Among the branches thus increased or introduced, the principal are the thread manufacture already mentioned, shawl-printing, soap-making, iron-founding, engineering, and iron ship-building.

Thursday is the market-day in Paisley, and there are four fairs annually, which last three days each. The races at St James' Day Fair were long well known in the west of Scotland, and attracted great numbers from the surrounding districts. For many years they were much frequented by the sporting world; but after the close of the races, on the last day of the sport in August 1857, a serious and disgraceful riot occurred on the course. A number of the inhabitants memorialized the burgh trustees, and the provost and magistrates, against the continuance of the races. After several meetings, the burgh trustees and the town council agreed to discontinue the races. The grounds, including the course, were let for agricultural purposes; and the Paisley race-course, one of the best in the kingdom, is now a ploughed field.

Paisley is abundantly supplied with the means of external communication. The Glasgow and Greenock, and the Glasgow and South-Western railways, both pass through it. There is a railway to the Clyde near Renfrew; and although the Glasgow, Paisley, and Johnstone Canal has ceased to carry passengers, it is still available, and largely used, for the conveyance of goods.

The yearly returns of the post-office show the growing prosperity of Paisley. In 1720 the amount was only L.28, 13s.; 1769, L.223, 3s. 8d.; 1809, L.2814, 17s. 4d.; 1834, L.3194. Since the introduction of the penny postage, the delivery of letters from the Paisley post-office has risen to about 676,000 in a year. In the money-order department there are about 14,000 transactions in a year.

The river Cart is navigable to Paisley for vessels of from 60 to 80 tons burthen. The river dues in 1835 amounted to L.260, and at the present time they are about L.600.

Paisley is well supplied with the means of religious instruction. There are 8 congregations in connection with the Church of Scotland, 6 with the Free Church, 6 with the United Presbyterian Church, and about 16 of various other denominations. There is, therefore, on an average, one congregation for every 1350 of the burghal population. The number of scholars attending the different sabbath schools in Paisley during the year 1857 amounted to 6614.

The grammar school of Paisley was established by King James VI. The charter of erection is dated "at Halierude House," 3d January 1576, but the oldest date on the tablet in front of the building is 1586. Besides the grammar school, there are three other burgh schools, and a number of private or adventure schools. Within the last few years large sums have become available for the education of the poor. The late John Neilson bequeathed a sum for this purpose, which is supposed to have accumulated to about L.30,000. He died in 1839; and the school was opened in 1852. Other sums of smaller amount have been bequeathed for similar purposes. At present, active preparations are being made for opening an institution for reclaiming youthful offenders. The late Miss Kibble, some years ago, bequeathed for that purpose a sum now amounting to L.10,000. The Educational Association supports several schools which supply education to a great number of pupils at a very cheap rate; and the Ragged School furnishes a home and education to the houseless and the destitute. Hutcheson's Charity, though possessed of very scanty means, gives gratuitous education to a large number of children; the General Session educates gratuitously 100 pupils; and several of the congregations support schools in which education is given either gratuitously or at nominal fees, in some cases as low as one penny a week. In addition to all this, the Committee of Privy Council on Education have at different times granted considerable sums to assist in building schoolhouses; and large sums are annually received from the same source to supplement teachers' salaries, and to pay for pupil teachers for the education of the poor. The amount received in Paisley in 1857 for these purposes, together with the sum required for reducing the price of schoolbooks, could scarcely be less than L.1000. In future years this sum will be very considerably increased.

The town is well lighted with gas, and there is an abundant supply of excellent water, collected from the neighbouring heights in two large reservoirs, from which it is conveyed into the town by gravitation. The assessment for the poor in the three town parishes for the year ending May 1858 was L.5200; and in the Abbey parish for the same year the assessment was L.5000.

There are few public buildings of importance in Paisley. Besides the Abbey, may be mentioned St George's parish church, the Free High church, the Episcopal church, and also the Oakshaw Street and Abbey Close United Presbyterian churches. The county buildings are of considerable extent and elegance, in the castellated style; and the newsroom at the Cross is also a handsome building. The John Neilson Institution is in itself a very fine building, and occupying, as it does, by far the best situation in Paisley, it appears to great advantage. There are three bridges over the Cart, connecting the Old and the New Town of Paisley, but none of them is remarkable. The most important public charity in Paisley is the infirmary, supported by voluntary subscriptions.

The civil history of Paisley affords little to interest or deserve the attention of the general reader. Its ecclesiastical history is curious and interesting, but supplies few points sufficiently salient and compact to be entered upon in so brief a sketch. The famous "Black Book of Paisley," which was long supposed to have been a history of Paisley and its monastery, has been ascertained to be the *Scotichronicon* of Fordun, a monk of the fourteenth century. The inhabitants of Paisley early embraced the doctrines of the Reformation, notwithstanding the naturally adverse influences of the great monastic establishment; and displayed their attachment to these on various occasions during the civil wars and prelatical persecutions of the seventeenth century. In 1715 and 1745 they showed equal zeal for the House of Brunswick; and the burgh had to pay a fine of L.500 to the Young Chevalier at the latter period, as a composition for its anti-Jacobite predilections. The magistrates afterwards memorialized government for compensation, but they never obtained it. In 1597 the queen of James VI. honoured the inhabitants with a visit to their town, when it would appear that the royal entertainment fell so heavy on the burgh funds, that in 1617, when her royal consort also visited it, the civic dignitaries prudently forbore so costly a welcome, but in lieu thereof employed "a prettie boy, a son of a Sir James Semple of Beltrees," to make him a speech, which was judiciously spiced for James's royal ear.

In 1695 the population of the town of Paisley, exclusively of the Abbey parish, where there were then very few houses, was only 2200. In 1755, sixty years after, it amounted in the town and Abbey parish to 6799; and in 1781 to 11,100 in the town alone, the population of the Abbey parish not being given in the register. In 1791 the total population was 24,592; 1801, 31,179; 1811, 36,722; 1821, 47,003; 1831, 57,466; 1841, 60,487; 1851, 60,332. In 1851 the population of the parliamentary burgh was 48,026; and in 1858 the same was estimated at 48,302.

PAJOU, Augustin, an eminent French sculptor, was born at Paris in 1730, and studied in the workshop of Lemoine. His talents and facile skill were soon recognised, and his career of distinction began early. At the age of eighteen he gained the French Academy's grand prize for sculpture, and the attendant privilege of being sent to Rome to complete his studies. On his return at the end of twelve years, he immediately assumed a high place in his profession. He was elected forthwith a member, and in 1767 a professor, of the Academy. Louis XVI. also employed him to adorn with sculptures the façade of the Palais Royal, and to execute statues of Pascal, Turenne, Bossuet, Buffon, and Descartes. From these and his numerous other works Pajou had realized a handsome competency; but the Revolution deprived him of it, and left him for the rest of his days in comparative poverty. His death took place in 1809.

PAK PATTAN, or the *Pure Town*, a town of India, in the Punjab, stands on a mound 40 feet high, in the midst of a plain, 5 miles W. of the Ravee, and 98 S.S.W. of Lahore. It derives its name from having been long the residence of a famous Mohammedan saint, whose tomb, a plain edifice in a depression below the general level of the town, is much frequented by pilgrims, both Hindu and Mohammedan. Pak Pattan is believed to be the site of the colossal altars erected by Alexander the Great to mark the limits of his conquests.

PAKS, a town of Hungary, county of Tolna, stands on the right bank of the Danube, 62 miles S. of Buda. The inhabitants are chiefly employed in the culture of the vine, and in sturgeon-fishing. There are two churches and a synagogue, a cattle market, and it has some trade in corn. Pop. (1846) 7310.

PALÆOGRAPHY (πάλαιος, *ancient*, and γράφω, *I write*), is that branch of knowledge which has to do with the interpretation of ancient inscriptions and documents. (See Archæology, Diplomatics, Hieroglyphics, and Egypt. For an account of the catalogues of manuscripts in the British Museum and elsewhere, see Libraries.)

PALÆOLOGUS, the name of an illustrious Byzantine family, first mentioned in history in the eleventh century, from which period it played an important part in the affairs of the empire till its downfall. The family of Palæologus occupied the throne of Constantinople without interruption from 1260 to 1453, when that city was taken by the Turks. (See Constantinopolitan History. A full account of this powerful house will be found in the *Familiæ Byzantinæ* of Ducange, pp. 230-348; and a stemma of the family is given under "Paläologen," in Ersch and Gruber's *Encyclopadie;* also in Smith's *Dictionary of Greek and Roman Biography and Mythology*.)

PALÆONTOLOGY[1]

Introduction. **Definition.** Is the science which treats of the evidences of organic beings in the earth's strata; evidences mainly consisting of petrified or fossil remains of plants and animals belonging to species that are mostly extinct.

Application to comparative anatomy, The endeavour to interpret such evidences has led to comparisons of the forms and structures of existing plants and animals, which have greatly and rapidly advanced the science of comparative anatomy, especially as applied to the animal kingdom, and herein more especially to the hard and enduring parts of the animal frame, such as corals, shells, crusts, scales, bones, and teeth.

physiology, In applying the results of these comparisons to the restoration of extinct species, physiology has benefited by the study of the relations of structure to function requisite to obtain an idea of the food and habits of such species. It has thus been enriched by the well-defined law of "correlation of structures."

zoology, Zoology has gained an immense accession of subjects through the determination of the nature and affinities of extinct animals, and its best aims have been proportionally advanced. Much further and truer insight has been gained into the natural arrangement and subdivision of the classes of animals since palæontology expanded our survey of them. Thus a few hard-scaled fishes,—*Polypterus, Lepidosteus, e.g.*,—which represent a subordinate group of the herring family (*Clupeidæ*), in the second edition of Cuvier's *Règne Animal*, have been found to be the remnants of an almost extinct order, equivalent to the whole *Malacopterygii* of that naturalist; and the *Ruminantia*, which Cuvier deemed to be a very natural and well-defined order, has since become known to be a peculiarly modified subdivision of a wider and more natural group of hoofed quadrupeds, the *Artiodactyla*.

homology, The knowledge of the type or fundamental pattern of certain systems of organs, *e.g.*, the framework of the Vertebrata and the teeth of the Mammalia, has been much advanced by the more frequent and closer adherence to such type discovered in extinct animals, and thus the highest aim of the zoologist has been greatly promoted by palæontology.

geology, But no collateral science has profited so much by palæontology as that which teaches the structure and mode of formation of the earth's crust, with the relative position, time, and order of formation of its constituent stratified and unstratified parts. Geology has left her old hand-maiden mineralogy, to rest almost wholly upon the broad shoulders of her young and vigorous offspring, the science of organic remains.

geography, By this science the law of the geographical distribution of animals, as deduced from existing species, is shown to have been in force during periods of time long antecedent to human history, or to any evidence of human existence; and yet, in relation to the whole known period of life-phenomena upon this planet, to have been a comparatively recent result of geological forces determining the present configuration and position of continents. In this relation, palæontology throws light upon a most interesting branch of geographical science, that, viz., which relates to former configurations of the earth's surface, and to other dispositions of land and sea than prevail at the present day.

and philosophy. Finally, palæontology has yielded the most important facts to the highest range of knowledge to which the human intellect aspires. It teaches that the globe allotted to man has revolved in its orbit through a period of time so vast that the mind, in the endeavour to realize it, is strained by an effort like that by which it strives to conceive the space dividing the solar system from the most distant nebulæ.

Introduction. Palæontology has shown that, from the inconceivably remote period of the deposition of the Cambrian rocks, the earth has been vivified by the sun's light and heat, has been fertilized by refreshing showers, and washed by tidal waves; that the ocean not only moved in orderly oscillations regulated, as now, by sun and moon, but was rippled and agitated by winds and storms; that the atmosphere, besides these movements, was healthily influenced by clouds and vapours, rising, condensing, and falling in ceaseless circulation. With these conditions of life, palæontology demonstrates that life has been enjoyed during the same countless thousands of years; and that with life, from the beginning, there has been death. The earliest testimony of the living thing, whether coral, crust, or shell, in the oldest fossiliferous rock, is at the same time proof that it died. At no period does it appear that the gift of life has been monopolized by contemporary individuals through a stagnant sameness of untold time, but it has been handed down from generation to generation, and successively enjoyed by the countless thousands that constitute the species. Palæontology further teaches, that not only the individual, but the species perishes; that as death is balanced by generation, so extinction has been concomitant with the creative power which has continued to provide a succession of species; and furthermore, that, as regards the various forms of life which this planet has supported, there has been "an advance and progress in the main." Thus we learn, that the creative force has not deserted the earth during any of the epochs of geological time that have succeeded to the first manifestation of such force; and that, in respect to no one class of animals, has the operation of creative force been limited to one geological epoch; and perhaps the most important and significant result of palæontological research has been the establishment of the axiom of *the continuous operation of the ordained becoming of living things*.

In entering upon the present survey of the evidences of organic beings in the earth's crust, it is proposed to commence with the lowest or most simple forms, and, as the subject of fossil plants has been ably dealt with under the head PALÆONTOLOGICAL BOTANY, in vol. v., p. 232, to treat chiefly of the remains of the animal kingdom.

A reference to the subjoined "Table of Strata" (fig. 1) will indicate the relative position of the geological formations cited. The numerals opposite the right hand give the approximative depth or vertical thickness of the strata.

Definition of organisms; of animals, of plants. Organisms, or living things, are those which possess such an internal cellular or cellulo-vascular structure as can receive fluid matter from without, alter its nature, and add it to the alterative structure. Such fluid matter is called "nutritive," and the actions which make it so are called "assimilation" and "intus-susception." These actions are called "vital," because, as long as they are continued, the "organism" is said "to live." When the organism can also move, receive the nutritive matter by a mouth into a stomach, inhale oxygen and exhale carbonic acid, develop tissues the proximate principles of which are quaternary compounds of carbon, hydrogen, oxygen, and nitrogen, it is called an "animal." When the organism is rooted, has no mouth or stomach, exhales oxygen, has tissues composed of "cellulose" or of binary or ternary compounds, it is

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[1] From *παλαιός, ancient, ὄντα, beings, λόγος, a discourse.*

Introduction.

Table of Strata and Order of Appearance of Animal Life upon the Earth.

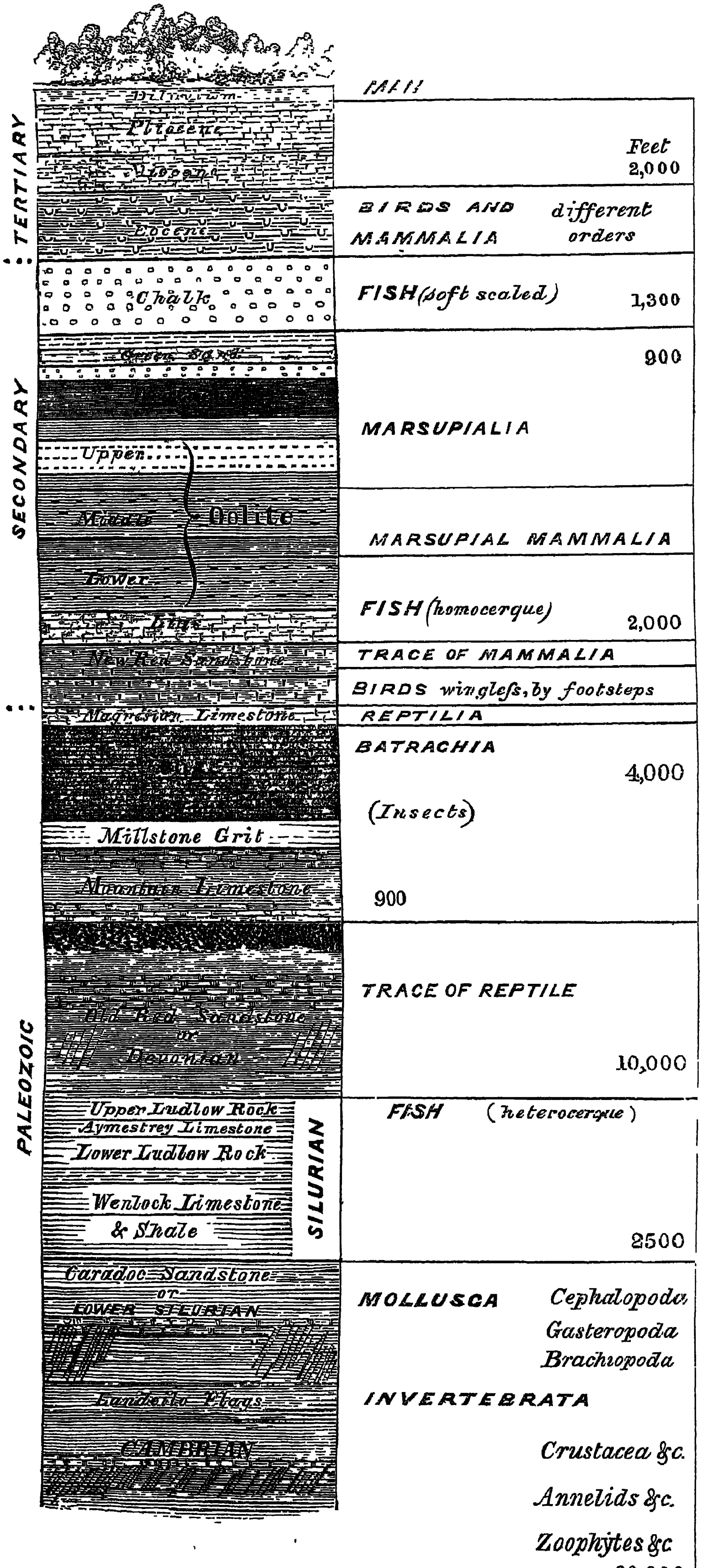

Fig. 1.

called a "plant." But the two divisions of organisms called "plants" and "animals" are specialized members of the great natural group of living things; and there are numerous organisms, mostly of minute size and retaining the form of nucleated cells, which manifest the common organic characters, but without the distinctive superadditions of true plants or animals. Such organisms are called "Protozoa," and include the sponges or *Amorphozoa*, the *Foraminifera* or Rhizopods, the *Polycystineæ*, the *Diatomaceæ*, *Desmidiæ*, and most of the so-called *Polygastria* of Ehrenberg, or infusorial animalcules of older authors.

Protozoa.

PROTOZOA.

Class I.—AMORPHOZOA.

Fossil sponges take an important place among the organic remains of the former world, not only on account of their great variety of form and structure, but still more because of the extraordinary abundance of individuals in certain strata. In England they specially characterize the chalk formation,—extensive beds of silicified sponges occur in the upper greensand, and in some beds of the oolite and carboniferous limestone. In Germany a member of the Oxford oolite is called the "spongitenkalk," from its numerous fossils of the present class.

Existing sponges are divided into *horny*, *flinty*, and *limy*, or "ceratose," "silicious," and "calcareous," according to the substance of their hard sustaining parts, which parts are commonly in the shape of fine needles, or *spicula*, of very varied forms, but in many species of sufficient constancy to characterize such species. The soft organic substance is for the most part structureless and diffluent; it is uncontractile and impassive. The larger orifices on the surface of a sponge are termed "oscula," and are those out of which the currents of water flow; these enter by more numerous and minute "pores."

The calcareous sponges abound in the oolitic and cretaceous strata, attaining their maximum of development in the chalk; they are now almost extinct, or are represented by other families with calcareous spicula. The horny sponges appear to be more abundant now than in the ancient seas, but their remains are only recognisable in those instances where they were charged with silicious spicula.

M. D'Orbigny enumerates 36 genera and 427 species of fossil sponges; and this is probably only a small proportion of the actual number in museums, as the difficulty of determining the limits of the species is very great, and many remain undescribed.

Palæospongia and *Acanthospongia* occur in the lower Silurian; and *Stromatopora*, with its concentrically laminated masses, attains a large size in the Wenlock limestone. *Steganodictyum*, *Sparsispongia*, and species of *Scyphia*, are found

in the Devonian; and *Bothroconis*, *Mamillopora*, and *Tragos*, in the Permian or magnesian limestone. Several

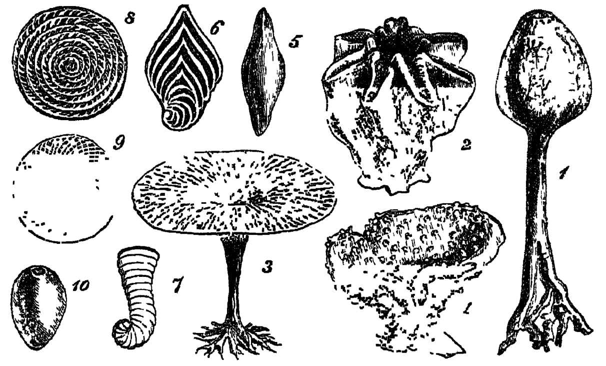

Fig. 2.

Amorphozoa; Rhizopoda.

1 Siphonia pyriformis, Goldf.; *Greensand*, Blackdown.
2. Guettardia Thiolati, D'Arch.; *U. Chalk*, Biarritz.
3. Ventriculites radiatus, Mant.; *U Chalk*, Sussex.
4. Manon osculiferum, Phil., *U. Chalk*, Yorkshire.
5. Fusulina cylindrica, Fisch.; *Carboniferous*, Russia.
6. Flabellina rugosa, D'Orb; *Chalk*, Europe.
7 Lituola nautiloidea, Lam; *Chalk*, Europe.
8. Nummulites nummularia, Brug.; *Eocene*, Old World.
9. Orbitoides media, D'Arch.; *U. Chalk*, France.
10. Ovulites margaritula, Lam.; *Chalk*, Europe.

genera are common to the trias and oolites; and several more are peculiar to the latter strata. The Oxfordian sponges belong chiefly to the genera *Eudea*, *Hippalimus*, *Cribrispongia*, *Stellispongia*, and *Cupulispongia*. Their fibrous skeleton appears to have been entirely calcareous, and often very solid; their form is cup-shaped, or mammillated, or incrusting; and many have a sieve-like appearance, from the regular distribution of the excurrent orifices (*oscula*) over their surface.

The greensand of Faringdon in Berkshire is a stratum prolific in sponges, chiefly cup-shaped and calcareous, of the genera *Scyphia* and *Chenendopora;* or mammillated, like *Cnemidium* and *Verticillopora*. The Kentish rag is full of sponges, which are most apparent on the water-worn sides of fissures. Some beds are so full of silicious spicula as to irritate the hands of the quarrymen working those beds. The greensand of Blackdown is famous for the number and perfect preservation of its pear-shaped *Siphoniæ* (fig. 2, 1); whilst those of Warminster are ornamented with three or more lobes. The latter locality is the richest in England for large cup-shaped and branching sponges (*Polypothecia*), which are all silicified. The sponges, chiefly *Siphoniæ*, of the upper greensand of Farnham are infiltrated with phosphate of lime, and have been used in agriculture.

The sponges of the chalk belong to several distinct families. *Choanites* resembles the *Siphonia*, but is sessile, and exhibits in section, or in weathered specimens, a spiral tube winding round the central cavity. It is the commonest sponge in the Brighton brooch-pebbles. Others are irregularly cup-shaped and calcareous; and many of the Wiltshire flints have a nucleus of branching sponge (*S. clavellata*). The chalk flints, arranged in regular layers, or built up in columns of "Paramoudræ," all contain traces of sponge structure, and their origin is in some measure connected with the periodic growth of large crops of sponges. Frequently the crust or outer surface only of the sponge has been silicified, while the centre has decayed, leaving a botryoidal or stalactitic cavity. The cup-shaped sponges are almost always more or less enveloped with flint, which invests the stem and lines the interior, leaving the rim exposed. The sponges of the Yorkshire chalk are of a different character: some are elongated and radiciform, others horizontally expanded, but they contain comparatively little silica; while those belonging to the genus *Manon* (fig. 2, 4), having prominent "oscula," are superficially silicified, and will bear immersion and cleaning with hydrochloric acid. The largest group of chalk sponges, typified by *Ventriculites* (fig. 2, 3), have the form of a cup or funnel, slender or expanded, or folded into star-like shape (*Guettardia*, fig. 2, 2), with processes from the angles to give them firmer attachment. Some have a tortuous or labyrinthic outline, and others are branched or compound, like *Brachiolites*. Curious sections of these may be obtained from specimens enveloped with flint or pyrites. The burrowing-sponge, *Cliona*, is commonly found in shells of the tertiaries and chalk. The great cretaceous *Exogyræ* of the United States are frequently mined by them; and flint casts of *Belemnites* and *Inocerami* are often covered by their ramifying cells and fibres. Thin sections of chalk flints, when polished and examined with the microscope, sometimes exhibit minute spherical bodies (*Spiniferites*) covered with radiating and multicuspid spines. From their close resemblance to the little fresh-water organism *Xanthidium*, they long bore that name; but they are certainly marine bodies, and probably the spores of sponges.

Class II.—Foraminifera.

The organisms of this class are small, and for the most part of microscopic minuteness,—of a simple gelatinous structure, protected by a shell. They grow by successive gemmation from a primordial segment, sometimes in a straight line, more commonly in a spiral curve; and each segment so developed has its own shelly envelope. As, however, they are organically connected, the whole seems to form a "chambered" or "polythalamous" shell. The last-formed segment is usually distinguished by very long, slender, pellucid, colourless, contractile filaments, like rootlets; whence the name "Rhizopods," sometimes given to the class. But both the outer wall and the septa of the compound shell are perforated by minute apertures, through which either connecting or projecting filaments of the soft organic tissue pass; whence the name *Foraminifera*. The several segments or jelly-filled chambers are essentially repetitions of each other; and there is no proof that the inner and earlier segments derive their nourishment from the outer and last-formed one. A Foraminifer may therefore be regarded either as a series of individuals, organically united, or as a single aggregate being, compounded according to the law of vegetative repetition.

The minute, chambered shells of Rhizopods enter largely into the composition of all the sedimentary strata, and are so abundant in many common and familiar materials, like the chalk, as to justify the expression of Buffon, that the very dust had been alive. The deep-sea soundings of the Atlantic Telegraph Company have shown that the bed of that great ocean, at a depth approaching, or even exceeding, two miles, is composed of little else than the calcareous shells of a *Globigerina* and a few other Rhizopods, with the silicious shields of the allied *Polycystineæ*. The composition of the chalk is extremely similar: when the finer portion, amounting to half or even less, has been washed away, the remaining sediment consists almost entirely of foraminated shells, some perfect, others in various stages of disintegration. They have also been found in other marine formations which are soft enough to be washed, down to the Lower Silurian; and in the hard limestones and marbles they can be detected in polished sections, and thin slices laid on glass. The greater part of these shells are microscopic, but some of the large extinct Foraminifera, called, from resembling a piece of money, Nummulites, are two inches in diameter. The generic divisions in use for these shells were mostly invented by M. D'Orbigny, but on artificial grounds,—viz., exclusively upon the plan of growth, or

Protozoa.

mode of increase in the number of chambers. The structure and anamorphoses of these complex atoms have been recently investigated by Messrs Williamson and Carpenter, and especially by Mr W. K. Parker. Six hundred and fifty-seven fossil species, belonging to seventy-three genera, are described,—commencing in the palæozoic age, increasing in number and variety with each successive stratum, and attaining their maximum in the present seas. Most of these genera, and even some of the species, pass through many formations; indeed, if correctly observed, they are the oldest known living organisms. *Dentalina communis*, *Orbitolites complanatus*, *Rosalina italica*, and *Rotalina globulosa*, all living species, are said to be found in the chalk; *Rotalina umbilicata* ranges to the gault; and *Webbina rugosa* is common to the upper lias, the chalk, and present sea. It has, however, been observed that fossil Rhizopods, set free by the disintegration of rocks, are mingled with the recent shells on every beach; and Mr M'Andrew has obtained them in this condition from great depths of the mid-channel.

The earliest important form is the *Fusulina* (fig. 2, 5), which forms layers many inches, or even feet, in thickness in the carboniferous limestone of Russia. The recent genera *Dentalina* and *Textularia* are found in the magnesian limestone; *Nodosaria*, *Cristellaria*, and *Rotalia*, in the lias. *Flabellina* (fig. 2, 6) is peculiar to the chalk; *Orbitoides* (fig. 2, 9) to the chalk and tertiary series; *Ovulites* (fig. 2, 10) is peculiar to the eocene tertiaries; *Operculina*, *Orbitolites*, and *Alveolina* appear first in the tertiary, and are still living. The *Lituola* (fig. 2, 7) occurs in the chalk and in chalk flints, and has been described as a species of "Spirolinite." Many of the cretaceous *Foraminifera* contain a brown colouring matter, which remains after the shell has been dissolved with weak acid, and has been regarded as the remains of the animal substance which once filled all the cells.

The "calcaire grossier," which is employed at Paris as a building-stone, contains *Foraminifera* in such abundance that one may say the capital of France is almost constructed of those minute and complex shells.

But it is in the middle eocene, or "nummulitic period," that the Rhizopods attained their greatest size, and played their most important part. Wherever limestones or calcareous sands of this period are met with, these Foraminifera abound, and literally form strata which in the aggregate become mountain masses. These "nummulitic limestones" are found in Southern Europe, in Northern Africa, and in India; they also occur in Jamaica. The commonest form is the *Nummulite* (fig. 2, 8), which occurs in the building-stone of the Great Pyramid. These *Nummulites* were evidently sedentary; and in the large thin species, one side is moulded to the inequalities of the sea-bed on which it grew.

Polycystineæ.—The tertiary marls of Barbadoes afforded to Ehrenberg an extensive series of novel and extraordinary microscopic organisms, composed of silica, but foraminated like the shells of the Rhizopods. The same forms, and others similar to them, have been met with in the deep-sea mud of the Gulf of the Erebus and Terror, and more recently in the mud of the Atlantic soundings. They are quite distinct in form and character from most of the silicious-shielded *Diatomaceæ*, but some of them resemble the *Coscinodiscus* and *Actinocyclus*. No less than 282 forms, grouped in 44 provisional genera, have been described.

Class III.—INFUSORIA.

(*Polygastria*, Ehrenberg.)

Numerous genera and multitudes of so-called species of free and locomotive microscopic organisms, which, because they do not present the distinctive characters of plants or animals, have been by turns referred to one or other kingdom, possess shells of flint, and consequently enter largely into the domain of fossil evidences of former life. The silicious shells of these infusory organisms present under the microscope the most definite as well as beautiful characters of form and sculpture, which are as recognisable and distinctive as those of the calcareous shells of Mollusca. The plates of the incomparable works and memoirs of Ehrenberg abound with exact figures of the delicate sheaths, shells, and shields of the loricated Infusoria of past and present æras of life, the deposits of which, by reason of their pure, flinty, atomic constitution, were known in the arts long before science had detected their nature and vital origin. In 1836 portions of the stone called "tripoli" or "polierschiefer" (polishing-slate of lapidaries) were microscopically examined by Ehrenberg, who discovered it to be wholly composed of the silicious shells of Infusoria, and chiefly of an extinct species called *Gaillonella distans*. At Bilin in Bohemia there is a single stratum of polierschiefer, not less than 14 feet thick, forming the upper layer of a hill, in every cubic inch of which there are forty-one thousand millions of the above-named organic unit. This mineral likewise contains shells of *Navicula*, *Bacillaria*, *Actinocyclus*, and other silicious organisms. The lower part of the stratum consists of the shells compacted together without any visible cement; in the upper masses the shells are cemented together, and filled by amorphous silicious matter formed out of dissolved shells. At Egea in Bohemia there is a stratum of 2 miles in length, and averaging 28 feet in thickness, of which the uppermost 10 feet are composed wholly of the silicious shells of Infusoria, including the beautiful *Campylodiscus*; the remaining 18 feet consist of the shells mixed with a pulverulent substance. Corresponding deposits of the silicious cases of Infusoria have since been discovered in many other parts of the world, some including fresh-water species, others marine species of Infusoria.

The conditions of such depositions will be readily understood by examining the sedimentary deposits of bogs and stagnant or slow-flowing sheets of water. In warm latitudes and seasons, such water swarms with infusorial life, and the indestructible cases of the loricated kinds are found in great quantities in the sedimentary deposits. Beneath peat bogs they have been found to form strata of many feet in thickness, and co-extensive with the turbary, forming a silicious marl of pure whiteness. A quantity of pulverulent matter is deposited upon the shores of the lake near Uranea in Sweden, which, from its extreme fineness, resembles flour: this has long been known to the poorer inhabitants under the name of "berg-mehl," or mountain-meal, and is used by them, mixed up with flour, as an article of food. It consists in great part of silicious shells of Infusoria, with a little organic matter. With regard to the source of fossil infusorial remains in sea-water, the following evidence is given in the *United States Coast Survey*, 1856:—

Soundings of the gulf-stream near Key Siscayne, Florida, varying in depths from 147 fathoms to 205 fathoms, give a light greenish-grey mud composed chiefly of Foraminifers, Diatoms, Polycistins, and Geolites, in a profusion only surpassed by the fossil polycistinous strata of Barbadoes. The Foraminifers compose the largest part of these muds, including *Textularia Americana*, *Marginula Bachei*, and other forms, particularly many species of the *Plicatilia* of Ehrenberg, which had been supposed to live only in shallower haunts. The silicious shells of Diatoms abound in the residue, after the calcareous Foraminifers have been dissolved by acid. The inorganic portion of the soundings is chiefly quartz sand, and its proportion is quite small. Such manifestations of life, with its mineral results, have been detected from the earliest sedimentary deposits to the present time; but as regards the Infusoria, they are given on the grandest scale in formations of the tertiary age.

Animalia.

The town of Richmond in Virginia, United States, is built on barren silicious strata of marine origin and tertiary age. The strata are 20 feet in thickness, composed chiefly of infusorial flint-shells, including the well-known and beautiful microscopic objects, *Actinocyclus* and *Coscinodiscus*.

Most of the infusorial formations, as the polishing-slates at Cassel, Planitz, and Bilin, are astounding monuments of the operation of microscopic organisms at former periods of the history of this planet. The minute size, elementary structure, tenacity of life, and marvellous reproductive power of the Infusoria have enabled them to survive as species those destroying causes which have exterminated contemporaneous higher forms of organism. Species of *Bacillaria* still exist which were in being at the period of the deposition of the chalk. Existing species of *Diatomaceæ* have been detected as low down as the oolite. The discovery by Ehrenberg of more than twenty species of silicious-shelled Infusoria, fossil, in the chalk and chalk-marls, which are identical in species with some now living in the bed of the Baltic, is an instructive addition to the obscure history of the introduction of species of living things in this planet, and must add greatly to the interest of the infusorial class in the eyes of the geologist and philosopher. "For these organisms," writes Ehrenberg, "constitute a chain which, though in the individual link it be microscopic, yet in the mass is a mighty one, connecting the life-phenomena of distant ages of the earth, and proving that the dawn of the organic nature co-existent with us reaches further back in the history of the earth than had hitherto been suspected." "The microscopic organisms are very inferior in individual energy to lions and elephants, but in their united influences they are far more important than all these animals." If it be ever permitted to man to penetrate the mystery which enshrouds the origin of organic force in the wide-spread mud-beds of fresh and salt waters, it will be by experiment and observation on the atoms which manifest the simplest conditions of life.

ANIMALIA.

INVERTEBRATA.

FOSSIL INVERTEBRATA.

Remains of invertebrate animals occur in strata of every age, from the partially metamorphic and crystalline rocks of the Cambrian system to the deposits formed by the floods of the last winter, and the tides of yesterday. They are found in every country, from the highest latitude attained by Arctic voyagers to the extremities of the southern continents, and at the greatest elevation hitherto climbed in the Andes or Himalaya. If some classes,—*e.g.*, *Tunicata*, *Acalephæ*,—seem not to be represented in stratified deposits, they are such as, either from the soluble and perishable tissues composing the entire frame, could not be expected to be fossilized under any conceivable circumstances; or from the same cause, are only not so recognisable at one of their metagenetic phases. Evidence of compound Hydrozoa,—*i.e.*, of the polypes which Ellis called "Corallines,"—and especially of the genus *Campanularia*, would show that the acalephal type and grade of organization had been manifested at the period of the formation of the strata containing such fossil Polypi. With the above seeming exceptions, every class of invertebrate animal is represented by fossil remains.

They consist of corals and shells, of the petrified skeletons of star-fishes and sea-urchins, of the hard coverings of crabs and insects, of the tracks and shelly habitations of worms, and of impressions of surfaces, and casts of cavities of organisms, retained, after these have perished, by the matrix.

Radiata.

The condition in which invertebrate fossils occur depends on the nature of the matrix and other accidental circumstances; for while some are scarcely altered in composition, or even in colour, others are silicified or infiltrated with carbonate of lime. Some may be cleared by the action of acid or exposure to the weather, and some require the chisel of the mason or the mill of the lapidary for the proper exhibition of their structure.

Multitudes of recent species are fossilized in the newer tertiaries whose history can be made out perfectly from living specimens; but the number of these diminishes gradually in each older stratum, while the proportion of extinct forms is ever on the increase. No living species more highly organized than a Rhizopod is found in the secondary rocks. Recent *genera* extend further back in time; indeed a few may be recognised in strata of palæozoic age, shedding a light on the probable affinities and conditions of their associates. Many of the smaller groups of genera, called *families*, disappear in the secondary, and still more in the palæozoic period, and are to a limited extent replaced by groups which no longer exist. But, as to the larger groups of *Protozoa* and true invertebrate animals, it may be affirmed that every known fossil belongs to some one or other of the existing classes, and that the organic remains of the most ancient fossiliferous strata do not indicate or suggest that any earlier and different group of beings remains to be discovered, or has been irretrievably lost, in the universal metamorphism of the oldest rocks.

PROVINCE I.—RADIATA [1]

Sub-Province POLYPI.

A polype is a small soft-bodied aquatic animal which generally presents a soft cylindrical oval or oblong body, with an aperture at one of its extremities, which is surrounded by a crown of radiating filaments or "tentacles." This aperture leads to the digestive cavity, which, in most Polypes, is without intestine or vent. A very large proportion of these animals has organs of support, called "polyparies" or corals, of various forms and substance, but for the most part consisting of carbonate of lime; and, as a general rule, locomotion is lost with the development of the polypary, which usually attaches the polype to some foreign body. The organization of the soft tissues is in general simple; the faculties of the Polypes are very limited; and the vital phenomena, save those of irritability and contractility, are inconspicuous. Nevertheless, the influence of the combined powers of some of the species, in adding to and modifying the crust of the earth, is neither slight nor of limited extent.

CLASS I.—HYDROZOA.

Char.—Polypary, when present, flexible, external; for the most part developing cells for the polypes according to regular patterns.

FAMILY I.—GRAPTOLITIDÆ.

To this class may probably belong the organic remains called "Graptolites," which are exclusively and characteristically Silurian fossils. A certain knowledge of their affinities would require examination of the soft parts; and the family has long been extinct. Indications of the flexible consistency of the polypary, and M. Barrande's statement of the existence of a cylindrical canal in its axis, which he conjectures to have contained the common connecting tissue of the polypes, have weighed with the writer in placing the Graptolites provisionally in the present class Polypi. The axis of the polypary is sometimes straight (fig. 3, *3*),

[1] For the characteristic organization of the provinces, classes, orders, and families of *Invertebrata*, reference may be made to the writer's *Lectures on Invertebrata*, 8vo, Longmans, 1855.

Radiata.

sometimes spiral (fig. 3, 6). The ordinary form, as given by the *Graptolites priodon* (fig. 3, 3), is serrated on one side only, and is found abundantly in the Cambrian or older Silurian beds of Scotland and Wales; it occurs also in the Ludlow rocks. The double Graptolites (*Diplograpsus*, fig. 3, 5, and *Didymograpsus*, fig. 3, 4) are Cambrian forms. *Rastrites* (fig. 3, 6) had the polypes only in one side, and they are less crowded: it characterizes Barrande's division E of the lower Silurian beds of Bohemia, and has not yet been found in Britain. The Graptolites occur in argillaceous strata, especially in the mud-stones of Wales and Cumberland, and in the alum-slates of Sweden. These beds remind one of the mud bottoms in which the Virgularia and other long aud slender graptolite forms of "Pennatulidæ" flourish in forest-like crowds. The primeval Graptolite may have presented a more generalized polype structure than is now met with in the specially differentiated Sertularians and sea-pens.

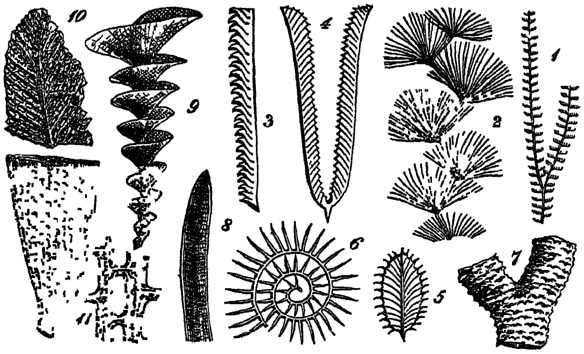

Fig. 3.

Hydrozoa; Anthozoa; Bryozoa.

1. Protovirgularia dichotoma, M'C.; *Silurian*, Dumfries.
2. Oldhamia antiqua, Forbes; *Cambrian*, Wicklow.
3. Graptolites priodon, Brun.; *Silurian*, Britain.
4. Didymograpsus Murchisoni, Beck; *L. Silurian*, Wales
5. Diplograpsus folium, His.; *L. Silurian*, Britain.
6. Rastrites peregrinus, Barr; *Silurian*, Bohemia.
7. Cœnites juniperinus, Eichw.; *U. Silurian*, Dudley.
8. Ptilodictya lanceolata, Lonsd.; *U. Silurian*, Tortworth.
9. Archimedipora Archimedea, Lesuer.; *Carboniferous*, Kentucky.
10. Ptilopora pluma, M'C.; *Carboniferous*, Ireland.
11. Fenestrella membranacea, Ph.; *Carboniferous*, Britain

Class II.—ANTHOZOA.

In this class of Polypes the tentacles are hollow, and, in most, with pectinated margins. The polypary is usually internal, and forms the bodies more properly called "corals" and "madrepores."

Asteroida.—Great doubt attaches to some of the fossils referred to this class of Polypi. The terms "Gorgonia" and "Alcyonium" have been applied to objects not well understood, and usually proving to be *Bryozoa* and sponges. The lower Silurian fossil called *Pyritonema* consists of a fasciculus of silicious fibres, and has been supposed to be related to the glass zoophyte (*Hyalonema*). The miocene deposits of Piedmont contain a species of the Mediterranean genus *Corallium*, an *Antipathes*, and an *Isis* (or *Isisina*, D'Orb.), which is also found in Malta. The London clay contains one coral (*Graphularia*), referred to the *Pennatulidæ*, and two *Gorgonidæ* (*Mopsea* and *Websteria*).

Anthozoa or Actinoida.—The lamelliferous or stony corals are (next to the *Testacea*) the largest and most important class of invertebrate fossils. They attained a great development in the earliest seas, and were perhaps more widely diffused and individually abundant in the Silurian age than at any subsequent period. "Reef-building" corals are now confined to warm seas, and are wanting even on great tracts of tropical coast. The *Oculina* is the only large coral now found in the north. But in palæozoic times the representatives of the modern Astræas and Caryophyllias extended as far northward as Arctic voyagers have penetrated; and at a much later period they formed reefs of considerable thickness and extent in the area of the coralline oolite. The Silurian limestone of Wenlock Edge is itself a coral reef thirty miles in length; and the Plymouth limestone and carboniferous limestone have frequently the aspect of coral-banks skirting the older regions of Cambrian slate and Devonian "killas." The structure of coral-banks may be studied in the lofty limestone cliffs of Cheddar, and in the wave-worn shores of Lough Erne, as well as in the upheaved coral islands of the southern seas. In the fields about Steeple-Ashton, every stone turned up by the plough is a coral; and our inland quarries and chalk-pits afford to the palæontologist materials for the study of a class almost wholly wanting on the present sea-shores of Europe. The history of the British fossil corals, as given by Milne Edwards and Haime in the *Transactions of the Palæontographical Society*, exhibits, equally with that of the fossil shells by other authors, a transition from a state very different from that which now subsists in our part of the world, and a gradual approximation to the present order of things.

In the palæozoic strata the corals belong chiefly to two extinct orders; those of the secondary period more resemble living corals of warmer climates than ours; and the few tertiary genera and species resemble those of Southern Europe and our own coast.

The distinction between one large group of the palæozoic *Anthozoa* (*Cyathophyllidæ*) and more modern corals consists in the quadripartite character of their plaited cups or stars, whereas the lamellæ (or *septa*) of the other families are developed in multiples of 6. A remarkable exception exists in the *Holocystis* (fig. 5, 8), an Astrea-like coral with quadripartite stars, which is found in the lower greensand. The old-rock corals are also remarkable for the manner in which they are partitioned off by horizontal "tabulæ" (fig. 4, 3), like the septa of the *Nautilus* and *Spondylus*. This character obtains not only in the *Cyathophyllidæ*, but also in the *Milleporidæ*, *Favositidæ*, and other palæozoic families. Of the 129 Silurian corals, 121 belong to the tabulated divisions.

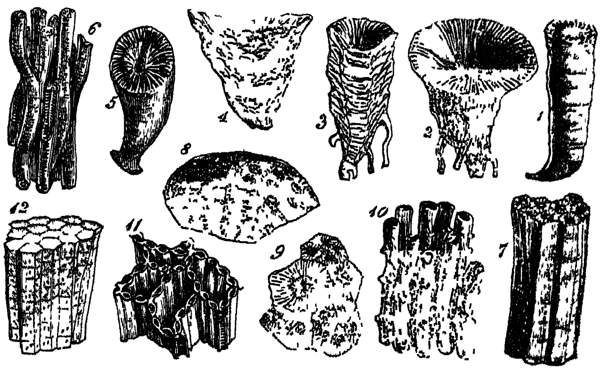

Fig. 4.

Palæozoic Corals (Anthozoa).

1. Amplexus Sowerbyi, Ph.; *Carboniferous*, Ireland.
2. Cyathophyllum turbinatum, Lin.; *U. Silurian*, Wenlock.
3. Cyathophyllum subturbinatum (section); *U. Silurian*, Wenlock.
4. Cystiphyllum Siluriense, Lonsd.; *U. Silurian*, Wenlock.
5. Zaphrentis Phillipsi, M. Edw.; *Carboniferous*, Somerset.
6. Lithodendron irregulare, Ph.; *Carboniferous*, Europe.
7. Lithostrotion striatum, Flem.; *Carboniferous*, Europe.
8. Acervularia luxurians, Eich.; *U. Silurian*, Europe.
9. Heliolites interstincta, Wahl; *U. Silurian*, Europe.
10. Syringopora ramulosa, Goldf; *Carboniferous*, Europe.
11. Halysites catenulatus, L.; *Silurian*, Northern Regions.
12. Favosites Gothlandica, Lam.; *Silurian*, North.

The Devonian system contains about 150 described corals, the carboniferous limestone 76, and the magnesian limestone only 5 or 6. The commonest forms of simple, turbinated corals are *Cyathophyllum* (fig. 4, 2 and 3),

Radiata.

which exhibits four slight *fossulæ* in its cup, and is often supported by root-like processes. In *Zaphrentis* (fig. 4, 5) there is but one deep fossula. *Amplexus* (fig. 4, 1) is a characteristic carboniferous fossil, nearly cylindrical, and often so straight and regular in its growth as to have been originally described as a chambered shell. The radiating septa are very slight, and the horizontal partitions simple, flat, and almost as regular as the septa of the *Orthoceras*. In the Silurian *Cystiphyllum* (fig. 4, 4) the lamellæ are also evanescent; but the *tabulæ* are represented by numerous vesicular plates. The corals of these genera are not always solitary, or merely in groups; some species of *Cyathophyllum* constantly form compound masses, with cups rendered polygonal by contact, like *C. regium* of the Bristol limestone. The allied genus *Acervularia* (fig. 4, 8) resembles an *Astræa*, and exhibits in a remarkable manner the multiplication of its corallites by calicular gemmation. The genus *Lithostrotion* (fig. 4, 7) of the carboniferous limestone is also compact and astræiform, but the new corallites are produced by lateral gemmation. Corals with the same structure, but not compact, are known by the name *Lithodendron* (fig. 4, 6). The "chain-coral" (*Halysites*, fig. 4, 11) and *Syringopora* (fig. 4, 10) resemble at first sight the recent asteroid *Tubiporidæ:* in *Halysites* the radiating septa are quite rudimentary; and in *Syringopora* the tabulæ are funnel-shaped, forming a central axis to each tube. The *Favositidæ* (fig. 4, 12) are mostly very regular both as to their polygonal shape and transverse tabulæ; the cells of adjacent corallites are connected by pores, either in the sides or angles of the walls; the septa are rudimentary. In the genus *Chætetes* the tubes are always slender, and much elongated, and their walls imperforate. *Michelinia* resembles the fruit of the *Nelumbium ;* it has vesicular tabulæ and root-like processes to its basal plate. *Heliolites* (fig. 4, 9), of which many species are found in the Silurian and Devonian limestones, is related to the recent *Milleporas*. The radiating septa are distinct, and the tabulæ regular; the interspaces between the stars are filled up with fine and regular tubes. One genus of *Fungidæ* (*Palæocyclus*) occurs in the upper Silurian.

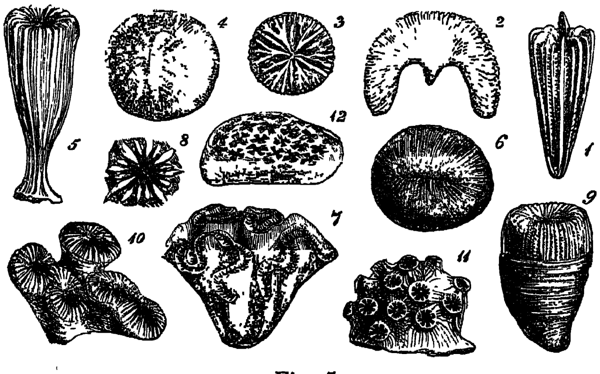

Fig. 5.

Secondary and Tertiary Corals (Anthozoa).

1. Turbinolia sulcata, Lam.; *M. Eocene*, Europe.
2. Diploctenium lunatum, Brug.; *Chalk*, France.
3. Micrabacia coronula, Goldf.; *U. Greensand*, Europe.
4. Aspidiscus cristatus, Lam; *Cretaceous* (?), Algeria
5. Cyclolites elliptica, Lam; *L. Chalk*, France.
6. Parasmilia centralis, Mant.; *U Chalk*, England.
7. Pachygyra labyrinthica, Mich.; *L. Chalk*, France.
8. Holocystis elegans, Lonsd.; *L. Greensand*, Isle of Wight.
9. Montlivaltia caryophyllata, Lam.; *Great Oolite*, France.
10. Stylina De la Bechei, M. Edw.; *Corallian*, Wilts.
11. Thecosmilia annularis, Flem.; *Corallian*, Wilts.

The British secondary corals are not very numerous; for although specimens abound in the coral-rag districts, only 14 species are found in that formation. Altogether, 65 species are found in the English oolites, and 22 in the chalk and greensands. These are mostly *Astræidæ*, or related to *Fungia*. Three common forms in the oolites are *Montlivaltia* (fig. 5, 9), *Stylina* (fig. 5, 10), and *Thecosmilia* (fig. 5, 11). The English cretaceous strata afford the *Holocystis* (fig. 5, 8), which is the most recent coral with quadripartite septa; *Trochocyathus* and *Parasmilia* (fig. 5, 6), resembling the recent *Cyathina ;* and the little "Fungia" *coronula* (fig. 5, 3), described in two genera of distinct orders (*Micrabacia* and *Stephanophyllia*) in the Monograph of the Palæontographical Society. The lower chalk of France and Germany contains many other corals, especially *Cyclolites* (fig. 5, 5), *Pachygyra* (fig. 5, 7), and *Diploctenium* (fig. 5, 2). The *Aspidiscus* (fig. 5, 4) was sent by Dr Shaw from Algeria.

The English *eocene* strata contain 25 corals, all extinct, and belonging to 15 genera. These include an *Astræa* (*Litharæa Websteri*), which grows on the water-worn flint pebbles; a *Balanophyllia*, similar to the existing coral; a *Dendrophyllia*, which is the oldest member of the genus; an *Oculina ;* and 8 species of the genus *Turbinolia* (fig. 5, 1). The corals of the English *pliocene* are mostly *Bryozoa ;* only four true corals have been found in the coralline crag, belonging to the genera *Sphenotrochus*, *Flabellum*, *Cryptangia*, and *Balanophyllia*, all reputed extinct, although the first is very closely related to the living *Sphenotrochus Macandrewi*.

The total number of fossil corals enumerated by M. D'Orbigny in the *Prodrome de Paléontologie* amounts to 1135, grouped under 216 genera. But notwithstanding all the labour which has been bestowed on this branch of palæontology by Goldfuss, Michelin, Lonsdale, and Milne Edwards, species are continually discovered or brought home from abroad which are altogether new, and cannot be placed in any of the constituted genera.

Class III.—BRYOZOA.

Char.—Tentacles of the polype hollow, with ciliated margins; alimentary canal with stomach, intestine, and anus; polypary, when present, external, horny, and calcareous.

The metamorphoses which the *Bryozoa* undergo are like those of the lower *Polypi ;* the embryo developed from the ovum is an oval, discoid, or subdepressed body, with a general or partial ciliated surface, by which it enjoys a brief locomotive life after its liberation from the parent. The *Bryozoa* are allied to the compound *Ascidia ;* but not one of the ascidian Molluscoids quits the ovum as a gemmule swimming by means of cilia; and no Bryozoon quits the ovum in the guise of a Cercarian or tadpole, to swim abroad by the alternate inflexions of a caudal appendage. In a progressive and continuous series of teachings, by pen or word of mouth, the place of an osculant or transitional group is governed by convenience, by considerations of how best to teach by comparison and easy gradation. The real merits of the man who would make scientific capital by changing the position of such group, and by imputing error or ignorance to the author from whom he may differ in this respect, are easily weighed and soon understood.

The *Bryozoa*, whether regarded as the highest organized Polypes, or as the lowest organized *Mollusca*, or as an intermediate type, are treated of in systematic palæontology in the position here assigned to them. The practical palæontologist finds himself compelled to arrange and study the fossil *Bryozoa* along with the corals, if only on account of the difficulty he in many cases experiences of determining to which class of Polypi his specimens belong. M. D'Orbigny, who has devoted much attention to this class, enumerates 544 fossil species, distributed in 73 genera. This number must be very far below the real one, since the *Bryozoa* of the chalk, which alone have been carefully examined, amount to 213 species; while only two species are known from the trias, none at all from the lias, and

only five from the upper oolites, so rich in corals and sponges. In the *Cours Elémentaire*, the fossil Bryozoa are stated to amount to 1676.

Of the 19 or 20 palæozoic genera, none extend into the secondary strata; but of the 18 oolitic genera, *Entalophora* and *Defrancia* range onwards to the tertiaries; and *Alecto*, *Idmenea*, and *Eschara* still survive. The oldest known fossil, *Oldhamia* (fig. 3, 2), is supposed to be a Bryozoon. The most common palæozoic form is *Fenestrella* (fig. 3, 11), resembling the recent "lace-coral;" there are 35 species, ranging from the lower Silurian to the Permian. One of its modifications resembles a feather (*Ptilopora*, fig. 3, 10), and is found in the carboniferous limestone. Another, more remarkable, has a spiral axis (*Archimedipora*, fig. 3, 9), and occurs in the same formation in Kentucky. One of the oldest genera is *Ptilodictya* (fig. 3, 8), of which 7 species are found in the lower Silurian formations. The slabs of Silurian limestone obtained at Dudley are covered with myriads of small and delicate fossils, including many *Bryozoa*. Some of these are spread like a film over other fossils, and have been doubtfully referred to the modern genera *Discopora* and *Berenicea;* others, with slender branches, and erect or creeping, are called Milleporas, Heteroporas, and Escharinas. The genus *Cœnites* (fig. 3, 7) perhaps belongs here. The magnesian limestone contains several large "lace-corals" of the genera *Fenestrella*, *Synocladia*, and *Phyllophora;* and two branching species of *Thamniscus* and *Acanthocladia*. The oolites afford many small incrusting species related to *Diastopora*, and branching forms like *Terebellaria* and *Chrysaora*. In the chalk, the *Escharas* are most numerous, and *Lunulites* and *Cupularia* first appear. Some thin beds of the lower chalk are almost composed of *Bryozoa*, mingled with *Foraminifera*. The coralline crag of Suffolk takes its name from the great abundance of *Bryozoa* it contains, among which *Eschara*, *Cellepora*, *Fascicularia*, *Theonoa*, *Hornera*, *Idmonea*, *Flustra*, and *Tubulipora* are the most important.

Class IV.—Echinodermata.

(*Star-Fishes, Sea-Urchins.*)

Char.—Marine; commonly free, repent animals, with the integument in most perforated by erectile tubular tentacles, hardened by a reticulate deposit of calcareous salts, and in many armed with spines.

The fossil Radiata present a mine of comparatively unexhausted richness to the palæontologist. More difficult of study than shells, and less uniformly present in all strata, the enduring remains of *Echinodermata* and corals are unsurpassed in beauty of form and structure, and in the value of the evidence they afford.

The present summary of the extinct forms of *Echinodermata* will commence with

Order 1.—Crinoidea.

Char.—Body with ramified rays, supported temporarily or permanently on a jointed calcareous stem; alimentary canal, with mouth and vent, both, as in Bryozoa, approximated.

The "stone-lilies," or crinoid star-fishes, formed a numerous and important group in the palæozoic seas, where they obtained their maximum number and variety. M. D'Orbigny describes 31 palæozoic genera, 2 triassic, 10 oolitic, and 4 cretaceous—of which latter 3 (*Pentacrinus*, *Bourgueticrinus*, and *Comatula*) are found in the tertiaries and modern seas. The *Crinoidea* differ from the other Echinoderms in having the generative organs combined with the arms, and opening into special orifices near their

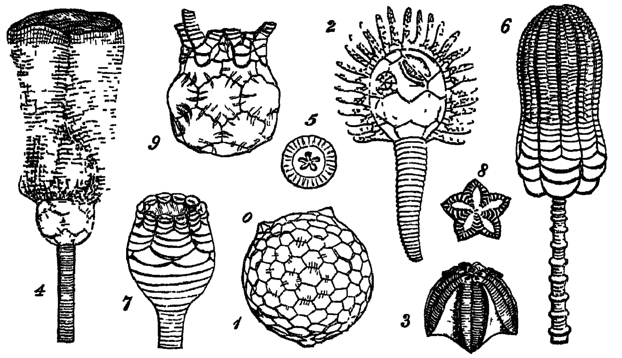

Fig. 6.

Crinoidea; Blastoidea; Cystoidea

1. Sphœronites aurantium, Wahl.; *L. Silurian*, Sweden.
2. Pseudocrinus bifasciatus, Pearce; *U. Silurian*, Dudley.
3. Pentremites florealis, Say; *Carboniferous*, Ohio.
4. Crotalocrinus rugosus, Mill.; *U. Silurian*, Dudley.
5. Poteriocrinus (joint of column); *Carboniferous*, Yorkshire.
6. Encrinus entrocha; *L. Muschelkalk*, Germany.
7. Apiocrinus Parkinsoni, Mill.; *Bradford Clay*.
8. Pentacrinus basaltiformis, Mill.; *Lias*, Lyme.
9. Marsupites ornatus, Mill.; *Chalk*, Sussex.

base. Nearly all the genera, except *Comatula* and *Marsupites* (fig. 6, 9), appear to have been attached either by the expanded base of the column, as in *Apiocrinus*, or by jointed processes, as in *Bourgueticrinus*. In many instances the lower part of the column throws out innumerable root-like side-arms, which strengthen and support it. The column is comparatively short in *Apiocrinus Parkinsoni*, and extremely elongated in *Pentacrinus Hiemeri*. It is round in nearly all the palæozoic Crinoids; and when five-sided, the articular surfaces of the joints are simply radiated, as in the rest. These joints are perforated in the centre, and when detached, are the "St Cuthbert's beads" of story (fig. 6, 5).[1] In *Platycrinus* the stem is compressed, and the articular surfaces are elliptical. In the genus *Pentacrinus*, which commences in the lias, the sculpturing of the articulations is more complex (fig. 6, 8), but it is quite simple in the other modern genera. The body of the Crinoid is composed of polygonal plates forming a cup, which is covered by a canopy of smaller plates. The mouth is often proboscidiform; the anal orifice is near it. The five arms which crown the cup are sometimes nearly simple, but feathered with slender, jointed fingers; in other genera they divide again and again, dichotomously; and in two remarkable Silurian forms, *Anthocrinus* and *Crotalocrinus* (fig. 6, 4), these subdivisions are extremely numerous, and the successive ossicles are articulated to each other laterally, forming web-like expansions, similar in appearance to the coral *Fenestrella* (fig. 3, 11.) Other remarkable Silurian Crinoids belong to the genera *Glyptocrinus*, *Eucalyptocrinus*, *Geocrinus* (the "Dudley Encrinite"), and *Caryocrinus*. Several are common to the Silurian and Devonian, as *Melocrinus*, *Cyathocrinus*, and *Rhodocrinus;* the two last, and *Poteriocrinus*, extend into the carboniferous formations. *Cupressocrinus* and some others are peculiarly Devonian; *Platycrinus*, common to Devonian and coal formations; and many genera (including the "nave Encrinite,"—*Actinocrinus*, *Gilbertsocrinus*, and *Woodocrinus*), are proper to the carboniferous limestone. The famous "lily Encrinite" (*Encrinus entrocha*, fig. 6, 6) is characteristic of the middle trias, or "muschel-kalk;" the "clove Encrinite" (*Eugeniacrinus*, fig. 7, 9) abounds in the Ox-

[1] Casts, in chert, of the canal which passes down the crinoidal column are called "screw-stones;" and those limestones which abound in columns and detached joints are called "entrochal marbles."

Radiata.

fordian oolites of Germany; *Apiocrinus*, *Millericrinus*, and several forms related to *Comatula*,—*e.g.*, *Pterocoma* and *Saccosoma*,—are also peculiarly oolitic. The "tortoise Encrinite" (*Marsupites*, fig. 6, 9) is found only in the chalk, along with *Bourgueticrinus* (fig. 7, 10); and the bodies of *Comatulæ*, which, when they have lost their arms and claspers, are called "Glenotremites." (Fig. 7, 7,—upper surface with sockets of the five arms; 8 under surface, showing articulations of claspers, and the scar of the larval stem.)

Order 2.—CYSTOIDEA.

This order was established by Von Buch for a small group of palæozoic Echinoderms formerly included with the *Crinoidea*. They have a globular body covered with close-fitting polygonal plates attached by a simple, jointed stem. The mouth is minute, and opposite to the stalk; close to it is the small anal opening; and a little more distant the generative orifice, covered by a pyramid of five or six little valves. Some of the genera, like *Pseudocrinus* (fig. 6, 2), have two or four tentaculiferous arms, bent down over the body and lodged in grooves, to which they are anchylosed. Others, like the *Sphæronites* (fig. 6, 1), have only obscure indications of tentacles situated close to the mouth. In *Pseudocrinus* and some other genera two or three pairs of lamellated organs, called *pectinated rhombs*, are placed on the contiguous margins of certain body-plates. They are supposed not to penetrate the interior, and no office has been conjecturally assigned to them; but Professor Forbes suggested that they might represent the "epaulettes" of the larval *Echinidæ*, to which group he supposed the Cystidean bore the same relation as the Crinoids hold to the star-fishes. There are 9 genera, of which 8 are found in the British strata—4 in the upper and 4 in the lower Silurian.

Order 3.—BLASTOIDEA.

A separate order has been proposed for another small group of palæozoic fossils typified by *Pentremites* (fig. 6, 3). The body is globular or elliptical, and supported on a small, jointed stalk, with radiated articular surfaces and irregular side-arms. It is composed of solid polygonal plates, with a minute oral orifice at the summit surrounded by five other openings, four of which are double and ovarian, the fifth rather larger and anal. There are five petaloid ambulacra of variable length, converging to the mouth, furrowed down the centre, and striated across. According to the observations of Dr Ferdinand Rœmer, these supported numerous slender, jointed tentacula, indicated by the rows of marginal pores. One species is found in the upper Silurian, 6 in the Devonian, and 24 in the carboniferous, which has received the name of "pentremite limestone" in the United States, on account of the abundance of these fossils it contains.

Order 4.—ASTEROIDEA.
(*Sea-Stars, Brittle Stars.*)

Char.—Body radiate; integument hardened by calcareous pieces, and more or less armed with spines; no dental apparatus.

Asteriadæ and Ophiuridæ.—Fossil star-fishes, though less common, have a wider range than their allies the fossil urchins, being found amongst the earliest organic forms. *Palæaster*, *Protaster* (fig. 7, 6), and *Lepidaster* (fig. 7, 5), are Silurian star-fishes, presenting many anomalies, and scarcely referable to any existing families. *Tropidaster*, *Pleuraster*, *Aspidura*, *Ophiurella*, and *Amphiura* are oolitic genera; *Ophiodermea*, *Luidia*, and *Astropecten* range from the lias to the present seas; *Stellaster* and *Arthraster* are peculiar to the cretaceous; and *Ophiura*,

Radiata.

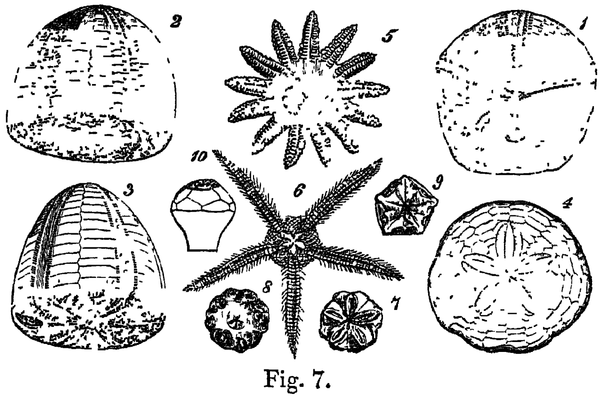

Fig. 7.

Galeritidæ; Asteriadæ; Crinoidea.

1. Pygaster semisulcatus, Ph.; *Inf Oolite*, Cheltenham.
2. Ananchytes ovatus, Lam; *U Chalk*, Europe.
3. Galerites albogalerus, Lam; *U. Chalk*, Kent.
4. Scutella subrotunda; *Miocene*, Malta.
5. Lepidaster Grayi, Forbes; *U Silurian*, Dudley.
6. Protaster Miltoni, Salter; *L. Ludlow rock*, Salop.
7. Comatula (Glenotremites), upper surface of body.
8. Comatula (lower surface); *Chalk*, Sussex
9. Eugeniacrinus quinquedactylus, Schl, *Oxfordian*, Wurtemberg.
10. Bourgueticrinus ellipticus, Mill; *Chalk*, Kent.

Astrogonium, *Oreaster*, and *Goniodiscus* are both cretaceous and living.

Order 5.—ECHINOIDEA.
(*Sea-urchins*)

Char.—Body spheroid or discoid, incased in a crust of inflexibly-joined calcareous plates, and armed with spines; dental system complex, arranged so as to resemble a "lantern."

The *Echinoidea* appear first in the carboniferous limestone, and attain their maximum in the cretaceous strata. In all secondary and more modern *Echinidæ*, the shell is composed of five double rows of ambulacral plates, and five inter-ambulacral; but in the *Palæchinus* (fig. 8, 1), of the carboniferous limestone there are six rows of inter-ambulacral plates, and in *Perischodomus* five. Only detached plates of *Archæocidaris* (fig. 8, 2) have been seen, and

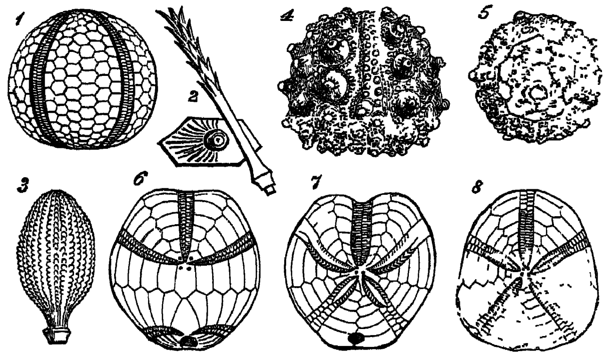

Fig. 8.

Echinidæ; Spatangidæ.

1. Palæchinus sphæricus, Scouler; *Carboniferous*, Ireland.
2. Archæocidaris Urii, Flem.; *Carboniferous*, Ireland.
3. Cidaris glandifera, Goldf. (spine); *Jura*, Mount Carmel.
4. Hemicidaris intermedia, Flem.; *Corallian*, Calne.
5. Salenia petalifera, Desm.; *U. Greensand*, Wilts.
6. Disaster ringens, Ag.; *Inferior Oolite*, Dorset.
7. Hemipneustes Greenovii, Forbes; *U. Greensand*, Blackdown.
8. Catopygus carinatus, Goldf.; *U. Greensand*, Wilts.

these, by their six-sided form, seem also to have been arranged in more than double series. Normal Echinidæ, of the existing genus *Cidaris*, abound in the upper *trias*.

Radiata.

Some of the secondary species of Cidaris have the ambulacral pores widely separated (=*Rhabdocidaris*); in others the rows of pores are doubled (=*Diplocidaris*). The genus *Hemicidaris* (fig. 8, 4), distinguished by the large spine-bearing tubercles on the lower part of the ambulacra, ranges from the trias to the chalk-marl. *Diademæ*, with smooth, solid spines (=*Hemidiadema*), appear in the lias, and continue to the chalk, where the modern type, with annulated, hollow spines, appears. *Echinopsis* also occurs in the lias; and *Acrosalenia*, a genus characteristic of the oolites, and distinguished from *Salenia* by its perforated tubercles. *Acrocidaris* and *Heliocidaris*, with *Glypticus*, and several other sub-genera of Echinus, are also peculiar to the oolites. *Salenia* (fig. 8, 5), with its ornamental disk, is characteristically cretaceous. *Arbacia* and *Temnopleurus* appear first in the eocene. The *Cassidulidæ* commence in the oolites, with *Pygaster* (fig. 7, 1) and *Holectypus*, and abound in the cretaceous system. *Galerites* (fig. 7, 3), *Discoidea*, *Pyrina*, and *Cassidulus* are peculiar to the chalk. The *Clypeastridæ* are represented in the oolites by numerous species of *Echinolampas* and *Nucleolites* (or *Clypeus*); the latter genus attains a large size. The sub-genus *Catopygus* (fig. 8, 8) is peculiar to the cretaceous series. *Conoclypeus* occurs in the chalk and tertiaries. *Clypeaster* flourished most in the miocene age; many large species are found in the south of Europe, Madeira, and the West Indies. Numerous genera, remarkable for their flattened form, and popularly known as "cake-urchins," are peculiar to the tertiaries and existing seas. *Lenita* and *Scutellina* are eocene; *Scutella* (fig. 7, 4) is miocene. *Mellita* and *Echinarachnius* are both fossil and recent. The heart-shaped urchins (*Spatangidæ*), are only remotely represented in the oolites by *Disaster* (fig. 8, 6); they are numerous in the chalk, to which *Micraster*, *Hemipneustes* (fig. 8, 7), *Archiacia*, *Holaster*, and *Ananchytes* (fig. 7, 2), are peculiar. *Hemiaster* is cretaceous and tertiary. *Spatangus*, *Eupatagus*, *Brissus*, *Amphidotus*, and *Schizaster* are tertiary and recent forms.

The shell of the *Echinodermata* has the same intimate structure in all the orders and families, and in every part of the skeleton, whether "test," or "spine," or "tooth." The smallest plates resemble bits of perforated card-board, and the largest and most solid are formed of a repetition of similar laminæ. In a few membranous structures, minute spicula, curved, bi-hamate, or anchor-shaped, are met with. They are always composed of carbonate of lime; but owing to their porosity, fossil examples are commonly impregnated with earth, or pyrites, or silica, and form bad subjects for microscopic investigation. Without, however, losing their organic structure, the fossil Echinoderms exhibit a cleavage like that of calcareous spar, by which the smallest ossicle of star-fish or Crinoid may be recognised: this peculiarity is most strikingly obvious in the great spines of the *Cidaris* (fig. 8, 3), or the enlarged column of the "pear Encrinite" (fig. 6, 7). Examples of the latter may be seen which had been crushed when recent, and before the sparry structure was superinduced.

Order 6.—HOLOTHURIOIDEA.

(*Sea-Cucumbers, Trepang.*)

Char.—Body vermiform; integument flexible, with scattered reticulate calcareous corpuscles, or beset with small anchor-shaped spicula.

The Holothurioid order presents scarcely any examples likely to be met with in a fossil state, except the genus *Psolus*, of whose imbricated shield a fragment has been found by Mr Richmond in the northern drift of Bute. Count Münster has figured the microscopic plates, apparently of a *Holothuria*, from the chalk of Warminster; and the anchor of a *Synapta* from a still older formation,—the upper oolite of Bavaria.[1] Microscopic observers will doubtless meet with many such detached plates and spines when searching for Polycystineæ and other Rhizopods in the oolitic and cretaceous strata; but it is scarcely probable that the order has dated far back in time.

Articulata.

PROVINCE II.—ARTICULATA.

In the great division of invertebrate animals called *Articulata* the brain is in the form of a ring encircling the gullet. A double ganglion above the tube supplies the chief organs of sense. The ganglions below the tube are connected with two chords which extend along the ventral surface of the abdomen, and are in most species united at certain distances by double ganglions, which are connected with the nerves supplying the body segments and their appendages. The body presents a corresponding symmetrical form. The skeleton is external, and consists of articulated segments of a more or less annular form. The articulated limbs, in the species possessing them, have a like condition of the hard parts, in the form of a sheath which incloses the muscles. The jaws, when present, are lateral, and move from side to side.

The worm, the lobster, the scorpion, and the beetle exemplify this province.

The articulate division of the animal kingdom, most universally distributed and numerically abundant at the present day, is least perfectly represented amongst the relics of the former world. Their chitinous integuments, often hardened with earthy salts, are quite as capable of preservation as the shells of the *Mollusca*, and remains of them are met with in all aqueous deposits; but that manifold, complex organization, which in the recent state fits them so admirably for generic and specific comparisons, is fatal to their entire preservation, and the fossil examples are often so fragmentary as to admit of little more than the determination of their class and family.

The most ancient fossiliferous rocks bear imprints which have been regarded as the tracks and burrows of marine worms. With these are found Crustacea of the lowest division, and of a group which is wholly extinct. A little later appear the Phyllopods, Copepods, and other existing orders of *Entomostraca*. Only a few obscure forms, doubtfully referred to the higher division *Malacostraca*, have been found in the carboniferous and Permian systems. The secondary strata contain abundant remains of Isopods, and of lobsters and hermit-crabs. True crabs (*Brachyura*) abound in the oldest tertiaries. Air-breathing insects and Arachnida existed even in the palæozoic age; the "sombre shades" of the carboniferous forests were not "uncheered by the hum of insects;" nor were the insects blind, like those which now inhabit the vast caverns of Kentucky and Carniola. The *Articulata* which come latest are the Cirripedes, whose lowest family appears in the lias; while the *Balanidæ* are only found in the tertiaries.

The number of fossil Articulata catalogued and described forms but a very small proportion of those which have probably existed. Bronn enumerates 1551 fossil insects: 131 Arachnida, 894 Crustacea, and 292 Anellida. Darwin describes 69 fossil Cirripedes, 12 of which are living species.

CLASS I.—ANELLIDA.

(*Worms, Tube-Worms, Nereids.*)

Char.—Body soft, symmetrical, vermiform, annulated, with suckers, or setæ, or setigerous tube-feet; blood of a red colour in most.

[1] Beitrage, heft 6, 1843.

The peculiar markings on the surface of the old Cambrian slate rocks, conjectured to afford the earliest indications of the existence of marine worms, are not without suspicion as to their origin. The so-called "Nereites" bear considerable resemblance to other equally ancient impressions which have been described as Zoophytes, under the name of *Protovirgularia* (fig. 3, 1). No such doubt attaches to the worm-tracks which abound in the thin-bedded sandy strata of the forest-marble; and the "Cololites" of the lithographic limestone are most probably the castings of worms. Long calcareous tubes occur in the upper Silurian and carboniferous strata, which have received the name of *Serpulites*. The *Microconchus* of the carboniferous period is now regarded as an Anellide; and in all the later formations, tubicolar Anellides, especially of the genera *Serpula*, *Spirorbis*, and *Vermilia* abound. Some of these, although attached and gregarious, are so regular in their growth as to have been usually called *Vermeti*, but are now placed in the genus *Vermicularia*. *Spiroglyphus*, and some other shell-excavators, are indicated in the tertiaries. Amongst the problematic fossils of the palæozoic strata, two are supposed to be *anellidous*,—viz., the *Tentaculites* (fig. 10, 7), which was apparently free, and almost always regular in its growth, so as more to resemble one of the gregarious Pteropods; and the *Cornulite* (fig. 10, 8), which is attached when young, singly or in groups, to Silurian shells and corals: the structure of its shell is vesicular, and the cavity resembles a series of inverted cones. The unattached and gregarious *Ditrupa* appears in the upper chalk, and abounds in the London clay and crag.

Class II.—CIRRIPEDIA.

(Barnacles, Acorn-Shells.)

Char.—Body chitinous or chitino-testaceous, subarticulated, mostly symmetrical, with aborted antennæ and eyes; thorax attached to the sternal surface of the carapace, with six pairs of multiarticulate, biramous, setigerous limbs; metamorphosis resulting in a permanent parasitic attachment of the fully-developed female to some foreign body.

The fossil Cirripedes belong chiefly to the sessile division, and consist of the ordinary forms of the still-existing *Balanidæ*. They are rare in the eocene tertiary, but more abundant afterwards. The *Balanus porcatus* attains a great size in the shelly beds of northern drift; its large basal plate, when detached, is a puzzling fossil, and has caused some mistakes. A *Coronula* has been found in the middle division of the crag which has afforded so many cetaceous bones. Remains of pedunculated Cirripedes occur in older deposits, but are mostly scarce and fragmentary. A species of *Pollicipes* is found adhering to drift-wood, perforated by bivalves, in the lias; another occurs in the Oxford clay, attached in groups to drift-wood, and the shells of Ammonites, which probably floated in the sea after death. The chalk affords many species of *Pollicipes* and *Scalpellum*, a species of the anomalous genus *Verruca*, and the only extinct genus of Cirripedes—*Loricula* (fig. 10, 6). This remarkable fossil is found attached to Ammonites, and exhibits only one side in any of the examples hitherto found. In this unsymmetrical development and the imbrication of its valves it more resembles *Verruca* than any other Cirriped. "During the deposition of the great cretaceous system, the *Lepadidæ* arrived at their culminant point: there were then three genera, and at least thirty-two species;" whereas at the present day the Philippine Archipelago, which is the richest marine province, affords but five species.

Class III.—CRUSTACEA.

Char.—Body articulated, with articulated limbs; head with antennæ; branchial respiratory organs; sexes distinct; metamorphosis in most, in none resulting in fixed individuals.

Sub-Class 1.—ENTOMOSTRACA.

Char.—Body with more or fewer segments than fourteen; integument chitinous, forming in some a bivalve shell; eyes sessile.

Small bivalve entomostracous Crustacea are found in all strata, and attain their maximum size in the older rocks. Minute *Ostracoda*, related to the recent *Cypris* (fig. 10, 5), swarm in the laminated fresh-water clays of the Wealden;

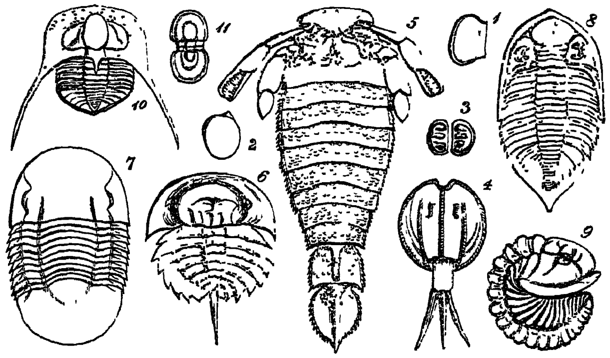

Fig. 9.

Palæozoic Entomostraca.

1 Leperditia Baltica, Wahl.; *U. Silurian*, Gothland.
2. Entomoconchus Scouleri, M'C.; *Carboniferous*, Ireland.
3 Beyrichia complicata, Salter; *L. Silurian*, Wales.
4. Dithyrocaris Scouleri, M'C.: *Carboniferous*, Ireland.
5. Pterygotus Anglicus, Ag.; *Old Red Sandstone*, Ludlow.
6. Bellinurus bellulus, König.; *Carboniferous*, Coalbrookdale.
7 Illænus Davisii, Salter; *L. Silurian*, Bala.
8. Phacops caudatus, Brun.; *U. Silurian*, Dudley.
9. Calymene Blumenbachii, Br.; *U. Silurian*, Dudley.
10. Trinucleus ornatus, Sternb; *L. Silurian*, Britain.
11. Agnostus trinodus, Salter; *L. Silurian*, Britain.

whilst the marine *Cytheridæ* assist with their multitudinous atoms in building up the chalk. Amongst the Phyllopods, the gregarious *Estheria* covers the slabs of Wealden and of Keuper with crowds of bivalve shells which have been commonly mistaken for *Cyclades* and *Posidonomyæ*. The globose *Entomoconchus* (fig. 9, 2) is found in the carboniferous limestone; *Leperditia* (fig. 9, 1) in the Silurian rocks of the north; and *Beyrichia* (fig. 9, 3), which is characteristically Silurian, may be distinguished from the young forms of Trilobites by the unsymmetrical shape of its separated valves. Other palæozoic Phyllopods (*Ceratiocaris* and *Hymenocaris*) related to the recent *Nebalia*, and having a conspicuous tail, occur in the upper and lower Silurian strata; the genus *Leptocheles* (M'C.) was founded on the tail-spines of these *Crustacea*. *Dithyrocaris* (fig. 9, 4), which resembles the recent *Apus* in the horizontal compression of its carapace, is found in the carboniferous limestone. The lower coal measures also contain in their nodules of clay-ironstone frequent examples of *Bellinurus* (fig. 9, 6), a small Pœcilopod, differing from the recent king-crab (*Limulus*) in the moveable condition of the body-segments. But the most extraordinary of the palæozoic Crustacea are the *Eurypterus*, *Himantopterus*, and *Pterygotus* (fig. 9, 5[1]), from the upper Silurian and old red sandstone, of which some far surpassed the largest living lobster or king-crab in size. They have been considered an extinct family, related to the *Limuli*; or as the repre-

[1] This figure (by Mr Salter), as well as several others, are taken from the *Siluria* of Sir R. Murchison, P.G.S.

sentatives of the larval condition of the stalk-eyed *Malacostraca*. But the following structures show an affinity to the *Ostracoda*. Their carapace is comparatively small, with compound eyes on the antero-lateral margins; the body segments are eleven or twelve in number, without appendages, and terminated by a pointed or bilobed tail. *Eurypterus* has eight feet; the others have three pairs of limbs,—viz., the chelate antennæ, the foot-jaws, and the natatory feet, with their fin-like palettes, which spring from the under side of their cephalo-thorax. The surface of the body and limbs often presents a peculiar imbricated sculpture, which caused them at one time to be regarded as fishes by Agassiz. The *Pterygotus problematicus* is supposed to have attained a length of seven feet, and some of the others were a yard long. Crustacea of this magnitude may have formed tracks on the sea-bed, like those on the Potsdam sandstone of America, called "Protichnites," subsequently to be described.

The great family of Trilobites is entirely confined to the palæozoic age; none are found even in the upper coal measures or Permian system. Above 400 species have been described, and grouped in 50 genera. Of these, 46 are Silurian, 22 Devonian, and 4 carboniferous. According to Bronn, 13 genera are peculiarly lower Silurian, 3 upper Silurian, 1 Devonian, and 3 carboniferous.

Order TRILOBITES.

Char.—Trunk segments trilobed; sessile compound eyes in most; limbs aborted.

The skeleton of the Trilobite consists of the cephalic shield, a variable number of trunk-rings or segments, and the *pygidium* or tail composed of a number of joints more or less anchylosed. In some species a *labrum* (or "hypostome") has been discovered, but no indications of antennæ or limbs have ever been detected; still there can be no doubt they enjoyed such locomotive power as even the limpet and chiton exhibit when requisite. Variations in the length of the cephalic and caudal spines (*e.g.*, in *Asaphus caudatus* and *longi-caudatus*), and in the prominence of the head-lobes, have been considered indications of difference of sex. One of the oldest and simplest forms is the minute *Agnostus* (fig. 9, 11); it is usually found in little shoals, with only the cephalic shield preserved, as if it were the larval form of some large Trilobite. According to the observations of M. Barrande, the *Sao* passes through twenty stages of growth, being first a simple disc, and ultimately having seventeen free thoracic segments and two caudal joints; the additional segments are developed between the thorax and abdomen. The *Trinucleus* (fig. 9, 10) with its ornamental border, and *Illænus* (fig. 9, 7), in which the trilobation is less conspicuous than in most genera, are characteristic of the lower Silurian strata. Two others from the Wenlock limestone have long been celebrated,—viz., *Calymene* (fig. 9, 9), or the "Dudley Trilobite," so compactly rolled up; and *Asaphus* (or Phacops) *caudatus* (fig. 9, 8), in which the lenses of the large eyes are frequently well preserved, and visible without a glass. Each eye has at least 400 facets, and in the great *Asaphus tyrannus* each is computed to have 6000. In one species (*Asaphus Kowalewskii*) the eyes are supported on peduncles. The largest Trilobite is *Asaphus gigas*; some of the fragments indicate a creature eighteen inches long.

Sub-Class 2.—MALACOSTRACA.

Char.—Body divided into thorax and abdomen, with seven segments in each.

The *Isopods* are represented in the upper oolite by *Archæoniscus Brodiæi*, which is gregarious, in large numbers in the slabs of Purbeck limestone; and in the Permian system by the *Prosoponiscus* (or *Palæocrangon*). The problematic *Pygocephalus*, and the "*Apus dubius*," both from the carboniferous strata, are doubtfully referred to the *Stomapoda*, and, with the exception of the *Gitocrangon* of Richter, are the oldest of the known stalk-eyed Decapods.

Macrourous Crustacea are of constant occurrence

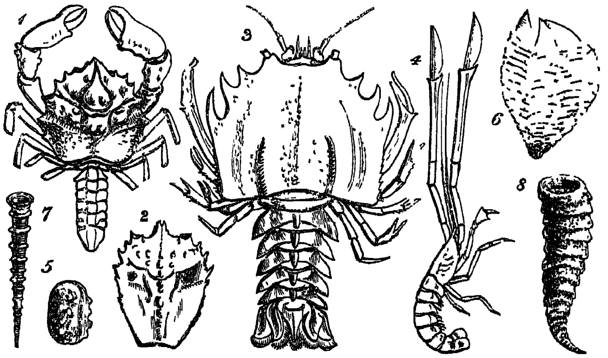

Fig. 10.

Crustacea; Annelida.

1. Dromilites Lamarckii, Desm; *London Clay*, Sheppy.
2. Notopocorystes Stokesii, Mant.; *Gault*, Folkestone.
3. Eryon arctiformis, Schl.; *Oxfordian*, Solenhofen.
4. Megachirus locusta, Germar; *Oxfordian*, Solenhofen.
5. Cypridea tuberculata, Sby; *Weald*, Sussex.
6. Loricula pulchella, G B. Sby; *L Chalk*, Sussex.
7. Tentaculites ornatus, J. Sby.; *U. Silurian*, Dudley.
8. Cornulites serpularius, Schl.; *U. Silurian*, Dudley.

throughout the oolites and cretaceous strata. One of the most remarkable forms, *Eryon* (fig. 10, 3), is found in the lias (with the closely-allied *Tropifer* and *Coleia*) and in the Oxford clay. The small lobsters of the genus *Glyphea*, in the oolites, and *Meyeria*, in the Speeton clay and greensand, are commonly the nucleus of hard nodules of phosphate of lime. The larger species of the chalk form the genus *Enoploclytia*. The Oxfordian oolite of Solenhofen, with its finely-laminated lithographic slates, opens like a book filled with compressed and wonderfully-preserved shrimps and lobsters. One of them, remarkable for its long and slender arms (*Megachirus*, fig. 10, 4) is also found in the Oxford clay of Wiltshire. One of the most remarkable repositaries of fossil Crustacea is the Isle of Sheppy, where the "London clay" has afforded countless examples of the higher organized division, including 9 Brachyura, 3 Anomura, and 5 macrourous species. The island of Hainan, on the coast of China, abounds with fossil crabs of the genus *Macropthalma*, which are sold in the drug-market of Shanghae. Others are found in the miocene of Malta, and of Perim Island in the Red Sea. The reputed instances of secondary *Brachyura* are open to doubt; in England we have only the little *Etyus Martini* (or *Reussia*) from the gault, for the *Podopilumnus* (M'C.) is probably from some foreign tertiary deposit. Pairs of chelate claws occur in the upper chalk which are referred to a hermit-crab (*Mesostylus Faujasii*). Small Crustaceans, resembling in form the living *Corystes*, abound in the gault (fig. 10, 2), but they are known to be anomourous by the small size and dorsal position of the posterior legs, and by the little plates intercalated between the last joints of the tail, as seen also in the *Dromilites* (fig. 10, 1) from the London clay.

CLASS IV.—INSECTA.

Char.—Body chitinous, articulated, with articulated and uncinated limbs; head provided with jointed antennæ; respiratory system tracheal.

The fossil insects hitherto examined have afforded no new types or forms of unusual interest. The oldest known, those from the lower coal measures, resemble the *Curculionidæ* and *Blattidæ* or *Locustidæ* of the pre-

sent day. The lias limestones have afforded a greater variety to the persevering skill of Mr Brodie: species of the genera *Berosus*, *Elater*, *Gyrinus*, *Laccophilus*, and *Melolontha*, and undetermined genera of the families *Carabidæ*, *Buprestidæ*, *Chrysomelidæ*, and *Telephoridæ;* Panorpa-like insects of the genus *Orthophlebia;* dragonflies, *Nepadæ* and *Cimicidæ*, *Cicada*, and the dipterous genus *Asilus*. Next in age is the insect depositary of the Stonesfield slate, which affords the large wing-covers of *Buprestis Bucklandi*, species of *Prionus* and *Coccinella*, and the great neuropteran *Hemerobioides*. The Purbeck limestone has supplied, in addition, species of *Cerylon* and *Colymbetes*, *Cyphon*, *Elophorus*, and *Limnius;* and examples of *Staphylinidæ*, *Cantharidæ*, *Harpalidæ*, *Hydrophilidæ*, and *Tenebrionidæ*, *Libellula* and *Phryganea*, *Acheta* and *Blatta*, *Aphis*, *Cercopis*, and other Homoptera, and ten dipterous genera. In the newer pliocene freshwater formations the recent *Copris lunaris* has been detected, and the elytra of *Donacia* and *Harpalus*. The principal foreign sources of fossil insects have been the lithographic slates of Solenhofen, and the tertiary deposits of Aix in Provence, and Œningen, near Constance, on the Rhine. Remains of species of *Tinea* and *Sphinx* are said to have been found in the lower Jura, and of a diurnal Lepidopteran in the Molasse. Numerous examples of insects in true amber have been obtained, and much more abundantly in "gum animi," a more modern fossil resin. These are all unknown to entomologists, and are probably extinct, since no department of recent natural history has been so closely worked, although the fossil insects have been comparatively neglected. It has been suggested by Mr Westwood that the lias insects have a sub-alpine character, and may have been brought down by torrents from some higher region. But no attempt has been made to show whether these or any other group of fossil insects most nearly resemble those of any particular zoological province of the present day.

Much has been said of the "indusial limestone" of Auvergne, supposed to be built up of the fossilized cases of caddis-worms (*Phryganeidæ*); but the only entomologist who has visited the country and examined the formation entertains doubts of the correctness of this interpretation.

Of the *Myriapoda*, 17 fossil species have been found, commencing in the oolitic system. And of the *Arachnida*, 131 species are catalogued; the earliest and most interesting of these is the fossil scorpion (*Cyclopthalmus senior*) of the Bohemian coal measures (figured in Buckland's *Bridgewater Treatise*). Fossil spiders are found in the Solenhofen slates and in the tertiary marls of Aix.

Province III.—MOLLUSCA.[1]

Remains of the *Testacea*, or shell-bearing molluscous animals, are the most common of all fossils, and afford the most complete series of "medals," or characteristic signs for the identification of strata. The duration of types and species, as a general rule, is inversely proportional to rank and intelligence. The most highly organized fossils have the smallest range, and mark with greatest exactitude the age of the deposit from whence they have been derived. But the evidence afforded by shells, if less precise, is more easily and constantly obtained, and holds good over larger tracts of country.

Class I.—BRACHIOPODA.

The lamp-shells (*Brachiopoda*), more than any other group, have suffered with the lapse of time. Of 1300 known species, only 75 are living; and of the 34 genera, the larger part (21) are extinct. The number of generic forms is greatest in the Devonian period and least in the upper oolites, after which a second set of new types gradually appears. The preponderance of fossil *Brachiopoda* is contrasted with the scarcity of the recent shells even more strongly by the abundance of individuals than by the number of species; for the living shells mostly inhabit deep water and rocky situations inaccessible to the dredger, and are seldom obtained in large numbers.

The genus *Terebratula*, as now restricted to shells with a short internal loop, musters above 100 fossil species, of which only one survives (*T. vitrea*), an inhabitant of the Lusitanian province.

The Waldheimias, or *Terebratulæ*, with long loops, are widely distributed in our present seas, although only 9 in number, being found on the coast of Spitzbergen and Labrador, at Cape Horn, and most abundantly in New South Wales and New Zealand: there are 60 fossil species dating from the trias. The *Terebratellæ* commenced in the lias, and occur in small numbers throughout the cretaceous and tertiary periods, and are the only lamp-shells which attain their climax in recent seas. Five species of *Argiope* occur in the greensand, chalk, and tertiaries. The allied genus *Thecidium* is represented by one species in the carboniferous and one in the triassic system, becomes comparatively common in the secondary period, and dwindles again to a single species in the newer tertiary; this species survives within still narrower limits in the Mediterranean sea. The sub-genus *Terebratulina* is represented by 20 species in the secondary and tertiary formations. *T. striata* of the chalk is so like the recent *T. caput serpentis* as to be with difficulty distinguished from it. Several extinct sub-genera occur in the cretaceous strata, of which the most remarkable are *Trigonosemus* (fig. 11, 1) and *Lyra*, shaped like a violin. The genus *Stringocephalus* (fig. 11, 2) is peculiar to the Devonian strata, and has a large internal loop, and a very prominent cardinal process, forked at the end, and fitting over the central plate of the opposite valve.

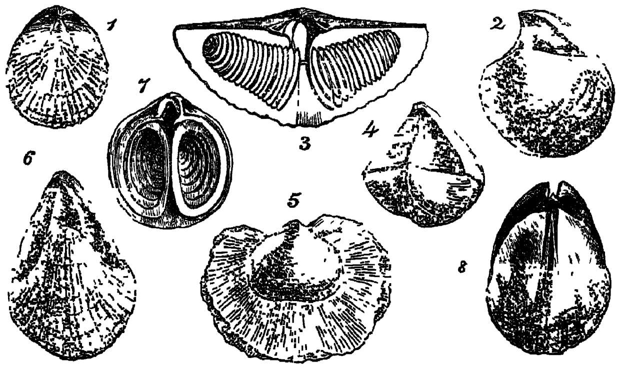

Fig. 11.

Brachiopoda.

1. Trigonosemus Palissyi, Woodw.; *U. Cretaceous*, Ciply.
2. Stringocephalus Burtini, Defr.; *Devonian*, Eifel.
3. Spirifera striata; *Carboniferous*, Britain.
4. Cyrtia trapezoidalis; *U. Silurian*, Dudley.
5. Athyris Roissyi, Lev.; *Carboniferous*, Ireland.
6. Uncites gryphus, Schl.; *Devonian*, Belgium.
7. Atrypa reticularis, L.; *U. Silurian*, Malvern.
8. Pentamerus lævis; *Caradoc S.*, Salop.

The shell of *Terebratula* and some of its allies (*Argiope*, *Thecidium*, *Cyrtia*, and *Spiriferina*) is dotted with minute quincuncial perforations, sometimes visible to the naked eye, as in *T. lima*, but usually requiring a lens of low power.[2]

[1] For the characters of this province and of its classes, see article MOLLUSCA.

[2] They are smallest in *T. carnea*, which Dr Carpenter has figured by mistake for *T. lima* in the *Trans. of the Palæontographical Soc.*

The lamp-shells with sharp beaks and plaited valves have been separated from the *Terebratulæ* under the name *Rhynchonella* (Fisch.) Their shells do not exhibit the punctate structure under a magnifying-glass, and they have no internal skeleton to support their arms, which in the recent species are coiled up spirally, and directed towards the concavity of the smaller valve, like the spires of the extinct *Atrypa* (fig. 11, 7). Of the 3 living species of *Rhynchonella*, one is found throughout the Arctic seas, a second in New Zealand, and the third at the Feejees (?). The fossil species exceed 250, and are found in all parts of the world; those from the palæozoic strata may prove distinct from the rest, since the permian species are known to be provided with large internal processes (*Camarophoria*, King). Casts of these shells are frequently impressed with the narrow and angular pallio-vascular impressions. The extinct genus *Atrypa* differs from *Rhynchonella* solely in having calcareous spires, which are preserved in many instances, and may be cleared to some extent by the application of acid. The foramen is separated from the hinge-line by a *deltidium*; and the interior of the valve is marked by ovarian and vascular spaces exactly as in *Rhynchonella*. The lower Silurian rock contains another genus, *Porambonites* (Pander), as yet imperfectly understood, but having the valves marked externally by impressed dots, which are not perforations. The genus *Pentamerus* occurs in all the strata below the carboniferous limestone, and is remarkable for its great internal partitions, causing the shell to split readily across the middle; and giving rise to deep incisions in those casts of the interior which are so common in the Caradoc sandstone (fig. 11, 8).

The extinct family *Spiriferidæ* are characterized by the possession of internal calcareous spires extending from the centre of the shell outwards (fig. 11, 3). These spires, like the shell itself, are frequently silicified, and may be disengaged from the matrix by the action of acid. At other times the shell is imbedded in soft marl, removeable by careful washing, so as to show the calcareous lamina of the spire fringed with hair-like processes, formerly the support of cirri. In the genus *Spirifera*, the shell has a long straight hinge-line, and the flattened *area* of the larger valve has a deltoid byssal notch.[1] The typical species are characteristic of the palæozoic strata, and have a shell-structure like *Rhynchonella*. The liassic species (*Spiriferina*, D'Orb.), have punctate shells, and the byssal opening is closed (at least in the adult) by a thin arched plate or "pseudo-deltidium." In the sub-genus *Cyrtia* (fig. 11, 4), the hinge-area is ultimately as long as it is wide, and the deltidium is perforated in the centre by a byssal tube; some of the species have a punctate shell. The genus *Athyris* (Dalman), not always easily distinguished from *Terebratula*, has usually a smooth and rounded shell, ornamented with concentric lamellæ or wing-like expansions (fig. 11, 5); the beak is truncated by a round foramen; the hinge-area is obsolete; and the spires are as in *Spirifera*, with the addition of some further complications near the hinge. There are 25 species, mostly from the Devonian and carboniferous rocks. The species of *Retzia* (King) are still more like plaited *Terebratulæ*, but have lateral spires; they range from the Silurian strata to the trias. *Uncites gryphus* (fig. 11, 6), a peculiar Devonian fossil, has a prominent beak, perforated in the young shell by a minute apical foramen; the hinge-area is filled up by a deeply concave deltidium, on each side of which (but only in some specimens) there is a lateral pouch formed by an inflection of the margin of both valves.

The family *Orthidæ* consists of shells with a straight hinge-line, bordered by a flat, narrow area, with a central notch in each valve; the ventral valve is furnished with articulating hinge-teeth, and the dorsal valve has short processes for the support of the oral arms, which appear to have been horizontally spiral (as in *Atrypa*). Between the oral processes there is a central projection for the attachment of the cardinal muscles. Internal moulds of the *Orthis* (fig. 12, 1) exhibit on the ventral side the single attachment of the adductor muscles in the centre, and on

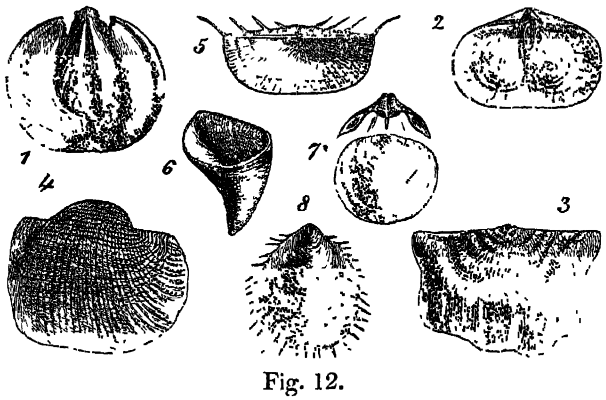

Fig. 12.

Brachiopoda.

1. Orthis hysterita, L. (cast); *Devonian*, Rhine.
2. Davidsonia Verneuili, Bouch.; *Devonian*, Eifel.
3. Strophomena rhomboidalis, Wahl; *U Silurian*, Dudley.
4. Producta semireticulata, Martin; *Carboniferous*, Derbyshire.
5. Chonetes striatella, Dalm; *U Ludlow rock*, Herefordshire.
6. Calceola sandalina, Lam.; *Devonian*, Eifel.
7. Obolus Apollinis, Eichw; *L. Silurian*, Northern Europe.
8. Siphonotreta unguiculata, Echw.; *U. Silurian*, Britain.

each side of it the cardinal muscles; these are surrounded by the punctate ovarian spaces and impressions of the large pallial sinuses. The genus *Orthis* includes 100 species, ranging upwards to the Permian, but it is most abundant in the Silurian rocks. Some of the lower Silurian species have a round foramen in the "pseudo-deltidium," and are called *Orthisinæ* (D'Orb.) Other species in the upper palæozoic rocks have the beak twisted or deformed, probably owing to the attachment of the shell when young (= *Streptorhynchus*, King). In *Strophomena*, Rafin (= *Leptæna*, Dalm.), there is a minute byssal foramen when young, of which no trace exists in the adult; and the deltoid notch is also closed, except the space required to receive the divided cardinal process of the dorsal valve. The oral processes appear to be shifted to the centre of the valve. The shell, when young, is plano-convex, but when it has attained a certain size the valves are bent over to one side or the other, and more or less suddenly. The pallial impressions are the same as in *Orthis*.

The genus *Davidsonia*, peculiar to the Devonian limestones, resembles an *Orthis* attached, like *Thecidium*, by the ventral valve to corals, and sometimes taking the markings of the body on which it grows, like the oyster and *Anomiæ*. The pallial impressions are like those of *Orthis*, and the form of the spiral arms is indicated by prominences which almost fill up the interior of the shell in aged examples. Some indications have been obtained of slender calcareous spires for the support of the arms in this genus; and also in *Koninckia*, a small shell from the trias of St Cassian, in which there are always spiral grooves in the interior of the valves crossed by the impressions of the pallial sinuses.

The anomalous fossil called *Calceola sandalina* (Lam.) is also peculiar to the Devonian limestones. In shape it resembles *Cyrtia*, but has no hinge, and neither foramen nor internal processes, except a row of small projections

[1] The term *deltidium*, applied by Von Buch to this foramen, has, by misconception of his meaning, become constantly used for the plates which partially close it.

Mollusca.

along the hinge-line, and two small lateral groups of ridges in the smaller valve. The interior is punctato-striate, but has no recognisable muscular markings.

The *Productidæ* are altogether palæozoic fossils, and most abundant in the carboniferous limestones. Their valves are concavo-convex, the hinge-line straight, and the interior marked with distinct impressions of the muscles for opening and closing the valves, and simple vascular spaces. There are 60 species of *Producta* found in the upper palæozoic rocks, and having a very wide range in North and South America, and from Spitzbergen to Thibet and Tasmania. Some of them are extremely variable in form; many are armed with long tubular spines, and others completely clothed with short, hair-like processes; they have no hinge-teeth, and the hinge-area is extremely narrow, except in the sub-genus *Aulosteges* of the Russian zechstein. *Producta proboscidea* has its convex valve prolonged into a tube, as if for the constant supply of respiratory currents. The Permian genus *Strophalosia* has its valves articulated by hinge-teeth, and covered with long and slender hollow spines; the shell is attached when young by the umbo of the large valve. *Chonetes* is distinguished from *Producta* by a row of spines along the hinge-margin of the convex valve; it also has a narrow hinge-area with a covered notch, and small hinge-teeth. There are 25 species in the Silurian and carboniferous, usually of small size, and finely striated.

Crania is one of the oldest living types, ranging upwards from the lower Silurian. One of the earliest species appears to have been unattached, and another to have had hinge-teeth. *Crania Ignabergensis*, of the chalk of Sweden, has the valves externally alike, being attached only when very young. The internal markings of *C. antiqua*, and other fossil species, are remarkably grotesque. Lower valves of this genus and *Thecidium* are not uncommon, attached to the tests of sea-urchins, in the chalk; but upper valves are scarce, either detached or *in situ*.

The *Discinidæ* are also ancient fossils, few in number, but appearing in every period. Some of the palæozoic *Discinæ* (= *Orbiculoidea*, D'Orb.) cannot be generically distinguished from the recent species by any characters with which we are as yet acquainted; but others (= *Trematis*, Sharpe) are ornamented with quincuncial punctures, and the casts exhibit indications of diverging internal plates, which imply very considerable difference in the organization of the animal. The genus *Siphonotreta* (Verneuil), peculiar to the Silurian formations, is covered with moniliform tubular spines.

Lingula, which has given its name to the older fossiliferous rock, is another form occurring unchanged in strata of every period. Only 34 species are known, and none of them are very common. The latest British *Lingula* is found in the coralline crag (older *pliocene*) of Suffolk: the nearest living species is as far off as the Philippines. *L. Davisii*, of the "lingula flags" in North Wales, has a pedicle groove in the ventral valve, by which the posterior adductor (or cardinal muscle) must have been divided into two elements, as in the genus *Obolus;* externally it has all the appearance of an ordinary existing shell. *Obolus*, Eichw. (= *Ungula*, Pander) is so abundant in the lower Silurian sandstones of Sweden and Russia as to have given its name to the "obolite grit." In England it occurs only in the upper Silurian of Dudley. The shell is horny in texture, and often stained blue, like the *Lingula*, by the presence of phosphate of iron. In shape it is regularly oval, and differs from *Lingula* in the character of the internal muscular impressions.

CLASS II.—LAMELLIBRANCHIATA.

(Bivalve Shells.)

More than a third part of the known fossil shells are ordinary bivalves (*Conchifera*, Dh.) They amount to nearly 6000, while the recent species scarcely exceed half that number. Nevertheless, it is a group which attains its maximum in the present seas. The genera are seven times more numerous in the newer tertiary than in the oldest geological system; and the number of species found in the entire Silurian series is less than 100, while the chalk contains 500, and the miocene 800. Out of 150 genera, 35 have become extinct, besides numerous sub-genera. The families *Cyprinidæ*, *Astartidæ*, and *Anatinidæ* have passed their maximum; the *Trigoniadæ* are nearly extinct; and the *Hippuritidæ* have no living representatives.

The monomyary bivalves, and others with an open mantle, attain a degree of importance at an early period; and with them some of the burrowing families (*Myacidæ* and *Anatinidæ*); while the highest organized siphonated shells (*e.g.*, *Veneridæ* and *Tellinidæ*), unknown in the older rocks, are most abundant now.

The family *Ostreidæ*, distinguished from the Pectens and *Anomiæ* by resting on the *left* valve, contains two fossil forms. Of these, *Exogyra* resembles an oyster with spiral umbones, directed backwards, or to the left hand; it is an attached shell, characteristic of the cretaceous strata. The genus *Gryphæa* (fig. 14, 1) abounds in the oolites, and is

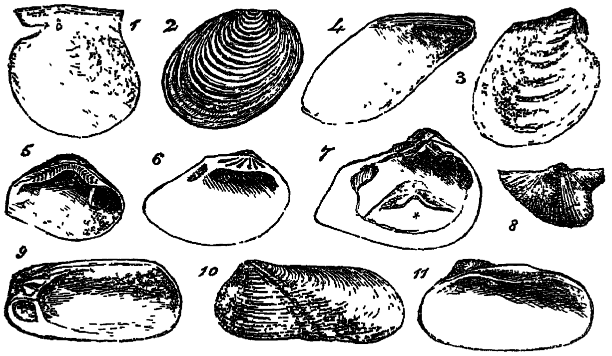

Fig. 13.

Palæozoic Bivalves.

1. Aviculopecten, sp.; *Carboniferous*, Belgium.
2. Posidonomya Becheri; *Carboniferous*, Hesse.
3. Ambonychia vetusta, Sby.; *Carboniferous*, Belgium.
4. Myalina Goldfussi, Dkr.; *Carboniferous*, Vise.
5. Ctenodonta cuneata, Hall; *L. Silurian*, Canada
6. Lyrodesma plana, Conrad; *L. Silurian*, Hudson River.
7. Axinus obscurus, Sby., *Magnesian limestone*, Durham.
8. Conocardium armatum, Ph.; *Carboniferous*, Tournay.
9. Pleurophorus costatus, T. Br; *Magnesian limestone*, Durham.
10. Grammysia cingulata, His.; *Ludlow rocks*, Kendal.
11. Edmondia, sp.; *Carboniferous*, Belgium.

gregarious, but unattached, the umbo of the larger valve being curved inwards like a claw. A single *Ostrea* occurs in the carboniferous limestone, after which the species become abundant, and are with difficulty distinguishable from the smooth and plaited, or "cocks-comb," oyster of the present day.

Several curious modifications of *Anomia* and *Placuna* have been obtained in a fossil state. *Limanomia* (Bouchard) has ears like *Lima*, and is attached to shells and corals of the Devonian age. *Placunopsis* (M. and L.), found in the oolites, has a transverse ligamental groove, which, like the umbo of the upper valve, is some way within the margin of the shell. And *Carolia* (Cantr.), a tertiary form of *Placuna*, has a byssal plug passing through a foramen like that of *Anomia* when young, but closed in the adult.

Fossil *Pectinidæ* are very numerous. Some of them in the carboniferous limestone (*e.g.*, *P. Sowerbyi*) cannot be distinguished generically from the living Pectens, and retain diverging bands of colour. But the greater part of

Mollusca.

these old species are somewhat aviculoid in form (fig. 13, 1), and their hinge-area is grooved with cartilage-furrows like those of *Arca*. The most beautiful forms occur in the

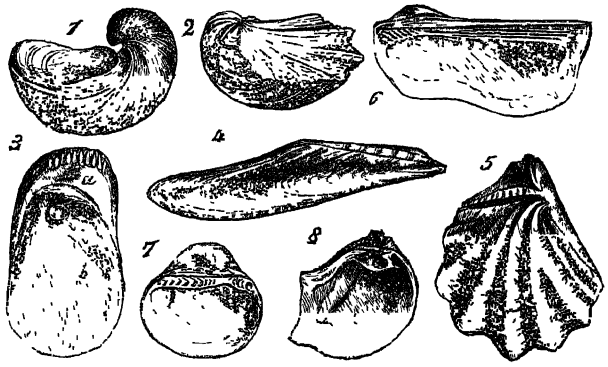

Fig. 14.

Secondary Bivalves.

1. Gryphæa arcuata, Lam.; *Lias*, Charmouth.
2. Pecten (Neithea) quinquecostata, Sby.; *Chalk*, Sussex.
3. Pulvinites Adansoni, Defr. (internal mould); *Corallian*, Rochelle.
4. Gervillia anceps, Dh.; *L. Greensand*, Isle of Wight.
5. Inoceramus sulcatus, Park., *Gault*, Folkestone.
6. Cucullæa (Macrodon) Hirsonensis, D'Arch.; *Great Oolite*, Minchinhampton.
7. Isoarca cordiformis, Schloth.; *Corallian*, Nattheim.
8. Myophoria decussata, Münt.; *Trias*, S. Cassian.

chalk and greensand, and resemble the recent scallop (*Janira*, Schum.) in the inequality of their valves, but are further characterized by the possession of articulating hinge-teeth like *Spondylus*. These constitute the genus *Neithea* (fig. 14, 2). *Plicatulæ* exist in the trias and oolites, along with shells referred dubiously to *Hinnites* and *Spondylus*. True *Hinnites* (a sub-genus of *Pecten*) are characteristic of the *miocene*. *Spondyli* appear in the greensand and chalk. Some of them (like the so-called "*Plagiostoma spinosum*") are unattached; others resemble the recent deep-water *S. Gussonii*, and have been called "Dianchoræ." The inner layer, including the hinge of these shells, is seldom preserved. *Lima duplicata*, and some other oolitic species, have two ranges of little hinge-teeth, but not like those of the recent species of *Limæa*. The large and smooth or striated Limas of the oolites have been called *Plagiostoma*, a name originally given by Llhwyd.

The pearl-oysters (*Aviculidæ*) are also very abundant fossils: but owing to the frequent repetition of similar forms, it is difficult to determine the genera with any degree of certainty by the aid of external characters alone. The Silurian species mostly belong to the genus *Pterinea* (Goldfuss), and are broadly winged, and have the hinge-area striated lengthwise, and a few diverging hinge-teeth. *Amboncychia* (Hall) resembles *Inoceramus*, and ranges from the Silurian to the carboniferous strata (fig. 13, 3). The Silurian genus *Cardiola* is ridged like a cockle; and *Posidonomya*, which is found in all the palæozoic rocks, is very thin and concentrically furrowed (fig. 13, 2). Many other genera have been proposed whose characters are even more imperfectly understood. *Monotis* (*Salinarius*), one of the common shells of the trias, has no anterior ear. *Pteroperna* (Lycett), an oolitic form, has a winged shell, with numerous small anterior teeth and long posterior laminæ. The genus *Gervillia* (fig. 14, 4), ranging from the carboniferous limestone to the chalk, consists of elongated shells, with several cartilage-pits in the ligamental area. *Bakewellia*, found in the Permian, has an anterior muscular impression like *Arca*. The recent genus *Perna* commenced in the lias or preceding formation, and exhibits great variety of shape. *Pulvinites Adansonii* (fig. 14, 3) appears to have been a Perna with a byssal foramen like *Anomia*; and *Inoceramus* (fig. 14, 5), characteristic of the cretaceous strata and oolites, differs from Perna chiefly in form, the larger valve being sometimes completely involute, and resembling a *Nautilus*. The genus *Pinna*, which appears to belong to this family, although provided with two adductor muscles, occurs fossil in the Devonian and all subsequent strata. Some of the oolitic species, distinguished by the name *Trichites*, are inequivalve and irregular, and attain a thickness of more than an inch, resembling mineral masses of fibrous carbonate of lime.

Amongst the *Mytilidæ* are many Silurian species distinguished by their large, round, anterior muscular scar (*Modiolopsis*, Hall), and others which have a straight hinge-line and plaited valves (*Orthonotus*, Conrad). *Myalina* has the cartilage-groove repeated (fig. 13, 4), and is found in the upper palæozoic rocks. Sometimes the anterior adductor is supported on a shelf, as in the recent *Septifera* and *Dreissenia*. True *Mytili* and *Modiolæ* abound in the oolitic strata. *Dreissenia*, now confined to the rivers of the Aralo-Caspian region, or only naturalized in Western Europe, was represented by many species, and some of large size, in the *eocene* of Hampshire and *miocene* of Vienna.

Fossil *Arcadæ* are far more numerous than the recent shells, and mostly belong to the division *Cucullæa*, of which a single species survives in the Coral Sea. The palæozoic Arks have anterior teeth like *Arca*, and posterior teeth like *Cucullæa*, and differ from both in the reduction of the hinge-area to a narrow tract corresponding with the posterior half only in the recent shells. The casts of Ark-like shells in the Silurian rocks are further distinguished by a deep furrow behind the front muscular impression. These constitute the genus *Ctenodonta* (Salter), which has hinge-teeth like *Nucula*, and a prominent external ligament (fig. 13, 5). Some of the oolitic Arks, with a byssal sinus, and the posterior teeth very long and parallel, form a sub-genus called *Macrodon* (fig. 14, 6). Others, with prominent umbones, teeth like *Nucula*, and a striated ligamental area, form the genus *Isoarca* of Münster (fig. 14. 7). Above 200 species of *Nucula* and *Leda* are known only as fossils, and range through all the rock systems. The palæozoic species are anomalous in form, and when better understood, will certainly be considered distinct as genera. *Yoldia* is a newer tertiary form characteristic of high northern latitudes; and *Solenella* occurs fossil in Patagonia and New Zealand. The problematic genus *Solemya* is supposed to have existed in the carboniferous period. *Pectunculi* appear first in the cretaceous strata, being less ancient than *Limopsis*, which occurs in the Bath oolite. A member of the latter genus found in the Belgian *eocene* has the ligamental area entirely *behind* the cartilage-pit, and is called *Nucunella* by D'Orbigny. The "Stalagmium" of Conrad (= *Myopara*, Lea) is identical with *Crenella* (T. Br.), a sub-genus of *Modiola*, found in the cretaceous and tertiary strata.

The *Trigoniadæ* are represented in the lower Silurian strata by *Lyrodesma* (fig. 13, 6), a shell with several radiating hinge-teeth, striated transversely; and in the upper palæozoics by *Axinus* (fig. 13, 7) and several other imperfectly-known genera. The trias contains true *Trigoniæ* associated with the genus *Myophoria* (fig. 14, 8), which has the umbones turned forwards, and a posterior hinge-tooth. The only member of this family which has yet been found in tertiary strata is the little genus *Verticordia* (Wood) of the crag. No *Trigoniæ* have been met with, although 100 species are known in the secondary rocks, and two are still living on the coasts of South Australia.

Fresh-water mussels (*Unionidæ*), of large size and various form, occur in the Wealden formation, and are not generically distinguishable from recent shells; but those of the

Mollusca.

coal measures and older rocks are extremely problematic, and may even belong to marine genera.

Of the genus *Chama* there is one species in the upper greensand and chalk of England, and another in the London clay. Elsewhere they are more abundant, amounting to thirty species. Closely allied to *Chama* is the *Diceras* (Lam.), of which the remarkable casts attracted attention at an early period (fig. 14, 1). They are found in the coral rag of France and Germany, and resemble the horns of some animal. The shell is attached by the *umbo* of either valve, indifferently, like some of the recent Chamas. The posterior adductor muscle is supported on a prominent ridge (as in *Pachydesma, Megalodon*, and the recent *Cardilia*), which causes a spiral furrow in each horn of the cast. The shells which succeed *Diceras*, in the lower cretaceous strata, have the right valve usually much smaller than the left, and in one instance (fig. 14, 2) it is like the operculum of a spiral univalve. The only British species of this group is *Requienia Lonsdalii*, found in the ironsand of Bowood. In France, and also in Texas, another form occurs, with the attached valve simple and conical, like a Hippurite. The ligamental groove is straight, and the umbo of the free valve marginal.

These shells are so intimately allied to the *Hippuritidæ*, that *Requienia* has been frequently included with them in the apocryphal order "Rudista." The members of the Hippurite group are attached and gregarious, like oysters, often occurring in great numbers, and filling large tracts of rock. Their valves are different in structure and sculpturing, and are articulated by two prominent teeth above and one below; the cartilage is internal, but there is a conspicuous ligamental furrow outside. There are nearly 100 species characteristic of the cretaceous strata, and especially of the lower chalk, or "hippurite limestone." Only one species (*Radiolites Mortoni*) is found in England; the rest are from the West Indies, Southern Europe, Algeria, and the East. The form which approaches nearest to *Chama* is the little genus *Caprotina* (fig. 15, 7), whose upper valve has a marginal *umbo*, but is in other respects like a miniature *Radiolite*. *Caprina* (D'Orb.) has the free valve perforated by canals which open in the inner margin, and in *Caprinella* the outer lamina of both valves possesses this structure. One valve is sometimes spiral (fig. 15, 6), and partitioned off internally by numerous *septa*,

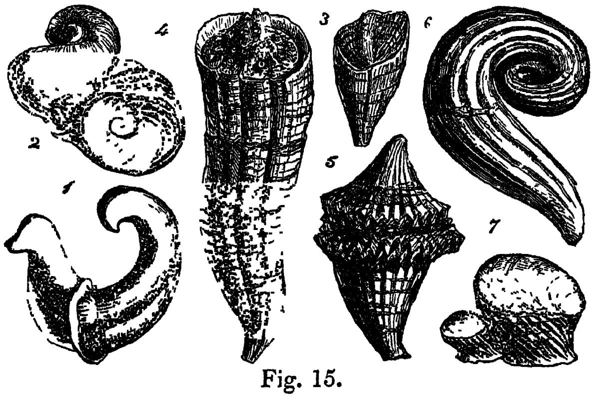

Fig. 15.

Secondary Bivalves.

1. Diceras arietinum, Lam.; *Corallian*, France.
2. Requienia ammonia, *Neocomian*, S. France.
3. Monopleura trilobata, D'Orb.; *Neocomian*, Orgon.
4. Hippurites Toucasiana, D'Orb.; *L. Chalk*, France.
5. Radiolites angeiodes, Lam ; *L. Chalk*, Gosau.
6. Caprinella Boissyi, D'Orb.; *L. Chalk*, Valley of Alcantara.
7. Caprotina semistriata, D'Orb.; *U. Greensand*, Le Mans.

like the water-Spondylus, but so regularly as to resemble the chambered shell of a *Nautilus*. In the *Radiolite* (fig. 15, 5), both valves are conical, and the *umbo* of the free valve (marginal in the very young shell) becomes central in the adult. The structure of the hinge is modified by the absence of any spirality in the valves, but is essentially the same as in *Caprotina* and *Diceras;* the prominent teeth of the upper valve support curved plates for the attachment of the adductor muscles, which become continually more undercut in the course of their growth. In *Hippurites*, the anterior muscular plate projects horizontally, the posterior vertically, like a third tooth, for which it has been mistaken. In this genus there are two longitudinal inflexions of the outer shell-wall beside the ligamental furrow, one corresponding to the posterior muscular plate, the other (or third) apparently a *siphonal* inflexion like that in *Trigonia* and *Leda* (fig. 15, 4).

The cockle-shells (*Cardiadæ*), as they have a world-wide distribution now, had a corresponding range in *time*, and are found in all strata from the Silurian upwards. The commonest fossil type of *Cardium* is ribbed concentrically on the sides, and radiately on the posterior slope, a style of ornament almost unique amongst the 200 recent species. The Caspian cockles, distinguished by a *sinus* in the pallial line, appear to have inhabited the Aralo-Caspian region almost from the middle tertiary period; the hinge-teeth are reduced to one (*Monodacna*) or two (*Didacna*) in each valve, and are sometimes quite wanting even in the young shell (*Adacna*, Eichw.) *Lithocardium aviculare* (fig. 16, 7) is a characteristic shell of the Paris basin, and appears to have spun a byssus, like the fry of some recent cockles; it also resembles the oriental *Tridacna*, of which a species is found in the *miocene* of Poland. The genus *Conocardium* (fig. 13, 8) of the upper Silurian and carboniferous systems is remarkable for the prismatic cellular structure of its shell, and the truncation of the posterior (?) side of the valves, which are furnished in some species with a slender siphonal process.

The *Lucinidæ*, allied to the cockles in their hinge-structure, are also plentiful in the fossil state, and have as wide a range. They are usually recognisable, even when in the condition of internal casts, by their circular form and the oblique ridge on their disk. Casts of *Lucina* also exhibit the peculiar narrow outline of the anterior adductor detached from the pallial line. *Cryptodon, Diplodonta, Kellia*, and *Pythina* are found in the eocene tertiary. *Corbis*, under the sub-generic form of *Sphæra*, commences in the trias; another modification, found in the oolites and chalk (*Unicardium*, D'Orb.), is edentulous; and *Tancredia* (Lycett), a compressed triangular shell, with a dentition like *Corbis*, is frequent in the lias and oolite.

The fresh-water *Cycladidæ* are represented in the *Wealden* and *eocene* by many species of *Cyrena*, mostly of small size. The recent *Corbicula fluminalis* of eastern rivers is a common fossil of the pliocene tertiary in England and Sicily.

The *Cyprinidæ* and *Astartidæ* are more abundant as fossil shells, and had a wider range of old than at the present day. Nearly 100 species of *Cyprina* have been catalogued, commencing in the trias; the dentition of the older species is, however, somewhat peculiar. The *Isocardiæ* are almost as numerous, and have the same range, but many of the fossil Isocardia-looking shells are really related to the *Anatinidæ*. A yet higher antiquity has been assigned to *Cypricardia*, a genus now very scarce and difficult to obtain, on account of its habit. The palæozoic *Pleurophorus* (fig. 13, 9) is distinguished by the prominent ridge behind the anterior muscular impression; and *Megalodon* (J. Sby.), by the plate supporting the posterior adductor. This genus is represented in the oolites by *Pachyrisma* (fig. 16, 1), and in the tertiaries and modern seas by *Cardilia*.

The genus *Astarte*, now limited to a dozen species in the North Atlantic and Arctic seas, has an almost world-wide geological distribution, and counts 200 species in

Mollusca.

D'Orbigny's catalogue, commencing with the *lias* period. *Crassatella*, now almost a southern form, is common in the cretaceous and tertiary strata of Europe. Closely allied to *Astarte* is the extinct genus *Opis* (fig. 16, 3), of which there are 42 species in the secondary series; and *Cardinia* (fig. 16, 2), characteristic of the lias and oolites.

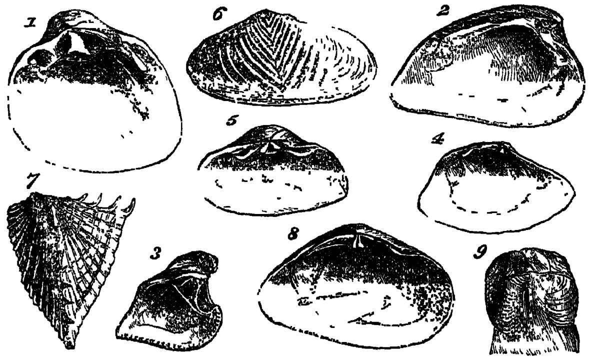

Fig. 16.

Secondary and Tertiary Bivalves.

1. Pachyrisma septiferum, Bur.; *Coralhan*, Meuse.
2. Cardinia hybrida, Sby.; *Lias*, Gloucester.
3. Opis tumulatus, Mill.; *Inf. Oolite*, Bayeux.
4. Tancredia securiformis, Dkr.; *Lias*, Saxony.
5. Sowerbya crassa, D'Orb.; *Oxfordian*, Ardennes.
6. Goniomya scripta, Sby.; *Kelloway rock*, Wilts.
7. Lithocardium aviculare, Lam.; *Eocene*, Paris.
8. Grateloupia irregularis, Bart.; *Miocene*, Bordeaux.
9. Teredina personata, Lam., *Eocene*, Bogna.

The so-called Unios of the coal measures (*Anthracosia*, King) are probably members of this group. One hundred species of *Cardita* (including *Venericardia*) are found in the secondary and tertiary strata; of the 50 recent forms, one only is Arctic, and this occurs in the glacial deposits of England. The allied genus *Myoconcha* is characteristic of the older secondary rocks, and *Hippopodium* of the lias.

The *Veneridæ* are pre-eminently characteristic of the tertiary and present period. Some obscure species of Venus are found in the oolites: *Cytherea* occur in the greensands; *Artemis*, *Trigona*, *Lucinopsis*, *Venerupis*, and *Tapes* appear in the middle tertiary; *Petricola* in the eocene. The only extinct form is *Grateloupia* (fig. 16, 8), which differs but little from *Trigona*.

The Mactras and Tellens are also comparatively modern groups; most of the supposed oolitic species belong to *Lucinidæ*, except *Sowerbya* (fig. 16, 5), which has a pallial sinus, and is found in the oolites of Malton and Portland. *Psammobiæ* and *Mesodesmæ* occur in the greensand; *Donax* and *Syndosmya* in the eocene; *Gastranæ* and *Lutraria* in the *miocene*. *Lutraria rugosa*, still living on the coast of Portugal, is fossil in the raised beaches of Sussex.

The oldest forms of razor-fish (*Solenidæ*) are those with the transverse internal rib (*Solecurtus*), which occur in the neocomian, whilst true Solens and *Glycimeris* appear first in the eocene strata. The genus *Mya*, as now restricted to the species resembling *M. arenaria*, are only met with in the newer tertiary. *Corbula* ranges upwards from the lower oolites; *Neæra* appears in the upper greensand; and *Thetis* (=*Poromya*, Forbes) in the neocomian.

Above 100 species of *Panopæa* (a genus essentially like *Mya*) have been obtained from oolitic and tertiary strata in all parts of the world. They are with difficulty distinguished from those equally numerous forms of *Anatinidæ* which have been associated with *Pholadomya* on account of the tenuity of their finely-granulated valves; they constitute the genus *Myacites* (Bronn), and occur in all the palæozoic and secondary rocks; some of the oolitic and cretaceous species are distinguished by V-shaped furrows (fig. 16, 6). Still more numerous are the fossil forms of *Pholadomya*, which range upwards from the lias, but are reduced to a single species now living in the Caribbean seas. Shells with the umbones fissured like *Anatina* also occur in the oolites. *Pandora* first appears in the older tertiary. Amongst the extinct genera referred to this family are the Silurian *Grammysia* (fig. 13, 10), with valves folded transversely; the carboniferous *Edmondia* (fig. 13, 11), with large oblique cartilage plates; and *Cardiomorpha*, shaped like *Isocardia*; and the oolitic *Ceromya* (Ag.), which also resembles the heart-cockle in form. *Cercomya* is an oolitic *Anatina*, with the posterior end of the valves much attenuated.

The genus *Gastrochæna* appears in the lower oolites; and casts of its burrows are frequently preserved after the decomposition of the coral in which they were made. *Clavagella* dates from the upper greensand, and *Aspergillum* from the *miocene*. *Saxicava* is found in the newer tertiary and raised beaches of Northern Europe; and the great species commonly called "*Panopæa*" *Norwegica* is a characteristic fossil of the newer pliocene of Britain and Greenland.

The Pholades and ship-worms appear first in the oolitic strata. Forms resembling the recent *Martesia striata* have been discovered in fossil wood of the lias and Speeton clay. *Jouannetia* (Desm.) was first known as a miocene fossil; and *Pholas* occurs in the older tertiary. Extinct species of *Teredo* are found in the silicified wood of the greensand of Blackdown and in the fossil palm-fruits of Brabant and Sheppy. The drift-wood of the London clay is usually perforated by the ship-worm, and also by an extinct form (*Teredina*, fig. 16, 9), which resembles *Martesia* in possessing an umbonal shield: when adult, it not only closes the anterior pedal opening, but also cements its valves to the shelly lining of its burrow, like an *Aspergillum*. Specimens have been obtained in which the whole interior of the valves and tube had been excessively thickened towards the close of life by successive layers of shell.

Class III.—GASTEROPODA.

Fossil univalves—the remains of spiral and limpet-like shells—are not wanting in any but the very oldest fossiliferous rocks ("lingula flags"). From the lower Silurian, where less than 100 species, referable to scarcely more than 10 genera, are found, they increase in number and variety slowly and regularly up to the newer tertiaries, which have afforded ten times as many genera and twenty times as many species. The total number of fossil marine univalves is less than 6000; the recent exceed 8000; and although we may expect to discover more new fossil species than recent, yet it is evident the group of univalves has only now attained its maximum development.

Between the extinct and living air-breathers the numerical discrepancy is still greater. About 300 land-snails, and half as many fresh-water *Pulmonifera*, are enumerated in the fossil catalogues; but the greater part of these are recent species, and the whole bears no proportion to the number of living land-snails, which exceed 4000. That many more have formerly existed is indicated by the fact, that the fossil land-snails of the older tertiaries of Europe are entirely different from their living successors, and most nearly represented at the present time in the West Indies and Brazil. The generic forms peculiar to oceanic islands (remains of old continents) are more numerous than those of the mainlands, as if this order had once been more important. But the circumstances favourable to their petrifaction must have been of such rare occurrence as to preclude the probability of attaining more than the scantiest information concerning them.

From the large and proportional number of living Gas-

Mollusca.

teropods, and the great amount of information which has been obtained of late years respecting their structure and habits, it might be expected that the affinities of the fossil univalves would be easily worked out, and their indications fully interpreted. Such, however, is not the case. Univalve shells present no internal markings, easily accessible

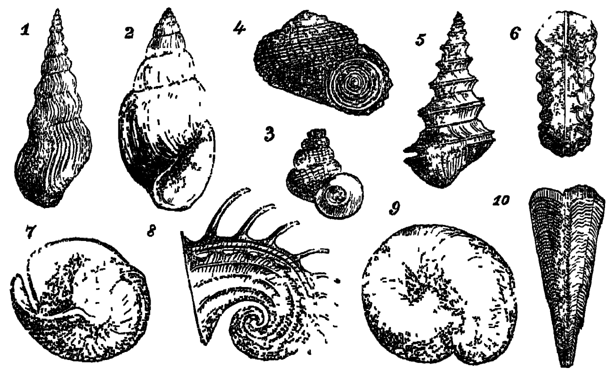

Fig. 17.

Palæozoic Univalves.

1. Loxonema Lefeburei, Lév. *Carboniferous*, Tournay.
2. Macrochilus Schlotheimi, D'Arch ; *Devonian*, Eifel.
3. Scoliostoma expansilabrum, Sdgr.; *Devonian*, Nassau.
4. Euomphalus sculptus, Sby.; *Wenlock Limestone*, May Hill.
5. Murchisonia angulata, Ph.; *Devonian*, Eifel.
6. Porcellia Puzosi, Lév.: *Carboniferous*, Tournay.
7. Bellerophon bi-carinatus, Lév.: *Carboniferous*, Tournay.
8. Tubina armata, Barr.; *U. Silurian*, Bohemia.
9. Maclurea Peachii, Salter; *L. Silurian*, Sutherland.
10. Conularia quadrisulcata, Sby.; *Carboniferous*, Lanark.

like those of bivalves, and exhibiting the essential characters of the soft parts; and their external forms are often so overlaid with ornament, and disguised by *mimetic* characters, as to mislead upon a first examination. Shells of any family may be limpet-shaped, or turreted, or discoidal, plain or ornamented. It is more desirable to ascertain whether they have been nacreous or porcellanous; whether the apex (or *nucleus*) presents any peculiarities; and if operculated, whether the operculum was few-whirled or multispiral.

The earlier describers of fossil univalves unhesitatingly recognised many familiar recent genera, even in the older rocks. But their "Melanias" were marine shells; the supposed *Buccinum* had no notch; the *Solaria* were pearly; the *Neritas* assumed, when adult, the irregular aperture of *Pileopsis;* the Naticas had non-spiral opercula; and the *Maclurea* was figured upside down.

The more closely palæozoic univalves are examined, so much the more do they appear to differ from ordinary recent types; and the search for allied forms has to be conducted amongst the rare and minute and least understood of recent shells.

Nucleobranchiata.—Those fossil univalves, which in their symmetry resemble the *Nautilus*, but are unfurnished with air-chambers, have been compared to the recent *Heteropoda* (or *Nucleobranchiata*, Bl.), and especially to that division typified by the tiny *Atlanta*, in which the animal can withdraw itself completely into its shell, and close the aperture with an operculum. The genus *Porcellia*, characteristic of the carboniferous age, has a discoidal shell, with a spiral nucleus projecting, as in *Atlanta*, from the right side; the whirls are exposed, and marked with a narrow band along the back, ending in a deep slit (fig. 17, 6). Another genus (*Bellerophon*) resembles the recent *Oxygyrus* in its more globose form, with a similar narrow umbilicus on either side (fig. 17, 7); sometimes the shell is thin and the aperture expanded, like a trumpet, whilst other species are globular and solid; the former may have been tenanted by large animals living at the surface of the open sea, the latter seem to have been more adapted to protect their owners crawling over the bottom, for it can scarcely be insisted that all were necessarily floaters on account of their organization. The species of *Bellerophon* are numerous in all the palæozoic rocks, and some of the smaller kinds appear to have been gregarious: those with disconnected whirls have been called *Cyrtolites* (Conrad.) The *Bellerophina* of D'Orbigny (fig. 18, 11) is a minute shell found in the gault. The other division (*Firolidæ*) consists of Mollusks in which the shell is wanting or rudimentary, and small compared with the bulk of the animal. A single species of the genus *Carinaria* has been found in the middle tertiary of Turin.

Strombidæ.— The Strombs, with their massive shells, nevertheless, resemble the fragile Heteropods in some respects. They have the same lingual dentition, and the same carnivorous habits; and though living on the sea-bed, they rather leap than glide, having a narrow sole and a deeply-divided operculigerous lobe. Characteristic of the warmer zones of existing seas, they are only found fossilized in the newer tertiary strata of countries south of Britain; but there is a group of little shells related to the recent *S. fissurellus* in the older tertiaries of London, Paris, and America, to which Agassiz has given the name *Rimella.* The allied genus of scorpion-shells (*Pterocera*), now peculiar to eastern seas, has been described as occurring fossil in the secondary strata of Europe; but the extinct species appear to be more nearly related to *Aporrhais.* This genus, now confined to the western shores of Europe, occurs in all the tertiaries, and is represented in the secondary rocks by many remarkable forms. Some have been separated under the name *Alaria;* and to this group the so-called *Pterocera Bentleyi* may perhaps be referred (fig. 18, 2). *Rostellaria* and *Serapis* (or *Terebellum*), now peculiar to the Red or eastern seas, are conspicuous fossils of the European eocene, at which time their range extended to America. Some of the ancient Rostellarias have the outer lip enormously expanded, as in the *R. ampla* (*Hippocrena*) of the London clay. In the oolites and chalk there are slender fusiform shells (*Spinigera*, D'Orb., fig. 18, 1) with spines on the sides of the whirls, as in some recent *Runellæ.*

Muricidæ.—The great family of whelks, by far the most

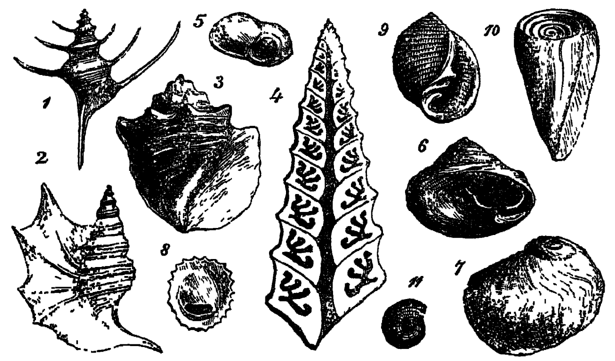

Fig. 18.

Secondary Univalves.

1. Spinigera, sp.; *Oxford Clay*, Chippenham.
2. Alaria Bentleyi, M. and L.; *Great Oolite*, Collyweston.
3. Purpurina Morrisii, Buv., *Great Oolite*; Minchinhampton.
4. Nerinæa Bruntrutana, Thurm.; *Coralian*, Poland.
5. Crossostoma Pratti, M. and L.; *Great Oolite*, Minchinhampton.
6. Trochotoma conuloides, Desl; *Great Oolite*, Minchinhampton.
7. Neritoma bisinnata, Buv.; *Oxfordian*, Ardennes.
8. Pileolus plicatus, Sby.; *Great Oolite*, Ancliff.
9. Cinulia incrassata, J. Sby.; *U. Greensand*, Blackdown.
10. Acteonina concava, Desl.; *Lias*, Normandy.
11. Bellerophina minuta, Sby.; *Gault*, Folkestone.

important group of living sea-shells, is scarcely of higher antiquity than the eocene tertiary. The *Purpurina* of the oolites (fig. 18, 3), and *Columbellina* of the chalk, are

extinct genera somewhat resembling *Purpura* and *Columbella*. But since the so-called "cones" of the oolites have proved to be *Tornatellæ*, it may not be unreasonable to distrust these other presumed affinities. The huge univalve of the chalk, which Sowerby called a *Dolium*, has been described as a *Pterocera* by D'Orbigny. In the tertiaries siphonated univalves abound, and are mostly referable with certainty to recent genera. The only marked change consists in the comparative abundance of some scarce existing forms, and the absence or rarity of many now most conspicuous. Moreover, the geographical distribution of the genera has undergone a great change since the close of the eocene period. This change is most noticeable in the cold-temperate zone, and is evidently the result of altered climate. The northern seas must ever have been inclement, and the tropical seas always tropical; but the latitude of England being most liable to vicissitudes of climate, might be expected to show the greatest variety, and the most complete and rapid alterations of organic

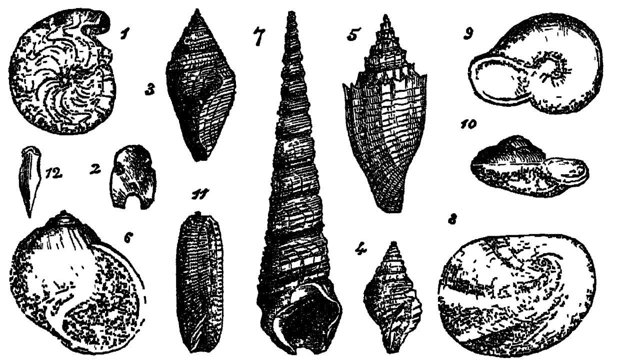

Fig. 19.

Tertiary Univalves.

1. Nautilus (Aturia) zic-zac, Sby., *Eocene*, Britain.
2. Nautilus zic-zac, front view of a *septum*.
3. Conorbis dormitor, Sol., *Eocene*, Britain.
4. Borsonia lineata, T Edw.; *M. Eocene*, Hants.
5. Volutilithes luctator, Sol., *Eocene*, Britain
6. Natica (Deshayesia) cochlearia, Brongn.; *Eocene*, N. Italy.
7. Turritella (Proto) cathedralis, Brongn., *Miocene*, Bordeaux.
8. Nerita (Velates) perversa, Gm.; *Eocene*, France
9. Helix (Lychnus) Matheroni, Req.; *Eocene*, S. France.
10. Ferussina tricarinata, M. Br.; *Miocene*, Hockheim.
11. Volvaria bulloides, Lam.; *Eocene*, Grignon.
12. Vaginella depressa, Bast.; *Miocene*, Bordeaux.

life. In the London clay are found many species of *Clavella, Typhis, Mitra, Pseudoliva, Oliva*, and *Ancillaria;* and some extinct forms (*Leiostoma* and *Strepsidura*) related to *Fusus*. The middle tertiary, wanting in England, but largely developed in Central and Southern Europe, also contains many genera belonging now to warmer latitudes, and many species still living in the south. In the newer tertiaries of Europe these southern forms disappear, and are gradually replaced by others of an opposite character (*Trophon, Neptunia*, and *Trichotropis*), now inhabiting the Arctic and boreal coasts. The entire number of fossil *Muricidæ* amounts to 1000, or about half as many as the recent. The older tertiaries of England also contain species of *Triton, Cassidaria, Cancellaria*, and *Pyrula*, shells (now foreign to our seas), which have formerly been included in this family. As regards bulk, there are no fossil species of *Fusus, Triton*, and *Cassis* (or *Strombus* and *Voluta*) to compare with those of the present day.

Conidæ.—The Cones and Pleurotomas appear first in the chalk, and are abundant in the eocene, accompanied by an intermediate form (*Conorbis*, fig. 19, 3), and another extinct sub-genus (*Borsonia*, fig. 19, 4), in which the column is plaited, as in *Mitra*. The genus *Terebra* is commoner in the miocene.

Volutidæ.—The Volutes also appear as cretaceous fossils in Europe and Southern India; they are very abundant in the London clay, and one occurs in the English crag. The ancient species are mostly distinguished by their spires being acute, as in *Mitra* (fig. 19, 5), a peculiarity only found in one very rare living (?) species, dredged from a bed of dead shells in 132 fathoms water (792 feet) off the Cape. The crag Volute resembles the Magellanic form. *Cymba olla*, the only living European Volute, is a fossil in the *pliocene* of Majorca.

Cypræidæ.—The Cowries form another group of subtropical shells once common in the temperate zone. Several large species are found in the London clay, most nearly related to the southern *Cyprovula;* whilst the crag contains only members of the sub-genus *Trivia*, one of which still lives on our coast.

The round-mouthed shells (*Holostomata*), whether animal-feeders or vegetarians, make a conspicuous figure amongst the fossils of an earlier period than that in which the last group began to flourish. The carnivorous *Naticidæ* and *Pyramidellidæ* are represented in the palæozoic strata by *Naticopsis, Loxonema* (fig. 17, 1), and *Macrochilus* (fig. 17, 2). The violet-snail (*Ianthina*), so unlike any other existing shell-fish, seems related to the Silurian *Scalites, Raphistoma*, and *Holopea*. Shells like *Scalaria* and *Solarium* occur in the trias and oolites associated with *Chemnitziæ* (?) of extraordinary size, and species of *Eulima* and *Niso*. These families of shells and the *Cerithiadæ* are more abundant fossil than recent, the known numbers being 1500 extinct and 900 living forms. *Solaria*, with disconnected whirls and pyramidal opercula (*Bifrontia*, Dh.), are common in the eocene tertiary, and a single living species (*B. zanclæa*) has been discovered by M'Andrew.

Amongst the tertiary Naticas are many with an oblique aperture and peculiar perforation (*Globulus*, J. Sby., = *Ampullina*, Bl.), and others with prominences on the pillar (*Deshayesia*, fig. 19, 6.) The *Nerinæas* of the oolites are remarkable for the spiral ridges (like the "worm" of a screw) winding round their interior, and giving rise to the variety of singular patterns seen in sections (fig. 18, 4). A similar structure exists in the recent "telescope-shell" (*Terebralia*). The fresh-water univalves of the Wealden and older tertiaries differ but little from their recent congeners of the genera *Paludina, Potamides, Melania*, and *Melanopsis*. Fossil *Turritellæ* are of doubtful occurrence before the tertiary; the Silurian species have the peristome complete (*Holopella*, M'C.); another form (*Proto*, fig. 19, 7) is characteristic of the miocene.

The bonnet-limpets (*Calyptræidæ*) are common in the old rocks, which also contain a few species of *Chiton* and shells like *Dentalium*. Fossil *Trochidæ* are very numerous, but hitherto many *Litorinidæ* have doubtless been included with them. Perhaps no true *Turbo* is known from strata before the cretaceous. The *Euomphali* (fig. 17, 4), which characterize the older rocks, have multispiral calcareous opercula, like the recent *Cyclostrema* (= *Adeorbis*). The genus *Maclurea* (fig. 17, 9), which has been regarded as a "left-handed" *Euomphalus*, is probably very different; it has a thick shelly operculum, sinistrally spiral, and furnished with an internal process, as the Nerites are; the spire is sunk and concealed, whilst the whirls are exposed on the flattened under-side; it occurs in the older Silurian rocks of Scotland and North America. One common feature of the palæozoic spiral shells is their tendency to become irregular towards the conclusion of their growth: in *Serpularia* (= *Phanerotinus*, Sby.), the whirls are all disunited; in *Scoliostoma* (fig. 17, 3) and *Catantostoma* the aperture is expanded. Some small oolitic shells have a thickened peristome (*Crossostoma*, fig. 18, 5), like the recent *Lietia*, which commences in the older tertiary. A large proportion of the trochiform fossil shells have their whirls, whether round or angular, marked by a peculiar band, terminating in a deep slit

Mollusca.

at the aperture; most of these were solid nacreous shells belonging to the genus *Pleurotomaria*, of which but a single species survives; others in their slenderness resemble *Turritellæ*, and have been named *Murchisonia* (fig. 17, 5). The carboniferous shell called *Polytremaria* has a row of holes in place of a slit; and the Silurian *Tubina* (fig. 17, 8) has three rows of tubular spines. The *Cirrus* of the inferior oolite is a reversed shell with one row of similar ornaments; and *Trochotoma* (fig. 18, 6) has a perforation near the margin of the aperture, which is carried onward as the shell grows. *Scissurella*, which is always diminutive and not pearly, makes its first appearance only in the newer tertiary. *Haliotis* occurs in the miocene of Malta. The *Neritidæ* appear in the oolites: besides true Nerites, there are *Neritomæ* (fig. 18, 7), with a channeled outer lip: *Pileolus*, which is perfectly limpet-like above (fig. 18, 8); and *Neritopsis*, with its angular columellar notch most distinctly marked. Key-hole limpets (*Fissurellidæ*) occur as early as the carboniferous period, but are very scarce at first, and never become numerous. The oolitic *Rimula* is a minute shell supposed to be related to a very rare living species. Ordinary limpets (*Patellidæ*) of unequivocal form are found in the Bath oolite, but are afterwards less plentiful, and almost disappear from the tertiaries; M. D'Orbigny regarded them as generically distinct, but employed for them a name (*Helcion*, Mont.) synonymous with *Patella*.

Pulmonifera.—The existence of air-breathing snails in the palæozoic rocks is indicated only by the somewhat problematic *Dendropupa*, discovered by Sir C. Lyell in a coal tree of Nova Scotia. The Purbeck limestone contains a modern-looking *Physa;* and other species of extraordinary size are found in the older tertiary of France, and also in Central India, where the genus does not exist at the present day. The fresh-water eocene of the Isle of Wight and Paris has afforded many species of *Limnæa* and *Planorbis;* a *Glandina* rivalling in size the *G. truncata* of South Carolina; a *Cyclostoma*, with a sculptured operculum like the *Cyclotus Jamaicensis;* and an elongated species of the section *Megalomastoma*, which is now living in both East and West Indies. At Hordle has been found the little *Helix labyrinthicus*, still living in Texas; and in the south of France occur representatives of the Brazilian genera *Megaspira* and *Anastoma* (fig. 19, 9). In the *miocene* is found another genus (*Ferussina*, fig. 19, 10) resembling the lamp-snail, but supposed to be operculated. The *Pulmonifera* of the English *pliocene* are in a few instances extinct, at least in England; nearly all are still living here, but more or less abundant now than they were in the times of the mastodon and elephant. The extinct land-snails of the Atlantic islands Madeira and Porto Santo are associated with remains of many recent species occurring in numbers which have relatively altered, telling the same tale of gradual changes, affecting some species prejudicially, but favourable to the increase of others. The fossil land-snails of St Helena were supposed by Mr Darwin to have become finally extinct only in the last century, owing to the destruction of the native woods by the instrumentality of goats and swine.

Tectibranchiata.—The families typified by *Tornatella*, *Ringicula*, and *Bulla* played a more important part in the secondary and tertiary periods, but their affinities have been seldom understood. The cone-like *Acteonina* appeared in the carboniferous rocks, and attained a remarkable development in the lias (fig. 18, 10). They were succeeded by the *Acteonellæ*, with a plaited columella, in the cretaceous strata; and by *Volvaria* (fig. 19, 11) in the eocene. The diminutive *Ringiculæ* of our seas were preceded by large species of the same genus in the tertiaries, and by *Cinulia* (fig. 18, 9), *Globiconcha*, and *Tylostoma*, in the cretaceous strata. The genus *Varigera* has varices recurring twice in each whirl, like *Eulima;* and *Pterodonta* is winged like *Strombus*.

Mollusca.

Pteropoda.—The fragile shells of *Hyalea* and *Cleodora* are found in the newer tertiary of Italy, with *Vaginella* (fig. 19, 12), a form allied to *Cuvieria*. But the occurrence of *Pteropoda* in the older rocks is attended with considerable obscurity. The shells called *Theca* are slender and conical; *Pterotheca* has a wing-like expansion; and *Conularia* (fig. 17, 10) is a four-sided sheath, with the apex partitioned off, as in the recent *Cuvieria*. If really pteropodous, these shells are the giants of the order.

CLASS IV.—CEPHALOPODA.

Order 1.—TETRABRANCHIATA.
(*Nautiloid Cephalapoda*.)

Of the lower group of Cephalopods, possessing chambered shells similar to the pearly *Nautili*, there are 1400 extinct species, belonging to above 30 genera, while 5 or 6 species alone exist in modern seas. These fossils resemble the *Nautilus*, and differ from the dibranchiate *Spirula* in the structure of their shell, which is composed of two layers, the outer porcellanous, the inner pearly; whereas the *Spirula*—an internal shell—is entirely nacreous. They also agree with the *Nautilus* in the relative capacity of their last chamber, which seems obviously large enough to contain the whole animal. Moreover, it appears, from the position of the siphuncle and the form of the aperture, that these shells were revolutely spiral, or coiled over the back of the animal, and not involute like the *Spirula*. No traces of fossil *sepia* or horny claws have been found associated with them, nor any indications of dense muscular tissue, even in the same matrix which has preserved so completely the mummy cuttle-fish. By their form and size they were ill adapted for rapid locomotion, and must have depended for safety on the shelter afforded by their solid shell. The discoidal *Ammonites* attained a diameter approaching 3 feet, and the straight-shelled *Orthocerata* were sometimes not less than 6 feet in length. These latter must have lived habitually in a position nearly vertical; whilst the discoidal genera would creep over the sea-bed with their air-chambers above them, like a snail-shell reversed. The *Ammonites* appear to have been provided with an *operculum*, more secure than the "hood" of the Nautilus, but, like it, composed of two elements united by a straight suture. These opercula, frequently mistaken for bivalve shells, have a porous structure altogether peculiar, and are frequently sculptured on their outer convex surface; whilst their concavity exhibits only lines of growth (fig. 21, 7.) Special forms are associated, in all localities, with particular species of ammonite; and their size is adapted exactly to the specimens in which they are found. Calcareous mandibles occur in all the secondary strata, but not (hitherto) in such numbers or circumstances as to imply that they belonged to any other genus beside the true *Nautilus*. They are of two forms: those corresponding to the upper mandible (fig. 21, 8) have been called *Rhyncholites* (*Palæoteuthis* and *Rynchoteuthis* of D'Orbigny); whilst the lower mandibles constitute the "genus" *Conchorhynchus* of De Blainville (fig. 21, 9). The arms of the extinct Tetrabranchs may have been organized like those of the Nautilus, but were probably less numerous in the genera with slender shells, and in those early forms with a small many-lobed aperture. The length of the body-chamber is greatest when its diameter is least; and the prominent spines which ornament the exterior are partitioned off internally by a nacreous lamina, indicating considerable motion of the animal in its shell. When the outer shell of the fossil is removed by decomposition or the hammer, the margins of the internal *septa* (or parti-

tions of the air-chambers) are exposed. These marginal lines are called *sutures.*

The chambered shells may be divided into two principal groups: those with simple sutures, like the recent Nautilus; and the Ammonitidæ, in which the margins of the septa are lobed and foliaceous. In the former the siphuncle is central or internal (*i.e.*, at the margin next the spire); in the latter it is external (*i.e.*, at the *back* of the shell, but *ventral* as regards the animal). There are, however, *Nautili* with lobed sutures (*Aturia*, Bronn, fig. 19, 1); and some with an external siphuncle (*Cryptoceras*, D'Orb.) And on the other hand, the sutures of the Ammonite are at first very slightly lobed, and become progressively more complex; so that specimens of the *same species* have been referred to three genera—*Goniatites*, *Ceratites*, and *Ammonites*—according to their age.

With the exception of *Goniatites*, the *Ammonitidæ* are peculiar to, and co-extensive with, the secondary strata; while the *Nautilidæ*, with the exception of *Nautilus* and *Aturia*, are confined to the palæozoic rocks. But the so-called palæozoic *Nautilidæ* exhibit peculiarities suggesting very wide differences. It has been proposed to associate the greater part of them with the *Orthocerata* as a distinct family, but at present the data are defective. Like the *Ammonitidæ*, their shells assume almost every conceivable form and curvature, and the genera founded on these characters are very ill defined.

The simplest form of *Orthoceras* is like a *Nautilus unrolled;* and *Lituites* (fig. 20, 2) is the same with the apex spiral. Some of the carboniferous *Nautili* have a square back, and the whirls either compact or open in the centre (fig. 20, 1); whilst the last chamber is more or less disunited. The species with the whirls quite disunited constitute the genus *Trigonoceras*, M'C. (=*Nautiloceras*, D'Orb.) The Silurian genus *Trochoceras*, Barr, is a spiral Nautilus. *Clymenia*, a characteristic Devonian fossil, has angular sutures and an internal siphuncle; it may perhaps be coiled up ventrally like the *Spirula*. The tertiary shell called *Nautilus zic-zac* (*Aturia*, Br., fig. 19, 1, 2), which is so widely distributed in Europe, America, and India, has a siphuncle nearly marginal when young, but gradually becoming more central in the adult: it has no special relation to *Clymenia.*

Those species of *Orthocerata* in which the aperture is contracted form the genus *Apioceras*, Fischer (=*Poterioceras*, M'C.), or when also curved, the *Oncoceras* of Hall. In Barrande's genus *Ascoceras* (fig. 20, 9) the shell is flask-shaped, the chambered and siphunculated apex being apparently deciduous; the aperture is contracted, and the air-chambers occupy only the dorsal half of the shell. In *Phragmoceras* (fig. 20, 7), the shell is slightly curved to the ventral side, and the aperture is remarkably contracted, the opening for the respiratory funnel being nearly distinct from the cephalic aperture. In *Cyrtoceras* the curvature is dorsal.

In some other members of this family the siphuncle attains a remarkable size or extraordinary complexity.

In *Camaroceras* (fig. 20, 4), the siphuncle is lateral, quite simple, and equal to half the diameter of the shell. Casts of these great siphuncles were called "Hyolites" by Eichwald; they frequently contain small shells of *Orthoceras*, *Bellerophon*, and other genera. In some species the siphuncle is strengthened internally by repeated layers of shell, or partitioned off by a succession of funnel-shaped diaphragms; these constitute the genus *Endoceras* of Hall. The same author has given the name *Discosorus* to a fossil which is evidently the siphuncle of some very delicate and perishable chambered shell (fig. 20, 6). In those *Orthocerata* with siphuncles most nearly resembling the *Discosorus* they diminish rapidly towards the last chamber. Perhaps the most remarkable fossil of this group is the

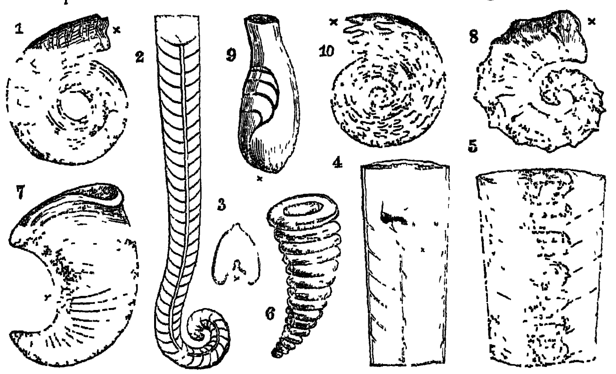

Fig. 20.

1. Nautiloceras Omalii, De Kon.; *Carboniferous*, Belgium.
2. Lituites (Breagnius), *U Silurian*, Sweden.
3. Section of Clymenia, showing internal siphuncle; *Devonian*. Petherwin
4. Section of Camaroceras duplex, Wahl.; *L Silurian*, Russia.
5. Siphuncle of Huronia Bigsbyi, Stokes; with outline of shell, and septa.
6. Siphuncle of Discosorus, Hall; *U. Silurian*, Lake Huron.
7. Phragmoceras ventricosum, Sby.; *L. Ludlow rock*, Herefordshire.
8. Gyroceras Eifeliense, D'Arch.; *Devonian*, Prussia.
9. Ascoceras Bohemicum, Barr.; *U. Silurian*, Prague
10. Goniatites, Henslowi, Sby.; *Carboniferous*, Asturias.

Huronia (fig. 20, 5), found in the upper Silurian limestone of Drummond Island. Siphuncles 6 feet in length and 1½ inch in diameter, were seen by Dr Bigsby in the cliffs; they are silicified, and stand out in bold relief from the matrix, but are unaccompanied by any vestige of the shell, except in one or two instances, where the septa are faintly indicated by coloured lines. They are sometimes overgrown with coral, and were evidently so durable as to remain on the sea-bed long after the shell itself had decayed. The joints of the siphuncle are swollen at the upper part, and the interior is filled with an irregularly-radiated structure, apparently produced by the plaiting and calcification of the lining membrane. This structure also exists and is very regular in the siphuncle of the Devonian *Orthoceras trigonale*, and in the shells referred to *Gyroceras* by D'Orbigny (fig. 20, 8); also in *Actinoceras*, a sub-genus of *Orthoceras*, discovered by Dr Bigsby, and described by Stokes (*Geol. Trans.*, vol. i., 1825). The plication of this interior structure takes place in segments corresponding to the septa, and meeting in the centres of the siphuncular beads, leaving spaces or foramina for the passage of blood-vessels to the lining membrane of the air-chambers.[1] The vascularity of the latter is well shown in the impression of septa on the fine mudstones of the Ludlow rock, often mistaken for *Spongaria*, which they somewhat resemble.

Towards the conclusion of its growth the air-chambers of the *Orthoceras* frequently become shallower, and the siphuncle diminishes in size. These indications of changed or diminished energies are accompanied by a diminution or disappearance of the internal radiated structure in the last part of the siphuncle.

In *Orthoceras bisiphonatum* (*Tretoceras*, Salter) the body-chamber is prolonged in the form of a marginal lobe, simulating a second siphuncle.

The genus *Bactrites* of Sandberger also resembles an *Orthoceras* with single-lobed sutures.

Ammonitidæ.—In the second division or family of chambered shells—those with lobed sutures and a marginal siphuncle—we find a similar series of forms,—straight, spiral, and discoidal, but more varied and more highly ornamented.

One large genus (*Goniatites*, fig. 20, 10) is found in the Devonian, carboniferous, and triassic strata, and permanently resembles the youngest form of the *Ammonites*,

[1] In the carboniferous species of *Actinoceras* (*e.g.*, *A. giganteum*), these foramina form a cross on the ventral side of the siphuncle.

having the sutures lobed but not foliated. They seldom exceed 6 inches in diameter, and are usually very much smaller.

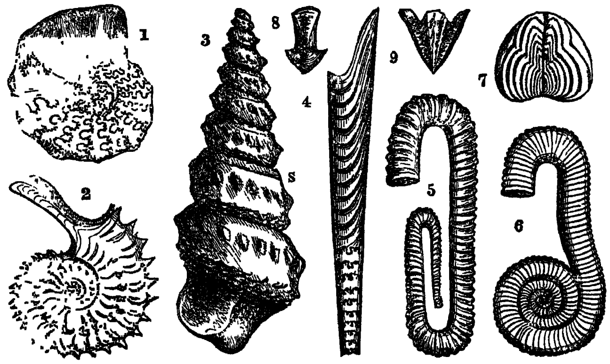

Fig. 21.

1. Ceratites nodosus; *Muschelkalk*, Bavaria.
2. Ammonites Duncani (spinosus, Sby.); *Oxford Clay*, Wilts.
3. Turrilites.
4. Baculites.
5. Hamites.
6. Ancyloceras.
7. Trigonellites.
8. (Rhyncholites hirundo), upper mandible of Nautilus arietis, Rein., *Muschelkalk*
9. Lower mandible (Conchorynchus avirostris.)

The whirls are most frequently concealed to some extent, and often marked by cross furrows or "periodic mouths."

The *Ceratites* are distinguished by having the lobes of the sutures serrated, while the intervening "saddles" (or curves directed towards the aperture) are simple. They are found in the *trias* of Europe, Thibet, and South America; and again very rarely in the cretaceous strata of France and Syria,—a circumstance quite anomalous in the history of the geological distribution of life. Many Ammonites, perhaps all, are like Ceratites when young.

The species of Ammonite exceed 500; and their range is co-extensive with that of the secondary rocks. They are found throughout Europe, and at the Cape, in Kamtschatka, Thibet, and S. India. They are absent from a large area of the United States, but are found in the cretaceous strata of New Jersey, Missouri, and the West Indian Islands; also in Chile and Bogota. The sections into which, for the sake of convenience, this extremely natural group has been broken up, are very ill defined, and have no pretension to be considered sub-generic. The group (called *Cassiani*) characterizing the triassic period, is remarkable for many-lobed and elaborately-foliated sutures,—a circumstance more important, because it is the oldest group, and associated with *Ceratites* and the last-surviving *Goniatites* and *Orthocerata*. They abound in the "alpine limestone" of St Cassian, and Hallstatt in Austria. A second group (*Arietes*), having the back keeled, with a furrow on each side of the keel, as in the great Ammonites called *Bucklandi* and *Coneybearei*, mark the lias period; they are less plentiful in the oolites, and are represented in the greensands by the "Cristati," which are keeled, but not furrowed, and develop a "beak," or process, from the keel when adult. The "Arietes" pass by many intermediate forms into the "Falciferi" (*e.g.*, *A. serpentinus*), also characteristic of the upper lias, and these are represented by a few quoit-shaped species (*Disci*), with sharp backs, in the oolites.

Ammonites with serrated keels (*Amalthei*), exemplified by *A. spinatus* and *margaritatus*, abound in the middle and upper lias, and again in the oolites (*e.g.*, *A. cordatus* and *excavatus*). They are succeeded by the "Rothomagenses" in the chalk,—thick Ammonites with a line of tubercles in the place of the keel.

Ammonites with channelled backs (*Colliciati*) are represented in the lias (*A. anguliferus*), inferior oolites (*A. Parkinsoni*), and middle oolite (*A. anceps*), and in the cretaceous strata by numerous species (*e.g.*, *A. serratus*, *lautus*, and *falcatus*), remarkable for their elegance.

Of the species with backs more or less squared, *armatus* and *capricornus* occur in the lias, *athleta* and *perarmatus* in the Oxfordian. But the oolitic forms which have the back square, and ornamented with two rows of spines when young, like *Goweri*, *Duncani* (fig. 21, 2), and *Jason*, become rounded and unarmed in their old age.

Round-backed Ammonites abound in the lias and oolites. The snake-like *Annulatus*, the spine-bearing *coronatus*, and *fimbriatus* with its ornamental fringes, have been regarded as types of small groups. A more important division (*ligata*) is distinguished by nearly smooth whirls, constrictions recurring at regular intervals. These are seen in *A. tatricus*, and others related to *Heterophyllus*; in many neocomian Ammonites, and in *A. planulatus* of the lower chalk.

These constrictions, often accompanied by a prominent rib, undoubtedly indicate periods of rest, when the Ammonite ceased for awhile to grow. They may be traced in species belonging to other groups, as well, *e.g.*, in *biplex* and *triplicatus*, as in the *ligati*; but most frequently all indications are obliterated by subsequent growth. It has been a question whether the lateral processes of *Ammonites Duncani* (fig. 21, 2), are formed and removed periodically, or whether they are peculiar to the adults, and mark the close of their outward growth. The first conclusion is more probable from analogy; and they are commonly found with small and apparently young shells, but not (any more than the lateral spines of the living Argonaut) in those of adult size and condition.

It was remarked by the elder Sowerby that Ammonites were most beautiful when of middle growth, the ornamental characters being less developed in the young, and lost in the adult. The ribs and spines, and even the keel or furrow of the back disappear, in many instances, from the body-whirl of the full-grown shell.

Varieties of form, such as marked the palæozoic *Nautilidæ*, are met with in the *Ammonitidæ*, chiefly towards the close of their reign. The Baculite (fig. 21, 4), with its straight shell, is characteristic of the upper chalk; and the *Turrilite*, which is spiral, and usually a left-handed spiral, abounds in the lowest beds of the same formation. In *Hamites* the shell is straight, returning upon itself after a certain space, and forming a simple or complex hook. In *Ptychoceras* these limbs of the hook-like shell are in close contact. The *Toxoceras* is curved like a bow; in *Crioceras* the discoidal whirls are separate; and in *Scaphites* (including *Ancyloceras*) the shell, at first compact like an Ammonite, or open-whirled like *Crioceras*, lengthens out finally, and returns upon itself like the crozier of the *Hamite*. *Helicoceras*, again, connects the last with the *Turrilite* by its elevated spire terminating in a prolonged crozier.

Of these forms, *Ancyloceras* alone is found in the oolites; all the rest are cretaceous; and most abound in the alpine districts of the south of France.

Order 2.—DIBRANCHIATA.
(*Cuttle-fishes.*)

Of the two great divisions of cephalopodous Mollusca, that which is represented at the present day by the pearly *Nautilus* was developed in the greatest profusion and variety in the palæozoic and secondary periods; whilst the more active and intelligent cuttle-fishes and squids have not been (certainly) found in rocks older than the lias, and scarcely above 100 are found in the whole secondary and tertiary series, while twice as many have been obtained in existing seas.

The *Sepiadæ* are represented in the middle and upper oolites by the genus *Coccoteuthis* (fig. 22, 6), whose strong and granulated bone is furnished with broader lateral expansions than the recent cuttle-fishes. In the older ter-

tiaries of London and Paris, many species of *Sepia* appear to have existed, but only the solid *mucro* (fig. 22, 5) of the shell is usually preserved. In the miocene tertiary of Malta, a diminutive cuttle-bone is not rare; and at Turin a remarkable form (*Spirulirostra*, fig. 22, 7) has been discovered, in which the apex is provided with a chambered and siphonated cavity like the shell of the *Spirula*. Two other genera, *Beloptera* (fig 22, 8) and *Belemnoris*, very imperfectly known by rare and fragmentary examples, occur in the eocene tertiary.

Remains of the *Calamaries* (*Loligidæ*) are often found in the fine-grained and laminated argillaceous limestones of the lias and Oxford clays, as at Lyme Regis, and Böll of Solenhofen. Some of these are slender, like the pens of the recent *Omonastrephes*, and furnished with a small conical appendix, as in that genus; whilst others are broad, and pointed at each end (*Beloteuthis*). The most common form has the shaft wide and longer than the wings, and is truncated posteriorly. It has a nacreous lining, and is usually accompanied by a large and well-preserved ink-bag (fig. 22, 4). These were called *Belemnosepia* by Agassiz and Buckland, who supposed them to belong to the same animal with the Belemnite. They have also been called *Loligo-sepiæ* and *Loliginites;* but the name *Geoteuthis*, given by Count Münster, appears least objectionable. One species (*Mastigophorus latificum*) is of frequent occurrence in the Oxford clay near Chippenham, which retains not only the horny (*chitinous*) pen and ink-bag, but also the muscular slieve, the rhombic terminal fins, and at least the bases of the arms, with the minute hooks, and traces of the mandibles. Horny claws, like those of the uncinated Calamary (*Onychoteuthis*), have been observed arranged in double series in the lias of Watchett, and they sometimes occur in great numbers in the coprolitic remains of the *Enaliosauri*. The most remarkable examples of this kind are preserved in the lithographic limestones of Solenhofen, and show that the extinct Calamary had ten nearly equal arms, the tentacles, in their retracted condition, being undistinguishable from the rest—each furnished with 20 to 30 pairs of formidable hooks. What further evidence was

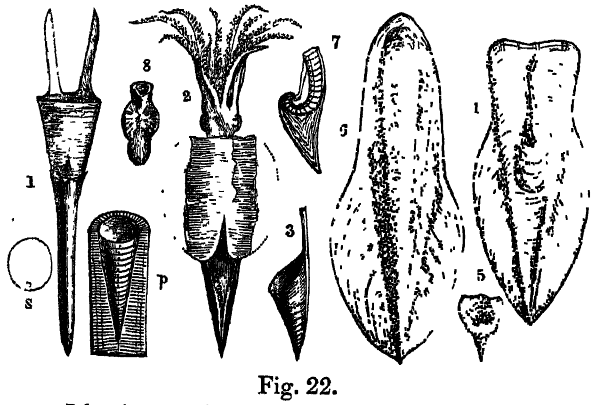

Fig. 22.

1. Belemnites Oweni; *Oxford Clay*, Chippenham. *p. Phragmocone* exposed by the removal of the fibrous guard from one side; *s, septum*, showing the marginal *siphuncle*.
2. Acanthoteuthis antiquus (Cunnington); *Oxford Clay*, Chippenham; dorsal aspect.
3. Conoteuthis Dupinii; *Gault*, Folkestone.
4. Geoteuthis.
5. Sepia.
6. Coccoteuthis.
7. Spirulirostra.
8. Beloptera anomala.

needed respecting the nature of this creature has been supplied by the Chippenham fossils, which in all probability are identical in genus, if not in species, with the *Acanthoteuthis*, described by Münster. One of these extraordinary fossils—the mummy of a cuttle-fish more ancient than the chalk formation and the upper oolites—is represented in fig. 22, 2, reduced to one-sixth from the original in the British Museum. Nine of the arms are preserved, the sclerotic plates of the eyes, the bases of the large lateral fins, the small ink-bag, and the conical shell. This shell, which is chambered internally, like the *phragmocone* of the Belemnite (fig. 22, 1), has an outer sheath of fibrous structure, one-fourth of an inch thick at the apex, and furnished with two converging ridges on its dorsal side; the external surface, however, is horny (or chitinous), like the pen of the Calamary. These chambered shells occur in great numbers, and are so like the phragmocones of the associated Belemnites, both in structure and proportions, that it is difficult to avoid believing they are in some way related; but hitherto they have only been noticed in the laminated Oxford clay of Wilts and the equivalent lithographic shales of Solenhofen.

The Belemnite, on the other hand, is found in all the oolitic and cretaceous strata, from the lowest lias to the upper chalk. In its ordinary imperfect state, it is a cylinder pointed at one end, and truncated or excavated by a funnel-shaped cavity (*alveolus*) at the other, and has a radiating fibrous structure, with less distinct concentric laminæ of growth. But even this "guard," which corresponds simply to the *mucro* of the cuttle-bone, exhibits such remarkable modifications of form, that nearly 100 species have been founded upon no higher evidence. In some Belemnites of half an inch diameter, the guard is scarcely an inch longer than the phragmocone, whilst in others it attains a length of ten inches, and is tubular, as in *B. acuarius*. Some are fusiform, others laterally compressed; some have a longitudinal groove extending from the apex along the upper or under side, and in others the apex is furrowed laterally as well. The Belemnites of the chalk have been called *Belemnitellæ* (D'Orb.), because they have a slit in the ventral side of the alveolar border of the guard; their external surface also exhibits more distinct traces of vascular impressions.

Specimens of Belemnite have been discovered in which the guard had been broken during the lifetime of the animal; but the broken portions being held together by the investing organized integuments, had been re-united by the deposition of new layers of the fibrous structure peculiar to the guard. Several examples of Belemnites, with the apex injured and healed during life, are preserved in the British Museum. In all perfect Belemnites, the *alveolus* is occupied by a *phragmocone*, with tender nacreous walls and septa, and terminating in a minute globular apex, and perforated by a ventral *siphuncle* (fig. 22, 1). The last chamber is rarely preserved, and appears to have thinned off into a mere horny sheath, with sometimes two pearly bands like knife-blades on the dorsal side. It must have been sufficiently capacious to contain all the viscera. The ink-bag has been very rarely found, and is even smaller than in the last genus, as if in relation to the more greatly developed shell.

The *Conoteuthis* (fig. 22, 3) of the Gault has an oblique phragmacone, with a very thin shell, and seems to have been attached to a slender style, like the funnel-shaped appendix of the gladius in the recent sagittated Calamary.

Mr Dana has described, under the name *Helicerus Fugiensis*, a belemnitoid fossil from the "slate" rock of Cape Horn. It is half an inch in diameter, has a thick fibrous guard, and the slender phragmacone terminates in a fusiform spiral nucleus.[1]

Subjoined is a table of the extinct genera of the molluscous province :—

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[1] For the drawings and most of the facts relating to invertebrate fossils, the writer is indebted to his experienced colleague in charge of that department of the British Museum, Mr S. P. Woodward, F.G.S.

Vertebrata.

BRACHIOPODA.—Trigonosemus, Lyra, Magas, Rhynchora, Zellania, Stringocephalus, Meganteris; Spirifera, Cyrtia, Suessia, Athyris, Merista, Retzia, Uncites; Camarophoria, Porambonites, Pentamerus, Atrypa, Anoplotheca; Orthis, Orthisina, Strophomena, Koninckia, Davidsonia, Calceola; Producta, Chonetes, Aulosteges, Strophalosia; Trematis, Siphonotreta, Obolus.

CONCHIFERA.—Gryphæa, Exogyra, Limanomia, Carolia, Placunopsis, Neithea, Eligmus; Pteroperna, Aucella, Ambonychia, Cardiola, Eurydesma, Pterinea, Monotis, Posidonomya, Aviculopecten, Gervillia, Streblopteria, Pulvinites, Inoceramus, Trichites; Megalina, Orthonotus, Modiolopsis, Hoplomytilus; Macrodon, Isoarca, Bakewellia, Nuculina, Nucinella, Cucullella, Ctenodonta; Myophoria, Axinus, Lyrodesma; Diceras, Monopleura, Requienia; Hippurites, Radiolites, Caprinella, Caprina, Caprotina; Lithocardium, Conocardium, Corbicella, Sphæra, Unicardium, Tancredia, Volupia; Pleurophorus, Myoconcha, Anthracosia, Megalodon, Pachydomus, Pachyrisma, Cleobis, Mæonia, Opis, Cardinia, Hippopodium, Megaloma; Grateloupia, Sowerbya, Quenstedtia, Goniophora, Redonia; Cercomya, Myacites, Goniomya, Grammysia, Ceromya, Cardiomorpha, Edmondia, Ribeiria.

GASTEROPODA.—Bellerophon, Porcellia, Cyrtolites, Ecculiomphalus; Rimella, Hippocrena, Alaria, Spinigera, Amberlya; Leiostomus, Strepsidura, Purpurina, Columbellina, Borsonia, Conorbis; Euspira, Naticopsis, Globulus, Deshayesia, Loxonema, Macrochilus; Diastoma, Nerinæa, Brachytrema, Ceritella, Vicarya, Scoliostoma, Proto, Holopella, Catantostoma, Naticella; Platyceras, Metoptoma, Hypodema, Deslonchampsia; Euomphalus, Ophileta, Phanerotinus, Serpularia, Discohelix, Platystoma, Crossostoma, Pleurotomaria, Murchisonia, Polytremaria, Cirrus, Trochotoma, Platyschisma, Scalites, Rhaphistoma, Holopea, Maclurea; Neritoma, Velates, Pileolus; Helminthochiton; Lychnus, Dendropupa, Ferussina; Cylindrites, Acteonina, Acteonella, Cinulia, Globiconcha, Varigera, Tylostoma, Pterodonta, Volvaria, Chilostoma; Vaginella, Theca, Pterotheca, Canularia.

CEPHALOPODA.—Aturia, Discites, Nautiloceras, Trigonoceras, Temnochilus, Lituites, Trocholites, Trochoceras, Clymenia; Orthoceras, Camaroceras, Huronia, Actinoceras, Discosorus, Gonioceras, Tretoceras, Apioceras, Gomphoceras, Phragmoceras, Cyrtoceras, Gyroceras, Ascoceras; Goniatites, Bactrites, Ceratites, Ammonites, Crioceras, Toxiceras, Ancyloceras, Scaphites, Helicoceras, Turrilites, Hamites, Ptychoceras, Baculites; Teudopsis, Beloteuthis, Geoteuthis, Leptoteuthis, Belemnites, Acanthoteuthis, Helicerus, Conoteuthis, Coccoteuthis, Belosepia, Spirulirostra, Beloptera, Belemnosis.

PROVINCE IV.—VERTEBRATA.

There is an enormous series of subaqueous sediment, originally composed of mud, sand, or pebbles, the successive bottoms of a former sea, derived from pre-existing rocks, which has not undergone any change from heat, and in which no trace of organic life has yet been detected. These non-fossiliferous, non-crystalline, sedimentary beds form, in all countries where they have yet been examined, the base-rocks on which the Cambrian or oldest Silurian strata rest.

Whether they be significative of ocean abysses never reached by the remains of coeval living beings, or whether they truly indicate the period antecedent to the beginning of life on this planet, are questions of the deepest significance, and demanding much farther observation before they can be authoritatively answered.

It has been shown that every type of invertebrate animal is represented in the superimposed stratified deposits called Cambrian and lower Silurian.

Vertebrata.

An important work,[1] embodying the labours of the accomplished naturalist and acute observer, Dr Christian H. Pander, has recently been published by the Russian government, descriptive of the fossil fishes of the Silurian formations of that empire. Of some hundred fossils described and beautifully figured in this work, and referred to different genera and species of fishes, from lower Silurian rocks, the writer, after the closest comparison and consideration of the evidence, is disposed to regard only those referred by Pander to the genera *Ctenognathus*, *Cordylodus*, and *Gnathodus*, as having any probable claims to vertebrate rank; and to this admission must be appended the remark, that the parts referred to jaws and teeth may be but remains of the dentated claws of *Crustacea*. With regard to the fossils called "Conodonts," on which the main part of M. Pander's evidence of lower Silurian fishes rests, the following remarks, penned after microscopic examination of specimens kindly submitted to the writer by Sir Roderick Murchison, are applicable to them.

Minute, glistening, slender, conical bodies, hollow at the base, pointed at the end, more or less bent, with sharp opposite margins, might well be lingual teeth of Gastropods, acetabular hooklets of Cephalopods, or teeth of cartilaginous fishes. Against the latter determination is the minute size of the "Conodont" bodies. Their basal cavity doubtless contained a formative pulp, but the proof that the product of such pulp was "dentine" is wanting: the observed structure of the hooklet presents concentric conical lamellæ of a dense structureless substance, containing minute nuclei or cells.

In some specimens the base is abruptly produced and divided from the body of the hooklet by a constriction,—a form unknown in the teeth of any fishes, but presented by certain lingual teeth of Gastropods,—*e.g.*, the lateral teeth of *Sparella*. In other Conodonts the elongated base is denticulate or serrate, as in the lateral teeth of *Buccinum* and *Chrysodomus*. It is improbable, however, that they belong to any conchiferous toothed Mollusk, the shells of such being wanting in the deposit where the Conodonts are most abundant.

The more minute hooklets have a yellowish, transparent, horny appearance; the larger, perhaps older ones, present a harder whitish appearance. Their analysis by Pander yielded "carbonate of lime," carbonic acid being evolved by application of dilute nitric acid, and oxalic acid producing an obvious precipitate. Some English analysts have believed that the Conodonts yielded a trace of phosphate of lime.

The detached condition of the hooklets, and the integrity of the thin border of the basal pulp-cavity, indicate that they have not been broken away from any of those kinds of attachment to a bone which the minute villiform teeth of osseous fishes would show signs of. The Conodonts have been supported upon a soft substance, such as the skin of a Mollusk or worm, the mucous membrane of a mouth, or throat, or the covering of a proboscis; but to select the teeth of cyclostomous or plagiostomous fishes as the exclusive illustration of the above condition, is to take a partial and limited view of the subject.

In comparing the Conodonts with the teeth of fishes, they present, as Dr Pander recognises, most resemblance with the conical, pointed, horny teeth of Myxinoids and Lampreys in that class: and the absence of any other hard part in the strata containing the Conodonts tallies with the condition of the cyclostomatous skeleton; but not more than it does with the like soft condition of annelidous worms and naked Mollusks. But the teeth of all known Cyclostomes are

[1] *Monographie der Fossilen Fische* (*Untersilurische Fische, Conodonten*, &c.), 4to, Petersburgh, 1856.

Vertebrata.

Plagiostomes.

much less slender and are less varied in form than in the Conodonts. Certain lingual plates of Myxinoids are serrate, but not with a main denticle of much greater length,—such as shown in the form of the Conodont called *Machairodus* by Pander. Most cyclostomous teeth are simple, thick cones, with a subcircular base; and every known tooth of a cyclostomous fish is much larger than any of the forms of *Conodon*, which rarely equal half a line in length. This minuteness of size, with the peculiarities of form, supports a reference of the Conodonts rather to some soft invertebrate genus. Certain parts of small Crustacea,—*e.g.*, the pygidium or tail of some minute *Entomostraca*,—resemble in shape the more simple Conodonts; but when we perceive that these bodies occur in thousands, detached, with entire bases, and that any part of the carapace, or shell of an Entomostracan or other Crustacean, has been rarely detected in the lower Silurian Conodont beds, it is highly improbable that they can have belonged to an organism protected by a substance as susceptible of preservation as their own substance. Much more likely is it that the body to which the minute hooklets were attached was as soluble and perishable as the soft pulp upon which the Conodont was sheathed. The writer finds no form of spine, denticle, or hooklet in any Echinoderm, and especially in any soft-bodied one, to match the Conodonts; and concludes that they have most analogy with the spines, or hooklets, or denticles of naked Mollusks or Annelides. The formal publication of these minute ambiguous bodies of the oldest fossiliferous rocks, as evidences of fishes, is much to be deprecated.

Order I.—PLAGIOSTOMI.

(*Sharks, Rays*)

Char.—Endo-skeleton cartilaginous or partially ossified; exo-skeleton placoid; gills fixed with five or more gill-apertures; no swim-bladder; scapular arch detached from the head; ventrals abdominal; intestine with spiral valve.[1]

The earliest good evidence which has been obtained of a vertebrate animal in the earth's crust is a spine, of the nature of the dorsal spine of the dog-fish (*Acanthias*), and of the dorsal spines of the extinct *Acanthodii*. It occurs in the most recent deposits of the Silurian period, in the formation called "Ludlow rock." Its discovery is due to Murchison;[2] its determination to Agassiz, who assigns it to a genus of plagiostomous cartilaginous fishes called *Onchus*.

The *Onchus* spines from the Ludlow bone-beds are compressed, slightly curved, less than two inches in length, with no trace at their base of the joint characteristic of the dorsal spines of the "sheat-fishes" (Ganoids of the family *Siluridæ*), or "file-fishes" (*Balistidæ*). The sides of the spine are finely grooved lengthwise, with rounded ribs between the grooves. They are referred to two species—*Onchus Murchisoni*, and *O. semistriatus*. Sir P. Egerton has lately figured another species from the argillaceous beds near Ludlow, which is more curved, and is armed along the posterior edge; the longitudinal ribs are fine and numerous, but are constricted at intervals, as in the genus *Ctenacanthus*, and become subtuberculate at the base. He deems them significant of a distinct genus of shark-like fishes.[3]

With the dorsal spines of *Onchus* are found petrified portions of skin, tubercular and prickly, like the shagreen of shark's skin, and referred to a genus called *Sphagodus*; also coprolitic bodies of phosphate and carbonate of lime, including recognisable parts of the small Mollusks and Crinoids which inhabited the sea-bottom in company with the Onchus-fish. No vertebræ, or other parts of the endo-skeleton of a fish, have been discovered, unless the fragments of a calcified bar, with tooth-like processes, called *Plectrodus*, be truly jaws with teeth. They resemble, however, parts of the pincer-claws of Crustaceans, as well as of the jaws and teeth of fishes, and do not indicate that class so satisfactorily as the *Onchus* spines and *Sphagodus* shagreen. Yet the denticles are confluent with an outer ridge of the bone, according to the "pleurodont" type, and consist of separated large teeth, with minute serial teeth in the interspaces; and the large teeth are grooved longitudinally.[4]

If the Plectrodonts be jaws with anchylosed teeth, they belong to an order distinct from the *Plagiostomi*. If they should belong to any of the fishes indicated by the dorsal spines and shagreen skin, a combination of characters would be exemplified not known in other formations or in any existing fishes.

No detached teeth unequivocally referable to a plagiostomous genus, nor any true ganoid scale of a fish, have yet been found in the formations that have revealed these earliest known evidences of vertebrate animals. What, then, it may be asked, were the conditions under which so immense an extent, as well as amount, of sediment was deposited,—including chambered Cephalopods, Gastropods, Lamellibranchs, Brachiopods, various and large trilobitic Crustaceans, with Crinoids, Polypes, and Protozoa,—that precluded the preservation of the fossilizable parts of fishes, if that class of vertebrate animals had existed in numbers, and under the variety of forms, comparable to those that people the ocean at the present day? Bonitos now pursue flying-fishes through the upper regions of an ocean as deep as any known part of the Silurian seas of which the deposits afford an idea of greatest depth. If fishes of cognate habits with the present deep-sea fishes, under whatever difference of form such Silurian fishes may have been manifested, had really existed, we might reasonably expect to find the remains of some of the countless generations that succeeded each other during that vast and indefinite period, sufficing for the gradual deposition of sedimentary beds of thousands of feet in depth or vertical thickness.

The evidences of plagiostomous fishes afforded by fossil spines will be here pursued. In most of the existing cartilaginous fishes of this order the defensive spine which stands erect in front of the dorsal fin is smooth; such is the case in the dog-fishes (*Spinacidæ*) in which each dorsal fin is fronted with a spine. In the Port-Jackson sharks (*Cestraciontidæ*) the spine in front of each dorsal is bony, and is armed along its hinder or concave border with bent spines. The fin is connected with this border, and its movements are regulated by the elevation or depression of the spine during the peculiar rotatory action of the body of the shark. This action of the spine in raising and depressing the fin resembles, Dr Buckland has remarked, that of the moveable or jointed mast, raising and lowering backwards the sail of a barge. But their more obvious use, in the small Plagiostomes possessing such spines, is as defensive weapons against the larger and stronger voracious fishes.

Certain bony fishes are similarly armed,—*e.g.*, sticklebacks (*Gasterostei*), sheat-fishes (*Siluridæ*), trigger-fishes (*Balistes*), and some species of snipe-fishes (*Fistularidæ*). In the latter family the *Centriscus humerosus* (fig. 23) shows a dorsal spine, denticulated behind, as in the Cestracionts, but the base of the spine in bony fishes is peculiarly modified for

[1] For an explanation of the technical terms in these characters, see the article ICHTHYOLOGY, especially of the scales, vol. xii., p. 216.

[2] *Silurian System*, ch xlv., p. 606.

[3] In a formation in Indiana, United States of America, referred by Messrs Norwood and Dale Owen to the Silurian formation, a badly-preserved fossil, considered as an Ichthyolite, and referred to a genus allied to *Pterichthys*, has been discovered, and called *Macropetalichthys raphidolabis*. (Silliman's *Journal*, 1846, p. 367.)

[4] Egerton, *Proc. Geol Soc.*, March 1857, p. 288, pl. x., figs. 2–4.

Vertebrata.

articulation with another bone. In the Plagiostomes the base of the spine is hollow, becomes thin and smooth when the body of the spine is sculptured, and is in the recent fish implanted in the flesh.

The following genera of plagiostomous fishes have been

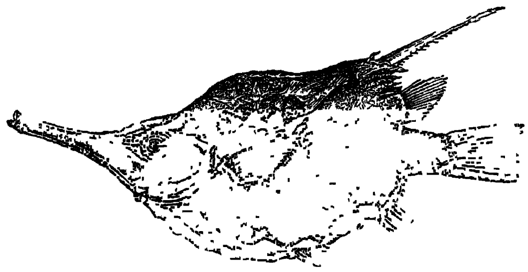

Fig. 23.

Centriscus humerosus.

founded on the fossil spines, or "ichthyodorulites," which have been discovered in the "Devonian," or "Old Red Sandstone series." *Onchus* (represented by *O. semistriatus*, *O. heterogyrus*), *Dimeracanthus*, *Haplacanthus*, *Narcodes*, *Naulas*, *Byssacanthus*, *Cosmacanthus*, *Homacanthus* (fig. 24), *Ctenacanthus*, *Ptyacanthus*, *Climatius*, *Parexus*, *Odontacanthus*, and *Pleuracanthus*.

The genus *Homacanthus* is founded on small compressed spines, with fine recurved teeth on the back edge, and longitudinal striæ on the sides. Specimens of *Homacanthus arcuatus* (fig. 24) have been found in Devonian formations near St Petersburg.

Fig. 24. *Homacanthus arcuatus.* (Devonian, Russia.)

The carboniferous series of formations includes the mountain limestone, millstone grit, and the coal measures (see fig. 1). In this series the genus *Onchus* is still represented by the *O. sulcatus*, *O. rectus*, and *O. subulatus;* and the genus *Homacanthus*, by *H. macrodus* and *H. microdus*, from the carboniferous limestone of Armagh. *Ptyacanthus*, *Ctenacanthus*, and *Pleuracanthus* are also forms common to the Devonian and carboniferous periods. The spine of the latter genus is denticulated along both margins, a structure which is presented, in existing Plagiostomes, only by species of the ray family: *Pleuracanthus*, therefore, as Agassiz concludes, may offer the earliest example of the flat form of cartilaginous fish, which is represented by the sting-rays (*Trygon*, *Myliobates*) in the present seas. The ichthyodorulite (*ichthys*, a fish; *dora*, a spear; *lithos*, a stone) here selected to illustrate this fossil, is a portion of the spine of the *Pleuracanthus levissimus* (fig. 25), from the carboniferous beds near Dudley. The other plagiostomous genera based upon fossil spines from the coal formations are,—*Oracanthus*, *Gyracanthus*, *Nemacanthus*, *Cosmacanthus*, *Leptacanthus*, *Homacanthus*, *Trystichius*, *Asteropterychius*, *Physonemus*, *Sphenacanthus*, *Platyacanthus*, *Dipriacanthus*, *Erismacanthus*, *Orthacanthus*, *Cladacanthus*, *Lepracanthus*.

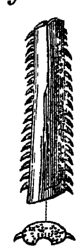

Fig. 25. *Pleuracanthus levissimus.* (Coal, Dudley).

Immediately above the coal-measures lie a variable series of sands and clays of different colours, including the coal plants: above this, a marl-slate in thin layers, containing scanty evidences of fishes; but these are more abundant and instructive in the superincumbent magnesian limestone, in which formation near Belfast ichthyodorulites of the genus *Gyropristis* (Ag.), have been found. Above this are the penean red sandstones, in which, at Westoe, have been found fossil spines closely allied to, if not identical with, the *Gyracanthus formosus* (Ag.) The foregoing formations constitute the uppermost of the palæozoic series called "Permian," from the Russian province in which these strata are most extensively developed. Their relative position is known by the term "magnesian limestone" in the "Table of Strata," fig. 1.

Vertebrata.

The superimposed strata, marked "new red sandstone," includes also a varied series of red and white sands, marls, and conglomerates, forming collectively the system called "triassic." The ichthyodorulites of this system are referable to the genera *Nemacanthus*, *Leiacanthus*, and *Hybodus*. In the "lias," which is the oldest or lowest of the great "oolitic" system, the dorsal spines of the genus *Hybodus* (fig. 26), are the largest and most abundant; this genus, however, is represented by detached teeth in the keuper and muschelkalk members of the "trias." The lias formations give evidence that the dorsal spines and fins of *Hybodus* were two in number; and the genus is shown, both by the structure of the spine and the form of the teeth, to have had its nearest affinities with the *Cestracion* amongst existing Plagiostomes. *Hybodus* continued to be represented by successive and varying specific forms up to, and including, the cretaceous period. *Hybodus* is therefore a genus of cartilaginous fishes eminently characteristic of the secondary or mezozoic period in palæontology, and ranges through every formation of that period. The specimen selected for the illustration of the dorsal spine of *Hybodus* is that of the *H. subcarinatus*, from the Wealden of Tilgate Forest.

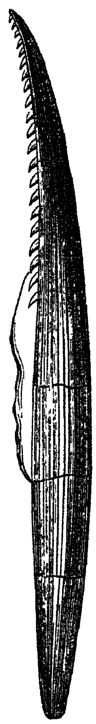

Fig. 26. *Hybodus subcarinatus.* (Wealden.)

Large fossil spines, longitudinally grooved, have been found associated with the teeth of the extinct cestraciont genus of the chalk called *Ptychodus*.

In the tertiary formations, the fossil spines present for the most part the generic characters of those of existing Plagiostomes,—*e.g.*, *Spinax*, *Trigon*, and *Myliobates;* but one form, found in the eocene beds near Paris, is the type of the extinct genus *Aulacanthus* of Agassiz.

The teeth of the plagiostomous fishes,—viz., sharks (*Squalidæ*), rays (*Raiidæ*), and Cestracionts, are described in the article ODONTOLOGY (vol. xvi., pp. 422–424). From the account and figures there given, it will be seen that the teeth are very numerous, and that, being attached only by ligament to the membrane of the mouth, they must soon fall off in the decomposition of the dead fish, become scattered abroad by the movements of the body through the action of the waters, and sink into the sediment.

FAMILY I.—CESTRACIONTIDÆ.

(Port-Jackson Shark.)

The existing genus which has thrown most light upon the fossil teeth which have thus become imbedded in the oceanic deposits of the palæozoic and mezozoic periods, is the *Cestracion*, now restricted to the Australian and Chinese seas, where it is represented by two or three species, and suggests the idea of a form verging towards extinction. It formerly flourished under a great number of varied generic or family modifications, represented by species, some of which attained dimensions far exceeding the largest known living Cestracions. The dentition of these fishes is adapted to the prehension and mastication of crustaceous and testaceous animals; they are of a harmless, timid character; and have the before-described denticulate dorsal spines given to them as defensive weapons. Figure

Vertebrata.

27 gives a side view of the upper and lower jaws of the "Port-Jackson shark," showing the oblique disposition of the large crushing teeth, which cover like a pavement the working borders of the mouth. Figure 28, p. 424, article ODONTOLOGY, gives a view of the crowns of the teeth of the upper jaw of the same species. From their mode of attachment, these teeth would become detached from the jaws of the dead fish, and dispersed in the way above described; and it is by such detached fossil teeth that we first get dental evidence of the Cestraciont family in former periods of the earth's history.

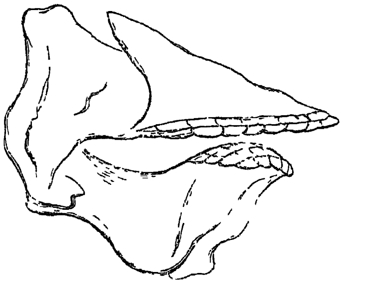

Fig. 27.
Cestracion Philippi (recent).

The teeth of the Hybodonts are conical, but broader and less sharp than those of true sharks. The enamel is strongly marked by longitudinal grooves and folds. One cone is larger than the rest, and called the "principal;" the others are secondary. In one genus (*Cladodus*, Ag.), the secondary cones go on enlarging as they recede from the "principal;" and teeth of this genus, referred by Eichwald to the *Hybodus longiconus*, have been discovered in the old red sandstone in the vicinity of Petersburg.

In the *Orodus*, the cones are more compressed, trenchant, and distinct from the body of the tooth than in *Hybodus*; but they present a principal and secondary cones. Fig. 28 is a tooth of the *Orodus cinctus* (Ag.), from the carboniferous beds near Bristol. The *O. porosus* and *O. compressus* are from deposits of similar age near Armagh.

Fig. 28.
Orodus cinctus (tooth).
(Carboniferous.)

If fig. 29 be compared with fig. 28, p. 424, vol. xvi., it would seem as if the several teeth of each oblique row in *Cestracion* had been welded into a single dental mass in *Cochliodus*, the proportions and direction of the rows being closely analogous. Whether in *Cochliodus* there were any small anterior prehensile teeth, is hypothetical; the large crushing dental plates must have been admirably adapted to crack and bruise the shells of Molluscs and Crustaceans. The *Cochliodus contortus* (Ag.) (fig. 29) has been found in the carboniferous formations near Bristol and Armagh, aud the genus is peculiar to that geological period.

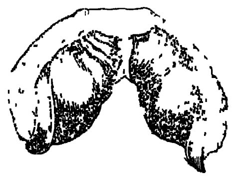

Fig. 29.
Cochliodus contortus, Ag.
(Carboniferous.)

Teeth referable to the genus *Hybodus* occur in all the secondary rocks from the trias to the chalk inclusive.

A form of tooth which more closely resembles the crushing-teeth of Cestracion, is that on which the genus *Acrodus* is founded, and which also ranges from triassic strata to the upper chalk of Maestricht. The species here selected (fig. 30) is the *Acrodus nobilis*, from the lias of Lyme Regis. The upper figure shows the grinding surface, which, from its finely and transversely striated character and dark colour, has suggested to the quarrymen the name of "fossil leeches." The older fossilists regarded these teeth as petrified Vermes; but the structure, as shown by the microscope, is closely similar to that of the teeth of Cestracion.[1] Portions of the jaw of the *Acrodus* have been discovered which show that these teeth were arranged, as in *Cestracion*, in oblique rows, with at least seven teeth in each row. *Acrodus lateralis* is a muschelkalk fossil, *A. hirudo* a Wealden, and *A. transversus* a cretaceous fossil. No tooth referable to the genus has been found in any tertiary stratum.

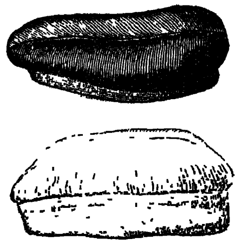

Fig. 30.
Acrodus nobilis (tooth).
(Lias.)

Vertebrata.

The genus *Ptychodus* is founded on teeth usually of large size, and of a more or less square form (fig. 31). The crown is deeper than the root, which is obtuse and truncate. The enamelled summit of the crown is granulate at the margin, and raised in the middle into an obtuse eminence, disposed in large transverse, parallel, sometimes wavy and rather sharp ridges. With teeth of this form are sometimes found others of smaller size, with more convex rounded crowns, doubtless forming the extremes of the multiserial pavement which, as in modern sharks and rays, covered the broad jaws of the Ptychodonts. Large dorsal spines have been found so associated with the above-described teeth as to indicate the affinity of the *Ptychodus* to the Cestraciont family of sharks. All the specimens and species referable to this genus have been found in the cretaceous strata.

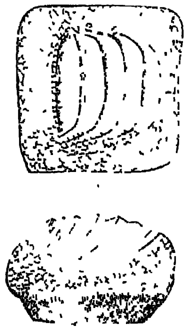

Fig. 31.
Ptychodus latissimus.
(Chalk.)

FAMILY II.—SQUALIDÆ
(*Sharks.*)

The well-marked, saw-shaped tooth (fig. 32), so closely resembles the lower jaw-teeth of the sharks, called "grisets" by the French (*Notidanus*, Cuv.), as to be referred to that genus by Agassiz. Such teeth nevertheless occur in strata of oolitic age (*Notidanus Munsteri*, Ag., fig. 32). Other species,—*e. g.*, *N. pectinatus*,—are found in the chalk of Kent; and *N. serratissimus*, in the eocene clay at Sheppy.

The tooth (fig. 33) on which Agassiz has founded the genus *Corax* indicates, by its close resemblance to those of *Carcharias*, its relationship with the true sharks (*Squalidæ*). Most of the species of *Corax*, including *C. falcatus*, are cretaceous; a few are tertiary: all are extinct.

Fig. 32.
Notidanus Munsteri.
(Upper Oolite.)

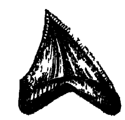

Fig. 33.
Corax falcatus.
(Chalk.)

Fig. 34.
Galeocerdo aduncus.
(Miocene.)

Another form of shark's tooth, deeply notched at one margin, and with the rest of the border finely denticulate, resembles more that of the "Topes" or gray sharks (*Galeus*, Cuv.), and is referred by Agassiz to the genus *Galeocerdo*. The species are found in both the cretaceous and tertiary formations; *Galeocerdo aduncus* (fig. 34) is from the miocene of Europe and America. In the same tertiary series are found the teeth of the *Hemipristis serra*, Ag. (fig. 35).

Odontaspis (Ag.), presents a form of tooth most like that in the blue sharks (*Lamna*) of the present seas. Species of *Odontaspis* occur in the cretaceous and tertiary beds. The *O. Hopei* (fig. 36) is from the London clay of Sheppy. It indicates a destructive and formidable species of shark.

[1] See Owen' *Odontography* vol. i. p. 54, pls. 14 and 15.

With these fossil teeth of sharks are found, though sparingly, in both the cretaceous and tertiary beds, petrified bodies of vertebræ, showing by their extreme shortness in comparison with their breadth, by their bi-concavity,

Fig. 35.
Hemipristis serra.
(Miocene.)

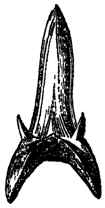

Fig. 36.
Odontaspis Hopei.
(Eocene.)

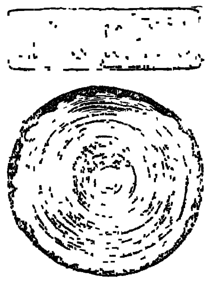

Fig. 37.
Side View and Back View of the Body of a Vertebra of a Shark, *Lamna* or *Odontaspis.*
(London clay, Sheppy.)

and the fissures on the external surface (as shown on the upper figure of cut 37), that they belonged to a shark closely allied to the Porbeagle, (*Lamna*, Cuv.)

Family III.—Raiidæ.

(*Rays.*)

Fossil evidences of this peculiar family of cartilaginous fishes have been discovered in oolitic, cretaceous, and tertiary formations, and consist of defensive spines, dermal tubercles, and teeth, but chiefly the latter. The most peculiar and distinctive modifications of the dental system, presented by the eagle-rays (*Myliobatidæ*) are unequivocally shown by fossils of the tertiary formations, and have not been found in earlier strata.

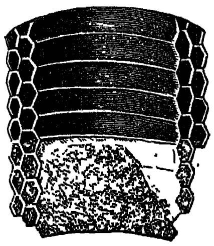

Fig. 38.
Myliobates toliapicus.
(Eocene, Sheppy.)

The form, structure, and arrangement of the dental plates of the existing *Myliobates* are described and illustrated in the article Odontology, p. 423, figs. 26 and 27. To this genus, as now restricted, certain fossils from the London clay of Sheppy (*Myliobates toliapicus*, Ag., fig. 38) belong.

In *Zygobates* (fig. 39), the middle series of teeth is less broad; and a still narrower series is interposed between it and the small lateral teeth. Existing rays showing this modification are found in Brazilian seas; fossil teeth of this genus, *e.g.*, *Zygobates Woodwardi*, Ag. (fig. 39), occur in the tertiary crag (probably miocene) of Norfolk, and in the miocene mollasse of Switzerland.

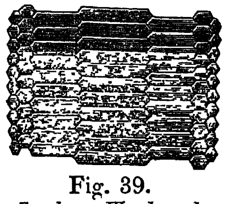

Fig. 39.
Zygobates Woodwardi.
(Miocene.)

When the teeth form broad transverse undivided plates, as in fig. 40, they characterize the genus *Ætobates.* Fossils of this genus occur in the English eocenes and the Swiss mollasse.

In the "crag" of Norfolk and Suffolk, and in marine pliocene beds, fossils have been found which closely resemble the osseous and spinigerous plates that beset the skin of the ray, thence called "thornback" (fig. 41), and which indicate the existence of a species allied to the *Raia clavata.*

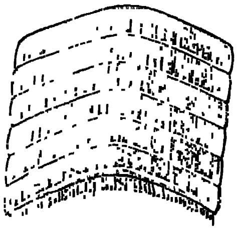

Fig. 40.
Ætobates subarcuatus.
(Eocene, Bracklesham.)

Thus we obtain evidence of fishes of the plagiostomous order in the marine deposits of every formation from the upper Silurian beds to the present period. But none of the palæozoic fossils are referable to any existing genus. A few only of the mezozoic Plagiostomes, and those chiefly from the chalk are so determinable. Most of the secondary Plagiostomes belong or are allied to a family (*Cestraciontidæ*), now nearly extinct; the evidence of the generic forms of Plagiostomes characteristic of the present time become common only in the tertiary periods. No fossil species is the same with any existing one.

Fig. 41.
Raia clavata
(Dermal spines)

Order II.—HOLOCEPHALI.

(*Chimæroid Fishes.*)

Char.—Jaws bony, traversed and encased by dental plates; endo-skeleton cartilaginous; exo-skeleton as placoid granules; most of the fins with a strong spine for the first ray; ventrals abdominal; gills laminated, attached by their margins; a single external gill aperture.

To judge from the paucity of existing representatives of this order of cartilaginous fishes, it would seem, like the Cestracionts, to be verging towards extinction. One genus (*Chimæra*, Linn.) is founded on a single known species of the northern seas called "king of the herrings" (*Chimæra monstrosa*); another genus (*Callorhynchus* of Gronovius) is represented by two known species in the Australian and Chinese seas. The only parts of chimæroid fishes likely to be fossilized are the jaws and spines. The bony and dental substances are so combined in the more or less beak-shaped jaws, that they characterize the order, and are never found separate. It is chiefly on such fossil mandibles, and portions of them, that the evidence of the *Holocephali* in former geological periods rests. These singular fishes ranged, under different generic and specific modifications, from the bottom of the oolitic series to the present period.

Genus Ischiodon, Egerton.—Of this genus, *I. Johnsoni* is from the lias of Dorsetshire; *I. Egertoni* from the Kimmeridge of Shotover; and *I. Townshendi*, a magnificent species, from the Portland stone. Two species (*I. Agassizii* and *I. brevirostris*) are from the cretaceous beds; at which period the genus appears to have perished.

Genus Ganodus, Egerton (including *Ganodus* and *Psittacodus* of Agassiz).—This genus is exclusively represented by species from the oolitic slate of Stonesfield,—*e.g.*, *G. Bucklandi*, *G. Colei*, *G. Owenii.*

Genus Edaphodus, Egerton (including *Edaphodon* and *Passalodon* of Buckland).—The large *E. Sedgwickii* is from the greensand near Cambridge; the still larger *E. gigas* from the chalk of Kent and Sussex. The ichthyodorulite called *Psittacodus Mantelli* by Agassiz may be the dorsal spine of this species. Three species, including the *E. Bucklandi*, are found in the eocene of Bagshot and Bracklesham; and one species (*E. helveticus*) is from the mollasse of Switzerland.

The genus *Elasmodus*, Egerton, is exclusively represented by species,—*e. g.*, *E. Hunteri*, from the London clay of Sheppy.

Order III.—GANOIDEI.

Char.—Endo-skeleton in some osseous, in some cartilaginous, in some partly osseous and partly cartilaginous; exo-skeleton formed by enamelled bones; fins usually with the first ray a strong spine.

Sub-Order 1.—PLACOGANOIDEI.

(*Placodermes*,[1] Pander.)

Char.—Endo-skeleton cartilaginous, or retaining the notochord; head and more or less of the trunk protected by large ganoid, often reticulated, plates; heterocercal.

The last term signifies a form and structure of tail illustrated by fig. 42, and to be seen in the sharks, dog-fishes,

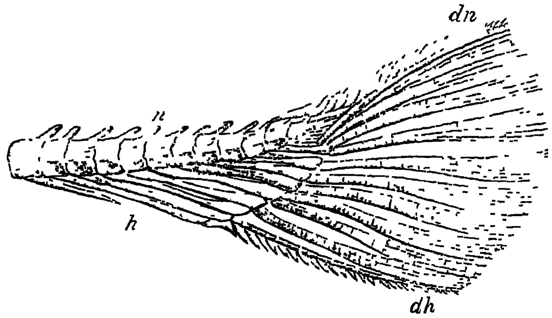

Fig. 42.

Heterocercal Tail (*Lepidosteus osseus*).

and sturgeons of the present day: it results from a prolongation of the vertebral column into the upper lobe *dn*, producing an unsymmetrical form of the caudal fin, which is contrasted with the symmetrical form of the same fin presented by most fishes of the present day, and illustrated by the skeleton of the perch, in art. ICHTHYOLOGY, fig. 10, p. 208, vol. xii., in which the vertebral column terminates at the middle of the base of the caudal fin. There are a few exceptional intermediate forms and structures of this fin.

The fossil remains of the singular fishes of the extinct order *Placoganoidei* were first discovered about 1813, in formations of the "old red" or Devonian age in Russia, and are preserved in museums at St Petersburg and Dorpat. The relation of these specimens to the class of fishes was first announced by Professor Asmuss,[2] and shortly after, the generic names *Asterolepis* and *Bothriolepis* were invented by Professor Eichwald,[3] to express certain modifications of the external surface of portions of the ganoid plates, subsequently recognised as constituting the buckler of the fore-part of the extinct fishes. In September 1840 Mr Hugh Miller submitted to the geological section of the British Association, at Glasgow, the first discovered specimens affording a recognisable idea of the form of one of these "old red" fishes, and for this form Professor Agassiz assigned the generic name *Pterichthys* (*pteron*, a wing, *ichthys*, a fish). Although, therefore, the term *Asterolepis* had been attached to a fragment of the cuirass of this fish a few months previously, yet, as no recognisable generic characters were associated with such name, and as *Asterolepis* has been applied also to another genus,—the *Heterostius* of Asmuss,—the example of British palæontologists will be here followed, in retaining the name *Pterichthys* for the genus. "Of all the organisms of the system," wrote the lamented Hugh Miller in his work on the *Old Red Sandstone*, "one of the most extraordinary, and the one in which Lamarck would have most delighted, is the *Pterichthys*, or winged fish, an ichthyolite which the writer had the pleasure of introducing to the acquaintance of geologists nearly three years ago (1840), but which he first laid open to the light about seven years earlier" (1833).

Genus PTERICHTHYS (fig. 43).—The head and the anterior half of the trunk are defended by ganoid plates,—*i. e.*, plates composed of a hard bone coated with enamel; those of the trunk forming a buckler composed of a back-plate (fig. 43) and breast-plate (fig. 44), articulated together at the sides. The rest of the trunk was defended by small ganoid scales, flexible, like scale-armour, and bore a small dorsal fin (fig. 43, *d*), and a terminal heterocercal fin, very rarely displayed

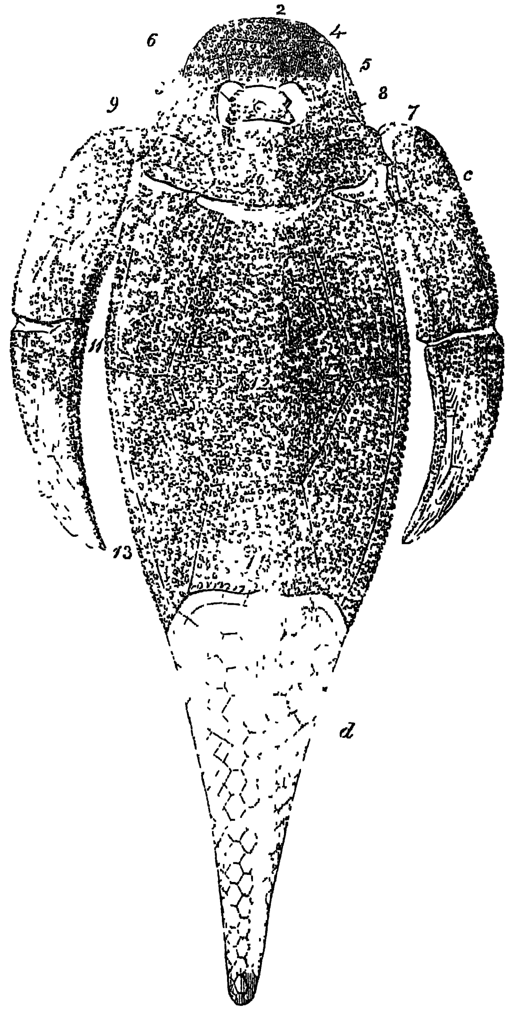

Fig. 43.

Pterichthys Milleri, dorsal surface (Devonian), after Pander.

in fossil specimens. The pectoral spines, *c*, are formed of ganoid material, like the buckler. The armour of the head, or helmet, appears to have been articulated by a moveable joint to the trunk-buckler. One of the few existing ganoid fishes (*Lepidosteus*) is remarkable for the degree in which the head moves upon the trunk. The component dermal plates of the helmet correspond in some measure with the position of the cranial bones in osseous fishes, but not sufficiently to sanction the application to them of corresponding names. They are indicated by figures in the cut 43: 2 is the front terminal or *rostral* plate; it is followed in the median line by four other plates in the following order:—4, *premedian*; 6, *median*; 8, *postmedian*; 10, *nuchal*; 3 is the *marginal*, and 7 the

[1] This term is used by other German writers as the equivalent of the PLACOIDEI of Agassiz, which answers to the *Plagiostomi* of Cuvier.

[2] *Bulletin Scient. par l'Acad. Imp. des Sciences de St Petersburg*, 1840, t. vi., p. 220.

[3] Ibid., t. vii., p. 78, communicated March 13th, 1840. Dr Fleming had recognized certain fossil scales as those of fishes in the "Old Red" of Fifeshire, in 1827.

postmarginal; 5 is the *prelateral*, and 9 the *postlateral*.

The dorsal shield of the trunk-cuirass is composed of two mid-plates and two on each side. 12 is the "*dorsomedian*," 14 the *post-dorsomedian;* 11 is the *dorsolateral*, 13 the *post-dorsolateral*. The ventral shield (fig. 44) consists of one mid-plate and three or four side-plates: 15 is the *pre-ventrolateral*, 19 the *ventrolateral*, 21 the *post-ventrolateral;* the small supplementary plate marked 17 is sometimes confluent with 19; 16 is the *ventromedian* plate; its margins are bevelled off and overlapped by the lateral plates.

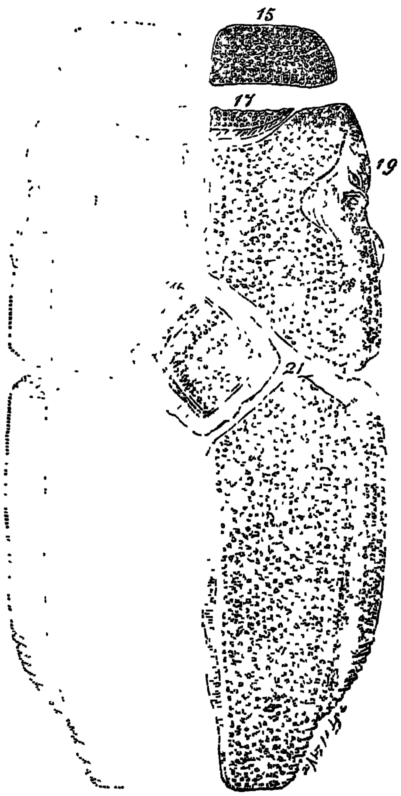

Fig. 44.

Pterichthys; Plastron or Ventral Shield. (Devonian), after Pander.

In the first-formed imperfect specimens of *Pterichthys*, the ventral shield was deemed the dorsal one. Sir P. Egerton has the merit of having first discerned its true position.

The pectoral spines are long and slender, and consist of two principal segments, both defended by finely tuberculated ganoid plates, like those of the head and trunk. From their form, they would seem to have served to aid the fish in shuffling along the sandy bottom or bed, if left dry at low-water. The fins attached to the flexible part of the body indicate a certain power of swimming, though not with any great rapidity. The jaws are small, and possess confluent denticles.

The type-species is the *Pterichthys Milleri;* others have been based upon proportions of the cuirass, of the pectorals, and the tail; all are from the "old red," and the great majority have been found in the Devonian strata of Ross-shire, Caithness, and other Scotch localities.

Genus CEPHALASPIS (*kephale*, head, *aspis*, buckler).—In this genus the posterior angles of the shield-shaped helmet are produced backwards in a pointed form, giving to the head the form of a "saddler's knife;" in other respects the genus closely resembles *Pterichthys*.

Mr D. Page has recently acquired specimens of *Cephalaspis* from Lanarkshire tile-stones, forming the base of the Devonian system, which show a dorsal fin, pectoral fins, and a large heterocercal fin, besides a well-marked capsule of the eye-ball.

Genus COCCOSTEUS (*kokkos*, berry, *osteon*, bone).—If a heterocercal fin were added in outline to the restoration of the fish of this genus, given in fig 45, a correct idea would be given of the "old red" fish, which, in the progress of its reconstruction, has suggested so many strange notions of its nature and affinities.

The helmet and cuirass are firmly united, and there is no trace of the jointed appendages, like pectoral fins, which characterize *Pterchthys*. The unprotected part of the trunk shows an ossification of the neural and hæmal spines, and of their appendages, the rays of a "dorsal" and "anal" fin; and by the analogy of *Cephalaspis*, the tail was most probably terminated by an unequal-lobed fin. The lower jaw is composed of two rami, loosely connected at the symphysis; so that, when displaced, as in fig. 46, 24, and as commonly in crushed fossil specimens, they gave the notion of the fish being provided with laterally-working jaws, like

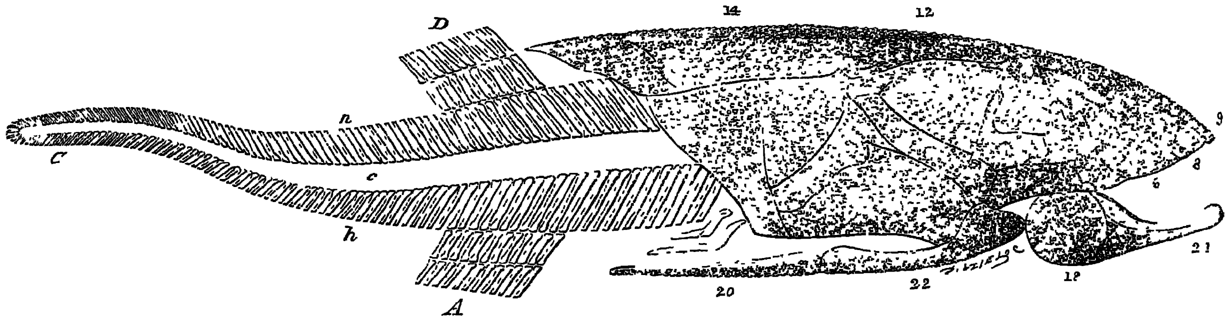

Fig. 45.

Coccosteus decipiens (Old Red Sandstone), after Pander.

those of the lobster. But, in reality, the jaw worked vertically upon a fixed upper jaw; both jaws being provided with from ten to twelve teeth on each side, anchylosed to the bone; each ramus of the jaw consisting of a premandibular (figs. 45 and 46, 24) and a postmandibular (fig. 45, 18) element.

An under-view of the cephalothoracic buckler of *Coccosteus*, according to Dr Pander's restoration, is given in fig. 46, showing the sutures of most of the cephalic plates, and the external surface of the plates of the plastron. 9, *Rostral plate;* 7, *premedian;* 5, *median;* 8, *prelateral;* 6, *lateral;* 16, *postmandibular;* 24, *premandibular;* 15, *pre-ventromedian;* behind the lozenge-shaped *ventromedian*, and on each side, are (22) the *pre-ventrolateral* and (23) the *post-ventrolateral*. The same figures mark the above plates in the side view (fig. 45), with the addition of (12) the *dorsomedian* and (14) the *post-dorsomedian*.

The blank space between the neural (n) and hæmal (h) spines of the fossil endo-skeleton indicates the position of the soft "notochord" (c), which has been dissolved away. The cylindrical gelatinous body, so called,—in Latin *chorda dorsalis*,—pre-exists to the formation of the bony bodies of the vertebræ in all vertebrate animals; and the development of those bodies seems never to have gone beyond this embryonal phase in any palæozoic fish; such fishes are accordingly termed "notochordal," retaining the notochord.

There are but two genera of existing fishes which manifest, when full grown, such a structure, associated with

Vertebrata. ossified peripheral elements of the vertebræ, viz., the *Protopterus* of certain rivers of Africa,[1] and the *Lepidosiren* of certain rivers of South America. Those fishes alone would,

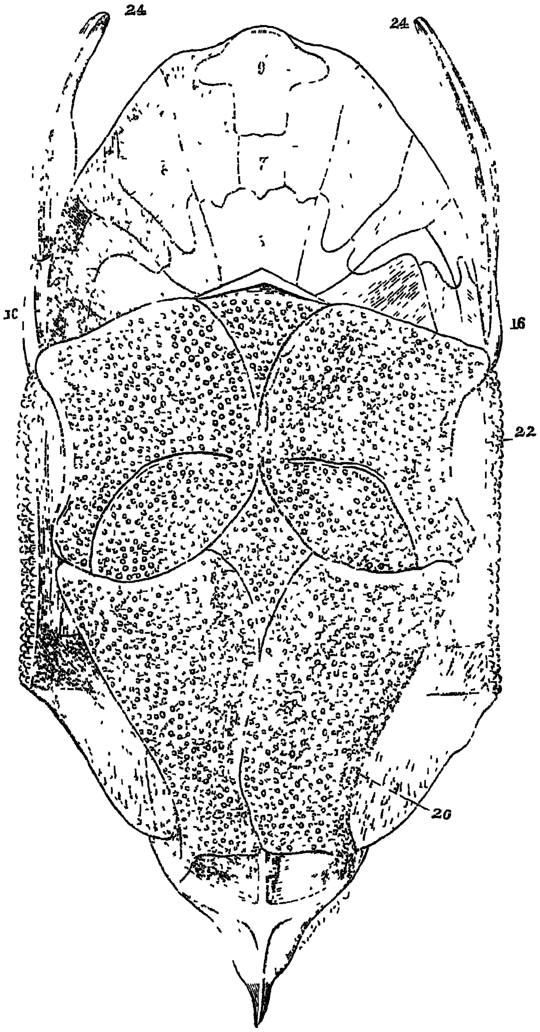

Fig. 46.
Cephalothoracic Buckler, ventral aspect, *Coccosteus decipiens* (Devonian).

if fossilized, present the appearance of the vertebral column shown in fig. 45, and which characterizes all the oolitic fossil ganoid fishes (see figs. 54 and 55). It is a strong illustration of a principle of "progression," this persistence in palæozic and most mezozoic fishes of an embryonic vertebral character, transitory in nearly all existing fishes.

The external "ganoid" surface of the buckler plates of *Coccosteus* is ornamented with small hemispherical tubercles; whence the generic name, signifying "berry-bone." The similarity of this ornamentation to that of the plates of the buckler in some *Tortoises*, led to the belief, when the coccosteal plates were first found, of their being evidence of the chelonian genus *Trionyx* in Devonian beds. Passing notions also got into print of the crustaceous affinities of *Coccosteus;* whence the trivial name of the type-species *decipiens*, or the "deceiving" *Coccosteus.*

Strange as seem the forms and structure of the placoganoid fishes of the "old red" period, there are not wanting existing species which throw much truer light on their nature than any existing *Chelonia* or *Crustacea.* The singular little family of "trunk-fishes" (*Ostracionidæ*) shows species in which the body is inclosed in a more or less quadrangular cuirass, composed of suturally-articulated ganoid plates, which are usually tuberculated on the external surface, and with the angles prolonged into spines in some species, like those of the helmet of *Cephalaspis.* The caudal part of the trunk protrudes from the back opening of the cuirass, as in *Coccosteus* and *Pterichthys*, and ossification of the endo-skeleton is incomplete. The species of this family are for the most part natives of seas of tropical or warm temperate latitudes. Vertebrata.

In another family of existing fishes, called "Siluroids," there are species in which the broad cranial bones, connate with dermal ossifications, form a helmet to the head, whilst one or two dermal spine-bearing bones combine to form the part called "buckler" by Cuvier.[2] In the genus *Doras*, the lateral line is armed with bony ganoid plates; and in *Callichthys*, these biserial plates are developed so as to incase the whole body. But generally, as in *Pimelodus*, the hinder muscular part of the trunk is undefended, as in *Coccosteus.* The ganoid plates of the head and back shields are fretted with rows or ridges of confluent tubercles, radiating from the centre to the circumference of the plate, whilst the inner surface is smooth, as in *Coccosteus* (fig. 46); and, moreover, the dorsal plate in existing Siluroids sends down a median ridge from its inner surface, like that from the "dorso-median" plate in *Coccosteus.* The point of resemblance to be mainly noticed, however, is the contrast furnished by the powerful armature of the head and back with the unprotected nakedness of the posterior portions of the creature—a point specially noticeable in *Coccosteus*, and apparent also, though in a lesser degree, in some of the other genera of the old red, such as the *Pterichthyes* and *Asterolepides.* "From the snout of the *Coccosteus* down to the posterior termination of the dorsal plate the creature was cased in strong armour, the plates of which remain as freshly preserved in the ancient rocks of the country as those of the *Pimelodi* of the Ganges on the shelves of the Elgin museum; but from the pointed termination of the plate immediately over the dorsal fin to the tail, comprising more than one-half the entire length of the animal, all seems to have been exposed, without the protection of even a scale; and there survives in the better specimens only the internal skeleton of the fish and the ray-bones of the fins. It was armed, like a French dragoon, with a strong helmet and a short cuirass; and so we find its remains in the state in which those of some of the soldiers of Napoleon's old guard, that had been committed unstripped to the earth, may be dug up in the future on the fatal field of Borodino, or along the banks of the Dwina or the Wap. The cuirass lies still attached to the helmet, but we only find the naked skeleton attached to the cuirass. The *Pterichthys* to its strong helmet and cuirass added a posterior armature of comparatively feeble scales, as if, while its upper parts were shielded with plate-armour, a lighter covering of ring or scale armour sufficed for the less vital parts beneath. In the *Asterolepis* the arrangement was somewhat similar, save that the plated cuirass was wanting. It was a strongly-helmed warrior in slight scale-armour; for the disproportion between the strength of the plated head-piece and that of the scaly coat was still greater than in the *Pterichthys.* The occipital star-covered plates are, in some of the larger specimens, fully three-quarters of an inch in thickness, whereas the thickness of the delicately-fretted scales rarely exceeds a line.

"Why this disproportion between the strength of the armature in different parts of the same fish should have obtained, as in *Pterichthys* and *Asterolepis*, or why, while one portion of the animal was strongly armed, another portion

[1] See *Linnæan Transactions*, vol. xviii.; and *Proceedings of the Linnæan Society*, April 2, 1839.

[2] *Histoire des Poissons*, tom. xii.

Vertebrata.

should have been left, as in *Coccosteus*, wholly exposed, cannot of course be determined by the mere geologist. His rocks present him with but the fact of the disproportion, without accounting for it. But the natural history of existing fish, in which, as in the *Pimelodi*, there may be detected a similar peculiarity of armature, may perhaps throw some light on the mystery. In Hamilton's *Fishes of the Ganges*, the habitats of the various Indian species of *Pimelodi*, whether brackish estuaries, ponds, or rivers, are described, but not their characteristic instincts. Of the *Silurus*, however, a genus of the same great family, I read elsewhere that some of the species, such as the *Silurus Glanis*, being unwieldy in their motions, do not pursue their prey, which consists of small fishes, but lie concealed among the mud, and seize on the chance stragglers that come in their way. And of the *Pimelodus gulio*, a little strongly-helmed fish with a naked body, I was informed by Mr Duff, on the authority of the gentleman who had presented the specimens to the Museum, that it burrowed in the holes of muddy banks, from which it shot out its armed head, and arrested, as they passed, the minute animals on which it preyed. The animal world is full of such compensatory defences; there is a half-suit of armour given to shield half the body, and a wise instinct to protect the rest. Now it seems not improbable that the half-armed *Coccosteus*, a heavy fish, indifferently furnished with fins, may have burrowed, like the recent *Silurus Glanis* or *Pimelodus gulio*, in a thick mud, of the existence of which in vast quantity, during the times of the old red sandstone, the dark Caithness flagstones, the fœtid breccia of Strathpeffer, and the gray stratified clays of Cromarty, Moray, and Banff unequivocally testify; and that it may have thus not only succeeded in capturing many of its light-winged contemporaries, which it would have vainly pursued in open sea, but may have been enabled also to present to its enemies, when assailed in its turn, only its armed portions, and to protect its unarmed parts in its burrow."[3]

Sub-Order 2.—LEPIDOGANOIDEI.

FAMILY I.—DIPTERIDÆ.

This family includes a few heterocercal fishes with a double anal as well as dorsal fin. The head is large and flattened; the teeth subequal; the scales perforated by small foramina; the notochord persistent.

In the genus *Dipterus* (fig. 47), the two dorsals, *d* 1, *d* 2, are opposite the two anals, *a* 1, *a* 2: the ventrals, *v*, are in

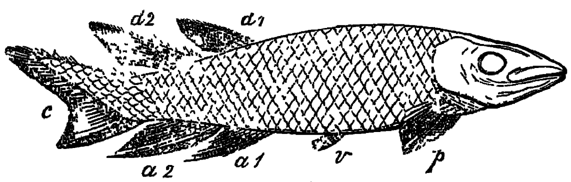

Fig. 47.
Dipterus macrolepidotus (Devonian).

advance of the first anal and first dorsal. The *Dipterus macrolepidotus* is characterized by the large size of its scales. Its remains are found in the old red sandstone of many localities of Scotland and England.

In the allied genus *Diplopterus* the vertical fins are opposite, but the dorsals are wider apart, and the teeth are larger and fewer. Four species have been recognised in the "old red" of Gamrie, Orkney, and Lethenbar, Ross-shire. Two species occur in the carboniferous series.

In the genus *Osteolepis* the vertical fins are alternate in position, the first dorsal being near the middle of the back. All the species of this genus are from the "old red."

Vertebrata.

FAMILY II.—ACANTHODII.

The species of this family are characterized by their very small scales: they are heterocercal and notochordal. There is a strong spine in front of each fin. The head is large; the orbits approximate; the mouth wide, and opening obliquely upwards, so that they have somewhat the aspect of the *Uranoscopi*. The principal genera are from the old red sandstone, and are as follows:—*Cheiracanthus*, with a single dorsal situated in front of the anal; *Cheirolepis*, in which the dorsal is situated behind the anal; and *Diplacanthus* (fig. 48), in which there are two dorsals.

The *Diplacanthus striatus* is found in the "old red" of Cromarty. In fig. 48, as in the other figures, *p* is the pectoral fin, *d* the dorsal, *v* the ventral, *a* the anal, and *c* the

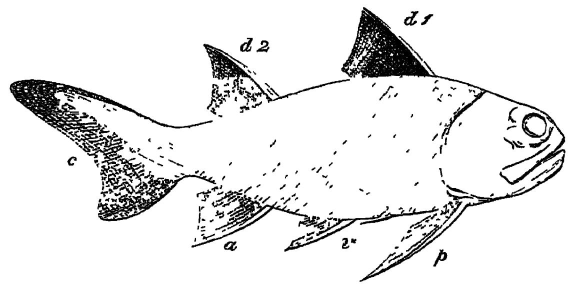

Fig. 48.
Diplacanthus striatus.

caudal. In this species the upper lobe of the caudal is much prolonged. The fin-spines in the *Acanthodii* were, like those of the recent dog-fish (*Spinax*), simply imbedded in the flesh, with their base, as it were, unfinished, not provided, as in the Siluroids and other modern bony fishes, with a joint-structure. Some species of *Acanthodii* existed in the seas of the carboniferous period.

FAMILY III.—CŒLACHANTHI.

The species of this family are characterized by the hollowness of the rays or spines; whence the name. The caudal fin has a peculiar structure, the vertebral column being continued into and beyond its middle part, supporting a kind of slender appendage between the two normal lobes. The species of the genus are most abundant in the Devonian and carboniferous formations; but some occur in oolitic and even cretaceous beds; but all became extinct before the tertiary epoch.

Glyptolepis had a heterocercal tail, with rounded scales, smooth externally, and with radiating compartments internally. The *G. microlepidotus*, of which a magnified view of some scales is given in fig. 49, occurs in the old red sandstone of Scotland and England.

FAMILY IV.—HOLOPTYCHIIDÆ.

The type-genera of this family were first recognised and characterized by the fossil scales, under the name *Holoptychius* (Ag.), and by the fossil teeth, under the name *Rhizodus* (Ow.) They include species which have left their remains in the "old red" and the coal measures. They are nearly allied to the Cœlacanthians, having, like them, but partially ossified bones and spines, the interior of which retained their primitive gristly state, and appear hollow in the fossils. The head was defended by large externally sculptured and tuberculate ganoid plates. The teeth consist of two kinds,—small

Fig. 49.
Glyptolepis microlepidotus (Devonian).

[1] Hugh Miller, *Rambles of a Geologist*, p. 288.

serial teeth, and large laniary teeth,—at long intervals; both kinds showing the "labyrinthic" structure[1] at their base, which is anchylosed to the jaw-bone. Large fossil teeth, with the more complex "dendritic" disposition of the tissues, characterize a genus (*Dendrodus*), most probably of the Holoptychian family.

The generic term *Rhizodus* is now retained for the *Holoptychians* of the coal measures which have more robust and obtuse serial teeth, and longer, sharper, and more slender laniaries, exemplified by the *R. Hibberti*.[2] Species of true *Holoptychius*,—*e.g.*, *H. giganteus* (Ag.), *H. nobilissimus* (Ag.), occur in the old red sandstone. A most noble specimen of the latter species, 2 feet 6 inches in length, discovered in the old red sandstone at Clashbinnie, near Perth, is now in the palæontological series of the British Museum. It is chiefly remarkable for the size and bold sculpturing of the ganoid scales (fig. 50).

Fig. 50.
Scale of *Holoptychius nobilissimus* (Devonian), ½ nat. size.

"The amount of design exhibited in the scales of some of the more ancient Ganoids,—design obvious enough to be clearly read,—is very extraordinary. A single scale of *Holoptychius nobilissimus*, fast locked up in its red sandstone rocks, laid by, as it were, for ever, will be seen, if we but set ourselves to unravel its texture, to form such an instance of nice adaptation of means to an end as might of itself be sufficient to confound the atheist. Let me attempt placing one of these scales before the reader in its character as a flat counter of bone, of a nearly circular form, an inch and a half in diameter, and an eighth part of an inch in thickness; and then ask him to bethink himself of the various means by which he would impart to it the greatest possible degree of strength. The human skull consists of two tables of solid bone, an inner and an outer, with a spongy cellular substance interposed between them, termed the *diploë*; and such is the effect of this arrangement, that the blow which would fracture a continuous wall of bone has its force broken by the spongy intermediate layer, and merely injures the outer table, leaving not unfrequently the inner one, which more especially protects the brain, wholly unharmed. Now, such also was the arrangement in the scale of the *Holoptychius nobilissimus*. It consisted of its two well-marked tables of solid bone, corresponding in their dermal character, the outer to the cuticle, the inner to the true skin, and the intermediate cellular layer to the *rete mucosum*; but bearing an unmistakeable analogy also, as a mechanical contrivance, to the two plates and the *diploë* of the human skull. To the strengthening principle of the two tables, however, there were two other principles added. Cromwell, when commissioning for a new helmet, his old one being, as he expresses it, "ill set," ordered his friend to send him a "*fluted pot*,"—*i.e.*, a helmet ridged and furrowed on the surface, and suited to break, by its protuberant lines, the force of a blow, so that the vibrations of the troke would reach the body of the metal deadened and flat. Now, the outer table of the scale of the Holoptychius was a "fluted pot." The alternate ridges and furrows which ornamented its surface served a purpose exactly similar with that of the flutes and fillets of Cromwell's helmet. The inner table was strengthened on a different but not less effective principle. Now, the inner table of the scale of the Holoptychius was composed on this principle, of various layers or coats, arranged the one over the other, so that the fibres of each lay at right angles with the fibres of the others in immediate contact with it. In the inner table of one scale I reckon nine of these alternating, variously-disposed layers; so that any application of violence, which, in the lath-splitter, would *run lengthwise along the grain* of four of them, would be checked by the *cross grain* in five. In other words, the line of the *tear* in five of the layers was ranged at right angles with the line of the *tear* in four. There were thus in a single scale, in order to secure the greatest possible amount of strength,—and who can say what other purposes may have been secured besides?—three distinct principles embodied, the principle of the two tables and *diploë* of the human skull, the principle of those of the variously-arranged coats of the human stomach, and the principle of Oliver Cromwell's "fluted pot." There have been elaborate treatises written on those ornate flooring-tiles of the classical and middle ages, that are occasionally dug up by the antiquary amid monastic ruins, or on the sites of old Roman stations; but did any of them ever tell a story half so instructive or so strange as that told by the incalculably more ancient ganoid *tiles* of the palæozoic and secondary period?"[4]

Such are some of the forms and structures of fishes that swam in the seas from which were deposited the sediment that has hardened into the "old red sandstones" of Great Britain, Russia, and other parts of the world. And in this process of consolidation the carcases of the fishes entombed in the primæval mud have had their share. For, just as a plaster-cast boiled in oil derives greater density and durability from that addition, so the oily and other azotized and ammoniacal principles of the decomposing fish operated upon the immediately surrounding sand so as to make it harder and more compact than the sediment not reached by the animal principles. Accordingly it has happened that in the course of the upheaval and disturbance of old red strata, parts of it, broken up and exposed to the action of torrents, have been reduced to detritus, and washed away, with the exception of certain nodules, generally of a flattened elliptic form, which are harder than the surrounding sandstone. Such nodules form the bed of many a mountain stream in "old red sandstone" districts of Scotland. If one of these nodules be cleft by a smart and well-applied stroke of the hammer, the cause of its superior density will be seen in a more or less perfect specimen of the fossilized remains of some animal, most commonly a fish.

But the placoganoid and ganoid, heterocercal and notochordal, fishes of the Devonian epoch existed in such vast shoals in certain favourable inlets, that the whole mass of the sedimentary deposits has been affected by the decomposing remains of successive generations of those fishes. The Devonian flagstones of Caithness are an instance. They owe their peculiar and valuable qualities of density, tenacity, and durability wholly to the dead fishes that rotted in their primitive constituent mud. In no other part of the world, perhaps, can the builder set a large flagstone on its edge with assurance of its holding long together in that position. A great proportion of the county of Caithness formed, before its upheaval, the bottom of what may truly be termed a "piscina mirabilis." Yet there are minds, one at least,[5] who, cognisant of the wonderful structures of the extinct Devonian fishes—of the evidence of design and adaptation in their structures—of the altered nature of the sediment surrounding them, and its dependence on the admixture of the decomposing and dissolved soft parts of the old fish—would deliberately reject the conclusions which healthy human reason must, as its Creator has constituted it, draw from such evidences of His operations. There are now individuals, one at least, who prefer to try to make it be believed that God had recently, and at once, called into being all these phenomena; that the fossil bones, scales, and teeth, had never served their purpose,—had never been recent,—were never truly developed, but created fossil; that the

[1] See art. ODONTOLOGY, vol. xvi., p. 412, fig. 12. [2] Ibid., p. 413, fig. 14. [3] Owen's *Odontography*, vol. ii., p. 75, pls. 35 and 36.
[4] Hugh Miller, *Rambles of a Geologist*, p. 284. [5] See *Omphalos*, by P. H. Gosse, 8vo, 1858.

creatures they simulate never actually existed; that the superior hardness of the inclosing matrix was equally due to primary creation, not to any secondary cause; that the geological evidences of superposition, successive stratification, and upheaval were, equally with the palæontological evidences, an elaborate design to deceive and not instruct! Surely, on such hypothesis, the workmanship must be that of the father of lies, not of the Author of Truth, and the imaginer of such hypothesis must be a Manichean at heart.

The sub-order of Placoganoids, so richly represented in the Devonian epoch, disappears in the carboniferous one; the Ganoids, with rhomboid scales, increase in number. These are characteristically represented by the genus *Palæoniscus*, species of which range throughout the carboniferous and Permian beds. *Palæoniscus* (fig. 51) is characterized by the heterocercal tail and moderate-sized fins, the dorsal, *D*, being single, and opposite the interval between the anal, *A*, and ventral, *V*, fins: each fin has an anterior spine.

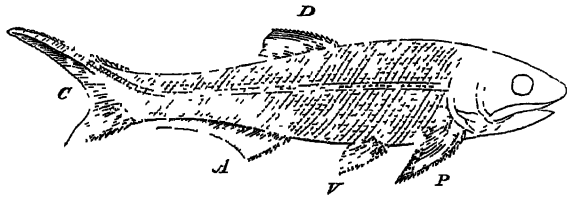

Fig. 51.
Palæoniscus (Permian).

The fore-part of the head is obtuse; the jaws armed with numerous small close-set teeth, or *en brosse*. The ganoid scales are rhomboidal: in the *Palæonisci*, from the coal formations at Burdie House, near Edinburgh, their outer surface is striate and punctate; *e.g.*, in *P. ornatissimus*, *P. striatus*; but in the *Palæonisci* of other British localities, and of the continental and American coal formations, the scales are smooth; *e.g.*, in *P. fultus*, from North America, *P. Duvernoyi* and *P. minutus*, from the coal beds of Munster-Appel. In the *Palæonisci* from the Permian copper schales and zechstein, the scales are striate or punctate. The *Palæoniscus Freieslebeni* is the most common, and was the first recognised species of the genus.

Amblypterus, with a geological range like that of *Palæoniscus*, differs in its shorter and deeper tail, and larger body-fins, which are devoid of anterior spines. In fig. 52 *a* indicates the outer surface of parts of two series of the rhomboidal ganoid scales; and *b* the inner surface of two scales, showing the ridge produced at one end into a projecting peg, which fits into a notch of the next scale, in the way that tiles are pegged together in the roof of a house. The species affording the above is the *Amblypterus striatus* from the coal-formations at Newhaven.

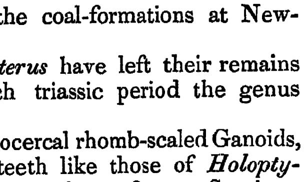

Fig. 52.
Scales of *Amblypterus striatus* (Carboniferous).

Several species of *Amblypterus* have left their remains in the muschelkalk, at which triassic period the genus seems to have passed away.

Magnificent species of heterocercal rhomb-scaled Ganoids, with large dispersed laniary teeth like those of *Holoptychius*, sometimes of a size rivalling those of great Saurians, for which they have been mistaken, have left their remains in the coal strata at Carluke, near Glasgow, and other localities, and constitute the genus *Megalichthys* of Agassiz. The head is defended by strong ganoid plates, of a beautiful polish; the trunk-scales are usually granulate exteriorly.

The sub-order *Pycnodontes* is represented in the carboniferous strata by the heterocercal genus *Platysomus* (fig. 53), and by the species *P. parvulus*, which has been found

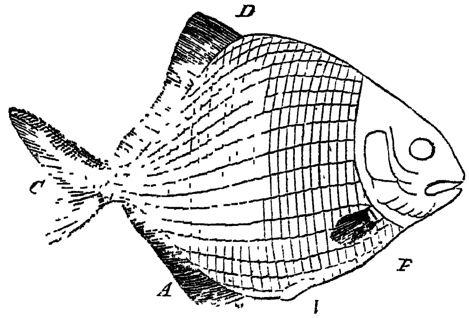

Fig. 53.
Platysomus gibbosus (zechstein of Mansfeld).

n that formation at Leeds; but most of the pycnodont fishes belong to the mezozoic period.

Pygopterus, *Acrolepis*, *Eurynotus*, *Elomichthys*, *Plectrolepis*, *Graptolepis*, *Orognathus*, *Pododus*, *Acanthodes*, and *Diplopterus* are carboniferous genera of Ganoids, with rhomboid scales. *Cœlacanthus*, *Isodus*, *Phyllolepis*, *Hoplopygus*, *Uronemus*, *Colonodus*, *Centrodus*, *Asterolepis*, *Psammosteus*, and *Osteoplax*, are genera of Ganoids with rounded scales, represented by species in carboniferous strata.

Of the above-named genera, *Acrolepis*, *Pygopterus*, *Palæoniscus*, *Platysomus*, and *Cœlacanthus*, continue to be represented in Permian beds; in which also are found species of the ganoid genera *Dorypterus*, *Holacanthodus*, and *Globulodus*, if the teeth on which the latter is based be not those of *Platysomus*.

The formations of the mezozoic or secondary periods give evidence of the full development of the ganoid order. In the lowest or "triassic" division this order is still represented by heterocercal and notochordal species belonging to some of the genera of the Permian period, as, *e.g.*, *Cœlacanthus*, *Amblypterus*, and *Palæoniscus*. The genus *Placodus*, a supposed pycnodont fish of the muschelkalk, has been shown to be a conchivorous Saurian.[1] In the oolitic division the heterocercal Ganoids are almost completely superseded by homocercal genera, which now, for the first time, appear on the stage of life; but the ossification of the endo-skeleton is still incomplete. In the cretaceous series the Teleostian, or well-ossified bony fishes, are numerous; and here also first are seen fishes with the flexible "cycloid" or "ctenoid" scales, and of genera which continue to be represented by living species.

Of 33 genera of fishes in the lias, 4 only were represented in older strata, while the rest extend into the upper oolitic beds. Of these, 19 genera are Ganoids with rhomboid scales, and two (*Leptolepis* and *Gyrosteus*) have rounded scales. The sub-order *Sturionii*, represented by the sturgeons of the present seas, makes its first appearance in the lias, under the generic form of *Chondrosteus*, which has recently received a full description and illustration in a memoir communicated by Sir P. Egerton to the Royal Society of London.[2] In this it is shown "that *Chondrosteus*, though essentially sturionian, yet evidences a transitional form between the sturgeons and more typical Ganoids; that its food was similar to that of the existing members of the family, but that it was procured in a tranquil sea, rather than in the tumultuous waters frequented by sturgeons at the present time."

[1] Owen, in *Phil. Trans.* 1858, p. 169.

[2] *Proceedings of the Royal Society*, April 20, 1858.

Sub-Order 3.—PYCNODONTES.

The name of this group of ganoid fishes refers to the form of the greater proportion of the teeth, especially those attached to the palate and hind alveolar part of the lower jaw: the few anterior teeth are small and sub-prehensile; but the whole dentition bespeaks fishes adapted to feed on small testaceous and crustaceous animals.

The Pycnodonts were for the most part deep-bodied fishes, symmetrically compressed from side to side. They were notochordal; a few of the earlier forms (*Platysomus, e.g.*, fig. 53) were heterocercal, but the majority of the sub-orders were homocercal.

In the lias, most beautiful fossil fishes of this group are found, which were referred by Bronn to the genus *Tetragonolepis*, and by Agassiz to the lepidoid sub-order. Sir P. Egerton has, however, shown that the dentition is truly "pycnodont," having a very close resemblance to that of *Microdon*, but with the masticatory apparatus smaller in proportion to the size of the fish. The scales, moreover, instead of being articulated by interlocking pegs and sockets, as in fig. 52, are joined in a peculiar way, which Sir P. Egerton describes as follows:—"Each scale bears upon its inner anterior margin a thick solid bony rib, extending upwards beyond the margin of the scale, and sliced off obliquely above and below, on opposite sides, for forming splices with the corresponding processes of the adjoining scales. These splices are so closely adjusted, that without a magnifying power, or an accidental dislocation, they are not perceptible. When *in situ*, and seen internally, these continuous lines decussate with the true vertebral apophyses, and cause the regular lozenge-shaped pattern so characteristic of the pycnodont family."[1]

The Pycnodonts so characterized are further distinguished from the closely-resembling lepidoid genus *Dapedius*, by having the small anterior teeth conical and single-pointed, instead of being bifurcate; and although this character is subject to occasional variations, nevertheless, on taking a comprehensive view of all the dapedioid species, it seems to have been sufficiently constant to warrant the continuance of the separation of the group into the unicuspid and bicuspid species. And Sir P. Egerton has accordingly proposed to apply the generic terms *Æchmodus* (from αἰχμή, *a point*, and ὀδοὺς, *a tooth*),[2] for the unicuspid and pycnocodont species, formerly termed *Tetragonolepis*, and to continue the name *Dapedius* for the bicuspid and unequivocally lepidoid homocercal deep-bodied Ganoids, many beautiful species of which are found in the lias.

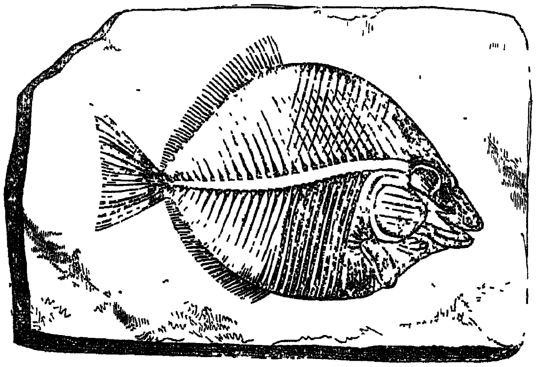

Fig. 54.
Pycnodus rhombus (Upper Oolites).

Genus Pycnodus (fig. 54).—The type-genus of this sub-order is characterized by the large size of the round flat crowned teeth, which cover the broad jaws as by a pavement of from three to five rows;[3] at the fore-part of the jaws are two or more trenchant incisive teeth both above and below.

The oblique inner processes of the scales, and which in some species appear as distinct dermal ossicles decussating the neural spines, are limited in *Pycnodus* to the space between the occiput and the dorsal fin (fig. 54).

This species of *Pycnodus* abound in the oolitic formations above the lias: the one figured (*P. rhombus*) is from a calcareous deposit, so charged with animal remains as to be fœtid, at Torre d'Orlando, near Naples. Species of *Pycnodus* (*P. cretaceous, e.g.*) occur in the chalk of Kent; and one species (*P. toliapicus*) has left its remains in the eocene clay of Sheppy. Some teeth from German miocene have been referred to this genus; but at this period, if not at the earlier tertiary one, *Pycnodus* became extinct.

Sub-Order 4.—LEPIDOSTEIDÆ, Muller.

Char.—Ganoids with rhomboid scales and conical teeth; a single dorsal.

Family I.—Sauroidei, Agassiz.

Char.—Some of the teeth much larger than the rest, and laniariform.

Genus Caturus.—In this genus the jaws are armed with close-set, large, conical teeth; the scales are delicate; all the species are homocercal and notochordal (fig. 55). The

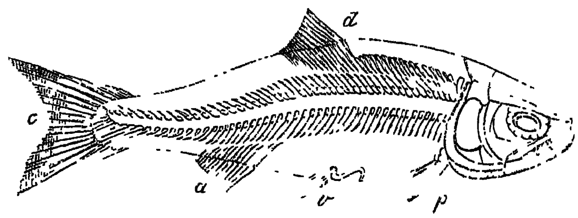

Fig. 55.
Caturus furcatus (Oolite, Solenhofen).

dorsal, *d*, is opposite the ventral, *v*, all the fins are of moderate size. One species of *Caturus* (*C. Bucklandi*) is from the lias; but the majority, like *C. furcatus*, are from the lithographic slates of Solenhofen. The most recent known species (*C. similis*) is from the chalk of Kent.

Pachycormus, Saurostomus, Sauropsis, Thryssonotus, and *Eugnathus*, are among the well-marked genera of the Sauroid family. It is represented at the present day by the North American genus *Lepidosteus;* but in this fish not only is the notochord converted into bony vertebral bodies, but these are united by ball-and-socket joints.

Sub-Order 5.—CYCLOGANOIDEI.

Family I.—Leptolepidæ.

The Ganoids of this family are homocercal, and have rounded scales. In the type-genus (*Leptolepis*, fig. 56), the scales are extremely thin, yet a fine layer of ganoin may be discovered in them. The teeth are minute and *en brosse*, with two of larger size in front of the mouth. It has not been determined whether the notochord is ossified; but traces of distinct vertebral bodies appear to the writer to be discernible in some specimens. Species of *Leptolepis* range from the lias to the calcareous slates of Eichstadt.

[1] *Proceedings of the Geological Society*, May 1853, p. 276.
[2] Ibid., May 1854, p. 367.
[3] For the disposition of these teeth on the palate, see Owen's *Odontography*, vol. i., pl. 34, figs. 1 and 2; and for their microscopic structure, ibid., p. 71, pl. 33.

They are very common in the lithographic slates of Solenhofen and Pappenheim.

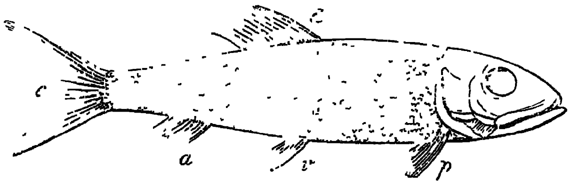

Fig. 56.
Leptolepis sprattiformis (Oolite, Solenhofen).

Genus Macropoma.—Fine specimens of homocercal ganoid fishes, with rounded scales, sculptured externally, as in fig. 57, have been discovered in the chalk formations of Kent and Sussex. They have been referred by Agassiz to the genus called *Macropoma*, significative of the large size of the gill-cover, and to the cœlacanthal family; but traces of vertebral bodies are apparent in some specimens. Casts of the "interior" of the alimentary canal, showing impressions of a broad spiral valve, are preserved in certain specimens in the British Museum. One species (*M. Egertoni*) is from the Speeton clay; the other (*M. Mantelli*) from the chalk.

Fig. 57.
Macropoma Mantelli.
(Chalk.)

In the tertiary division the ganoid order rapidly diminishes, and its place is taken by fishes with better ossified internal skeletons, and with thinner, more flexible, and usually soluble scales. The gills are supported on bony arches, and are protected by branchiostegal rays, and by an operculum or gill-cover. The aortic bulb is provided with but two valves; and the optic nerves decussate. For this group, including the majority of existing fishes, and of those which made their appearance during the tertiary period, Müller proposed the name "Teleostei," which almost corresponds with the "osseous fishes" of Cuvier. After the full and accurate illustration of this great group in the article Ichthyology, little is required to be added by way of illustration from extinct species.

Order IV.—ACANTHOPTERI.

Sub-Order 1.—CTENOIDEI.

Char.—Endo-skeleton ossified; exo-skeleton as ctenoid scales (fig. 58); fins with one or more of the first rays unjointed or inflexible spines; ventrals in most beneath or in advance of the pectorals; swim-bladder without air-duct.

Of this order may be given two genera, both of which are now extinct. One (*Semiophorus*) belongs to the chetodont family;[1] the other (*Smerdis*) to the Percoids.[2]

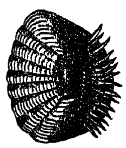

Fig. 58.
Scale of *Perca* (Recent).

The genus *Semiophorus*, Ag. (fig. 59), is represented exclusively by extinct species peculiar to the tertiary deposits at Monte Bolca. It is characterized by the extreme height or prolongation of the anterior part of the dorsal fin, D, and for the correlative elongation of the slender pointed ventral fins. The anal fin, A, is much shorter than the dorsal. Owing to the soluble nature of the scales, and to the well-ossified skeleton, the fossils of this, as of most other tertiary fishes, are exemplified by the vertebral column and skull more than by the skin.

Sub-Order 2.—CYCLOIDEI.

Genus Smerdis.—The species composing this genus are of small size, and are wholly extinct; they likewise are chiefly met with in the tertiary ichthyolite beds of Monte Bolca; but some (*e.g.*, the *Smerdis minutus*, fig. 60) are

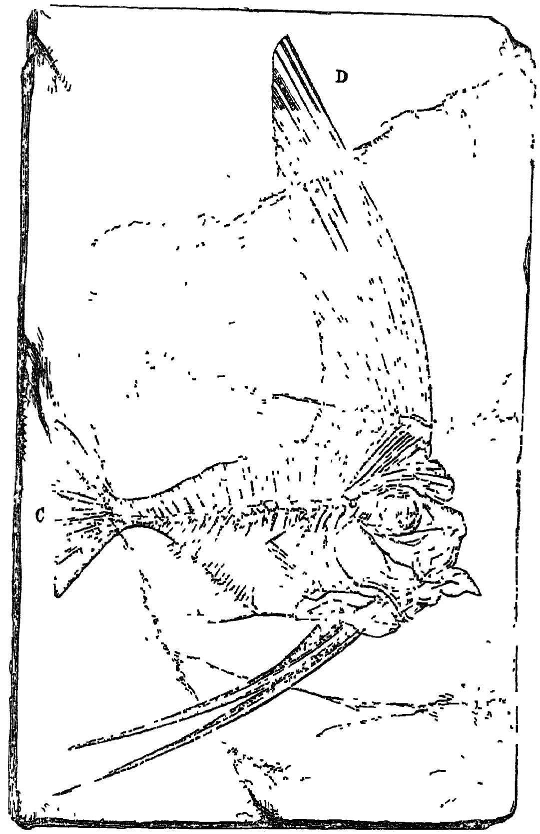

Fig. 59.
Semiophorus velicans (Monte Bolca).

from eocene deposits in France. In all the species the first suborbital or lacrymal bone is stongly dentate, as is

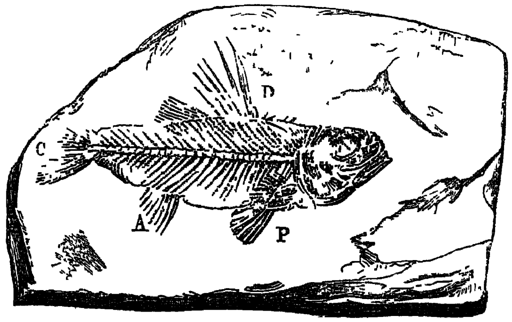

Fig. 60.
Smerdis minutus (Gypsum of Provence).

also the preoperculum; but this has no spine at the angle. The operculum terminates behind by a rounded prominence. There are two dorsals. The scales are minute, but are occasionally preserved. Those of *Smerdis minutus* present, under a magnifier, the structure shown in fig. 61.

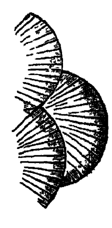

Fig. 61.
Scales of *Smerdis minutus* (mag.)

In the article Ichthyology, figures are given of the two kinds of existing sword-fish (*Xiphias*, fig. 112; and *Histiophorus*, fig. 113); in the former the sword-like prolongation of the confluent premaxillaries is flattened, in the latter it is rounded.

[1] See art. Ichthyology, pp. 299–232.

[2] Ibid., p. 273.

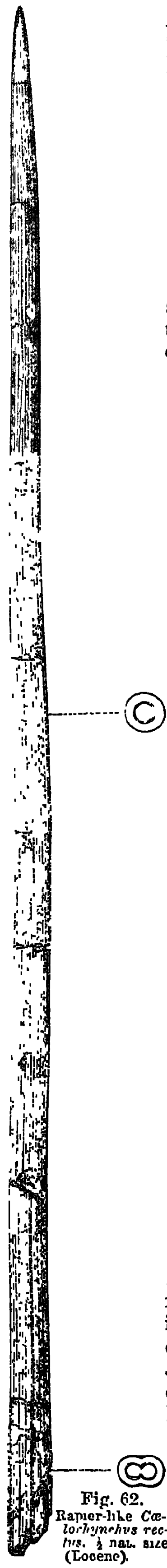

Fig. 62.
Rapier-like *Cœlorhynchus rectus*. ½ nat. size (Eocene).

Fossil remains of a rounded rapier-like sword, but much longer and more slender than in the existing *Histiophorus*, have been found in the eocene clay at Sheppy and Bracklesham. They are referred to an extinct genus of the xiphioid family by Agassiz, called *Cœlorhynchus*, or "hollowbeak." The most perfect specimen hitherto found is figured in fig. 62, of half the natural size. It forms part of the instructive collection of Captain Le Hon at Brussels. The upper transverse section shows the single cavity at the middle of the rostrum; and the lower section shows the double or divided cavity near its base.

Order V.—Anacanthini.

Char.—Endo-skeleton ossified; exo-skeleton in some as cycloid, in others as ctenoid scales; fins supported by flexible or jointed rays; ventrals beneath the pectorals, or none; swim-bladder without air-duct.

Family.—Pleuronectidæ.

(*Flat-Fishes.*)

In this family the symmetrical form is lost, and both eyes are on one side of the head. Species of still existing genera of this much-modified family have been found in tertiary deposits. The little turbot (*Rhombus minimus*, *e.g.*, fig. 63) occurs in the tertiary deposits of Monte Bolca. An equally extinct species of sole (*Solea antiqua*) has been found in tertiary marls near Ulm.

Fossil fishes of the cod, mullet, carp, salmon, and herring genera, are found in the tertiary formations, but are distinct from all known species.

The Ganoids are reduced to the genera *Lepidosteus* and *Acipenser*, but may have been represented by the palates with crushing teeth, to which the names *Pisodus*[1] and *Phyllodus*[2] have been given. With respect to the fishes of the tertiary period, "they are so nearly related," says Agassiz, "to existing forms, that it is often difficult, considering the enormous number (above 8000) of living species, and the imperfect state of preservation of the fossils, to determine exactly their specific relations. In general I may say that I have not yet found a single species which was perfectly identical with any marine existing fish, except the little species *Mallotus villosus*, which is found in the nodules of clay of unknown geological age in Greenland."

For a list of the genera and species of fossil fishes known at the date of publication, reference may be made to the article Fossil Ichthyology. Since that was written, it has been determined that the "schists of Glaris" and of "Monte Bolca," belong to the eocene tertiary period.

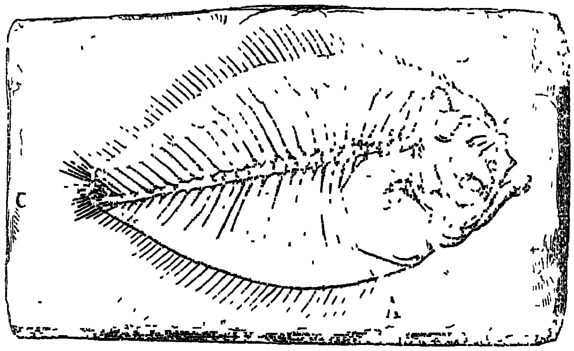

Fig. 63.

Rhombus minimus (Monte Bolca).

We cannot, from present knowledge, assign to any past period of the earth's history a characteristic derived from a fuller and more varied development of the entire class of fishes than has since been manifested, nor predicate of the present state of the class that it has degenerated in regard either to the number, bulk, powers, or range of modifications of the piscine type. A retrospect of the genetic history of fishes imparts an idea rather of mutation than of development, to which the class has been subject in the course of geological time. Certain groups, now on the wane, have existed in plenary development, as, *e.g.*, the ganoid order in the mezozoic period, and the cestraciont form of Plagiostomes in both palæozoic and mezozoic times.

As to the variety of the forms of fishes, seeing that the earth yields no evidence of Ctenoids or Cycloids[3] anterior to the cretaceous epoch, yet still retains living representatives of both Ganoids and Placoids, the present would appear to be the culminating period in the development of fishes, in respect of the number of ordinal forms or modifications of the class. It represents, however, rather a period of mutation of the piscine character, depending upon the progressive assumption of a more special piscine type, and progressive departure from a more general vertebrate type. The Scomberoids, as fishes, are at the head of the piscine modification of the vertebrate type. And as the retention of general vertebrate characters implies closer affinity with the proximate cold-blooded class, so a higher character of organization may be predicated of the palæozoic Placoids and Ganoids than of the Ctenoids and Cycloids forming the great bulk of the class at the present day. The comparative anatomist dissecting a Shark, a Polypterus, or a Lepidosteus, would point to the structures of the brain, heart, generative organs, and in the last two genera to the air-bladder, as being of a higher or a more reptilian character than the corresponding parts would present in most other fishes. But the palæontologist would point to the persistent notochord, and to the heterocercal tail in palæozoic and many mezozoic fishes, as evidence of an "arrest of development," or of a retention of embryonic characters in those primæval fishes.

No class of animals is more valuable in its application to the great point now mooted by the Uniformitarians and Progressionists of the present day than that of fishes; for they are exempt from the attack of the Uniformitarian

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1 See Owen's *Odontography*, p. 138, pl. 47, fig. 3.

2 Ibid., p. 139, pl. 47, figs. 1 and 2.

3 See for the explanation of these terms in the system of Agassiz the article Fossil Ichthyology, *Ency. Brit.*, vol. xii.

on the score of the defect of negative evidence, to which attack conclusions from the known genetic history of air-breathing animals are open. Many creatures living on land may never be carried out to sea; but marine deposits may be expected to yield adequate evidence for general conclusions as to the character of the vertebrate animals that swarmed in the seas precipitating such deposits.

One other conclusion may be drawn from a general retrospect of the mutations in the forms of the fishes at different epochs of the earth's history,—viz., that those species, such as the nutritious cod, the savoury herring, the rich-flavoured salmon, and the succulent turbot, have greatly predominated at the period immediately preceding and accompanying the advent of man; and that they have superseded species which, to judge by the bony Garpikes (*Lepidosteus*), were much less fitted to afford mankind a sapid and wholesome food.

ICHNOLOGY.[1]

In entering upon the genetic history of the class of reptiles, we have to inquire, as in that of fishes, in what period of the earth's history the class was introduced, and under what forms; at what period it attained its plenary development, in regard to the size, grade of structure, number and diversities of its representatives; and the relations which the existing members of the class bear to its past condition. Fifteen years ago, the oldest known reptilian remains were those of the so-called "Thuringian Monitor," from the Permian copper-slates of Germany. Five years ago, the batrachian *Apateon*, or *Archegosaurus* of the Bavarian coal-field, represented the known commencement of reptilian existence. In October 1851 the following notice appeared in the *Elgin Courant* for the 10th of that month:—

"*Geological Discovery.*—A fossil has been obtained from the old red sandstone at Spynie, near Elgin, which serves to establish the fact that air-breathing Vertebrata of the order *Sauria* existed during the deposition of the Devonian system of rocks, which hitherto had only been surmised from the discovery of impressions of foot-prints on the surface of the strata. This fossil, or rather impression, was brought to a gentleman in Elgin, who now possesses it, by a quarryman, who with praiseworthy care preserved the fragments, without tampering with the impression to any injurious extent, so that its character is unmistakeable. It presents the figure of a reptile about four inches in length, showing the head containing fragments of conical teeth, part of the neck, the back-bone and ribs, the pelvic bones and hind legs, with part of the tail (the rest of the tail, which seems to have been long, being still unexposed). The appearance of this small specimen is very striking,—the animal matter in its decomposition having stained the matrix to a dark ochre, while the rest of the stone is a pale gray, almost white. No doubt this interesting relic will receive a more scientific description than we can pretend to give, but we cannot resist the impulse to announce the occurrence in this district of an object so well calculated to forward the investigations of geologists."[2]

An accurate drawing of this fossil was transmitted to the writer by its possessor, Mr Patrick Duff of Elgin, together with the newspaper containing his announcement of the discovery; and the writer's opinion, written on the inspection of that drawing in October 1851, was to the effect that it was a true saurian reptile. The fossil itself was subsequently transmitted to London, and submitted to different palæontological authorities. To the present writer was kindly accorded the opportunities of having the requisite drawings made for the illustration of the fossil in his *History of British Fossil Reptiles;* the results of a minute and careful comparison of the impression were briefly given in the *Literary Gazette* of December 20; and the name *Leptopleuron*, significative of its most conspicuous lacertian character, was proposed for it. Other palæontologists regarded the fossil as a batrachian reptile,[3] and Dr Mantell assigned to it the name of *Telerpeton;* but all concurred that it belonged to an air-breathing vertebrate animal. The following is the summary of the grounds on which the writer's conclusions as to the higher affinities of the little Elgin reptile, in its class, were based:—

"*Vertebrate air-breathing Life in the Old Red Sandstone.*

"Our readers may recollect that the geological world was startled by the announcement, in the *Elgin Courant* of October 10th, of the discovery of a fossil reptile in the 'old red' at Spynie, near Elgin. The specimen has been submitted to the examination of Professor Owen, from whom we have received the following notice of its nature and affinities:—

"Royal College of Surgeons, *Dec.* 15, 1851.

"Mr Duff, the proprietor of the very remarkable fossil recently discovered in a sandstone of the Devonian system of rocks at Elgin, transmitted me a drawing of it, with the request that I would undertake its examination; to which having gladly acceded, the specimen itself was brought to me by a friend of Mr Duff's. It is the impression, in two pieces of a gray variety of the old red sandstone, of a long and slender four-footed vertebrate animal, four inches and a half in length, clearly belonging, by the form, proportions, and positions of the scapular and pelvic arches, and their appended limbs, to the reptilian class. The osseous substance has disappeared; the cavities in the sandstone which contained it remain, stained by a deposit of an ochreous tint. The impressions are so well defined as clearly to show that there were twenty-six vertebræ between the skull and sacrum, two sacral vertebræ, and thirteen caudal vertebræ, before the tail disappears by dipping into an unexposed part of the matrix. Impressions of twenty-one pairs of ribs are preserved, all very slender, short where they commence near the head, but rapidly gaining length as they are placed further back. The cervical and anterior ribs are expanded, but not bifurcate, at their vertebral end; all the ribs articulate close to the bodies of the vertebræ. In the crocodilian reptiles the anterior ribs are bifurcate, and the posterior ones, with a simple head, articulate with long diapophyses. The distinctive characters of the batrachian skeleton are the double occipital condyle; ribs wanting, or very short and subequal; a single sacral vertebra, and rib-shaped ilium. The first character cannot be determined, the occipital articulation not being preserved in the fossil. Instead of the second character, the fossil shows ribs of varied length, and most of them much longer than in the salamanders, newts, or any known Batrachian. With regard to the third character, the impression in the matrix clearly shows two sacral vertebræ and a short subquadrate pelvis.

"Both the humerus and the femur show the lacertian sigmoid shape, and near equality of length, which distinguish them alike from the crocodilian and batrachian orders; they are likewise, as in lizards, relatively longer than in the newts and salamanders. Near the imperfect impression of the head may be seen the hollow bases of some large, slightly-compressed, conical teeth, which also tell for the saurian and against the batrachian nature of this ancient reptile. I propose to call it *Leptopleuron lacertinum*.[4] Many particulars of minor import, bearing upon the more immediate affinities of this most rare and interesting fossil, have been noted, and will be given, with the figures, in my *History of British Fossil Reptiles*, for which work Mr Duff has kindly consented to place the

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[1] Ἴχνος, *a footstep*, and λόγος.

[2] *Elgin Courant*, Oct. 10, 1851.

[3] The following notice of this determination of the fossil will be found in the *Athenæum* of Dec. 13, in the title of a paper to be read at the ensuing meeting of the Geological Society:—"Notice of the occurrence of Fossil Foot-Tracks, and the Remains of a Batrachian Reptile, in the Old Red Sandstone of Morayshire, by Capt. Brickenden and Dr Mantell."

[4] Λεπτός, *slender*, πλευρόν, *rib;* for this compound we have the authority of *Poikilopleuron*, already applied to an extinct genus of Saurians.

Ichnology. specimen at my disposal. In the meanwhile, I beg to offer the above *précis* of the main characters of the fossil.

"RICHARD OWEN."

Admitting the saurian affinities of the *Leptopleuron*, it may have been, like the little *Amblyrhynchus* of the Gallopagos Islands, a lizard of marine habits. As no part of the osseous texture is preserved, and the impressions of the vertebræ are only those of the neural arches, we cannot be assured that the bodies of the vertebræ may not have been unossified, and in the same embryonal stage as in some reptiles, next to be noticed, from the coal formations. It is most probable, however, that the *Leptopleuron* was more nearly allied to the thecodont than to the labyrinthodont Reptilia.

Very recently the remains of a true saurian reptile, protected by pitted bony plates like those of crocodiles, but with a broad coracoid like that of *Cetiosaurus* or *Polyptychodon*, have been discovered in the same formation and locality.[1] The matrix is a fine-grained whitish sandstone, with a cement of carbonate of lime. It belongs, according to Sedgwick and Murchison, to the uppermost beds of the "old red" or Devonian system. As yet, however, no characteristic Devonian or old red fossils of any class have been discovered associated with the foregoing evidences of reptiles, which, according to the determination of strata by characteristic fossils, would belong to the secondary or mezozoic period. In the same sandstone, in the quarry at Cummingstone, near Elgin, a continuous series of thirty-four impressions have been observed by Captain Binkendon, and attributed by him to the foot-prints of a quadruped. The impressions are in pairs, forming two parallel rows, the hind one being one inch in diameter, and larger than the fore one in the proportion of three to four. The stride of the animal, on this hypothesis, must have been about four inches.

There are several circumstances under which impressions made on a part of the earth's surface, soft enough to admit them, may be preserved after the impressing body has perished. When a shell sinks into sand or mud, which in course of time becomes hardened into stone, and when the shell is removed by any solvent that may have filtered through the matrix, its place may become occupied by crystalline or other mineral matter, and the evidence of the shell be thus preserved by a cast, for which the cavity made by the shell has served as a mould. If the shell has sunk with its animal within it, the plastic matrix may enter the dwelling-chamber as far as the retracted soft parts will permit; and as these slowly melt away, their place may become occupied by crystallized deposits of any silicious, calcareous, or other crystallizable matter that may have been held in solution by water percolating the matrix, and such crystalline deposit may receive and retain some colour from the soft parts of which it thus becomes a cast.

Evidences of soft-bodied animals, such as *Actiniæ* and *Medusæ*, and of the excremental droppings of higher animals, have been thus preserved. Fossil remains, as they are called, of soft plants, such as sea-weeds, reeds, calamites, and the like, are usually casts in matrix made naturally after the plant itself has wholly perished.

Even where the impressing force or body has been removed directly or shortly after it has made the pressure, evidence of it may be preserved. The hailstone, the ripple wave, the rain-drop, even the wind that bore it along and drove it slanting on the sand, have been registered in casts of the cavities which they originally made on the soft sea-beach; and the evidence of these and other meteoric actions, so written on imperishable stone, have come down to us from times incalculably remote. Every form of animal life that, writhing, crawling, walking, running, hopping, or leaping, could leave a track, depression, or foot-print, behind it, might thereby leave similar lasting evidence of its existence, and also to some extent of its nature.

Ichnology.

The interpretation of such evidences of ancient life has much exercised the sagacity of naturalists since Dr Duncan, in 1828, first inferred the existence of tortoises at the period of the deposition of certain sandstones in Dumfriesshire, from the impressions left on those sandstones, and the casts afterwards formed in those impressions. The faculty of interpreting has been still more racked by similar evidences of more extraordinary foot-prints, probably of large batrachian reptiles, first noticed in 1834 at Hildberghausen in Saxony, in sandstones of the same geological age as those in Scotland.

The vast number and variety of such impressions, due either to physical or meteoric forces, to dead organic bodies, parts or products, or to the transitory actions of living beings, have at length raised up a distinct branch of palæontological research, to which the term "Ichnology" has been given.

In this class of evidences the impressions called "protichnites"[2] (fig. 64), left upon the "Potsdam sandstones" of the older Silurian age in Canada, are the most ancient; but the foot-prints of birds surpass all others in regard to their number, distinctness, and variety of sorts.

But how, it may be asked, are such foot-prints preserved? A common mode may be witnessed daily on those shores where the tide runs high, and the sea-bottom is well adapted to receive and retain the impressions made upon it at low-water.

Dr Gould of Boston, U.S., first called the attention of naturalists to this interesting operation on the shores of the Bay of Fundy, where the tide is said to rise in some places 70 feet in height. The particles deposited by that immense tidal wave are derived from the destruction of previously existing rocks, and consist of silicious (flinty) and micaceous (talcky) particles, cemented together by calcareous (limy) or argillaceous (clayey) paste, containing salts of soda, especially the muriate (common salt), and coloured with various shades of the oxide of iron, of which the red oxide predominates. The perfection of the surface for receiving and retaining an impression depends much upon the micaceous element. Vast are the numbers of wading and sea birds that course to and fro over the extensive tract of plastic red surface left dry by the far retreat of the tide in the Bay of Fundy. During the period that elapses between one spring tide and the next, the highest part of the tidal deposit is exposed long enough to receive and retain many impressions; even during the hours of hot sunshine, to which, in the summer months, this so-trodden tract is left exposed, the layer last deposited becomes baked hard and dry, and before the returning tidal wave, turbid with the same comminuted materials of a second stratum, has power to break up the preceding one, the impressions left on that stratum have received the deposit. A cast is thus taken of the mould previously made, and the sediment superimposed by each succeeding tide, tends more and more surely to fix it in its place. Then, let ages pass away, and the petrifying influences consolidate the sand layers into a fissile rock: it will split in the way it was formed, and the cleavage will expose the old moulds on one surface and the casts on the other.

Another condition for fixing the impressions on a sandy shore is the following:—When an extensive level tract is

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[1] They were submitted by Sir R. Murchison to the writer's examination at the meeting of the British Association at Leeds, September 24, 1858: similar fossils had previously been assigned to the class of fishes, by the name *Steganolepis*

[2] See Owen, "Description of the Impressions and Foot-prints of the Protichnites from the Potsdam Sandstone of Canada," *Quarterly Journal of the Geological Society*, 1852, p. 214.

[3] Logan, ibid., p. 2.

left dry by the retreating tide, as at the estuary of the small rivers entering the Bay of Morecombe, on the Lancashire coast, those rivers occasionally overflow the sands at low-water, and deposit in the foot-prints made previous to such overflow the fine mud which sudden heavy rains have brought down from the surrounding hills. Again, those sudden "freshets," as they are locally called, sometimes as quickly subside, and the thin layer of argillaceous mud is left dry on the sand before the returning tide. Such layer of mud readily receives and retains the foot-prints of the many birds that course over the flat expanse; and as the tide returns, it deposits in such foot-prints a layer of the fine sand which the rising waters hold in suspension.

The best-defined foot-prints in the new red sandstone quarries at Stourton, on the Cheshire coast, are found where strata of sandstone are separated by a thin layer of argillaceous stone, which, when exposed, soon breaks up and crumbles away. This layer has, however, received the impressions when it was plastic, and the superincumbent deposit of sandstone retains those impressions in relief upon its under surface. The observations which have just been recorded, of the circumstances that produce an interposition of a thin layer of claystone between thicker beds of sandstone, and which circumstances the writer has witnessed in the Bay of Morecombe, explain the formation and the preservation of the best "ichnites" of the labyrinthodont and other reptiles in the new red sandstone of Stourton.

There is a third condition under which impressions, and casts of impressions, on a sandy beach may be preserved. On a dry windy day clouds of fine sand are drifted along the surface exposed at low-water, are spread lightly over all its little inequalities, and fill up every impression that may have been made on it since it was left bare by the retreating waves. On the return of the tide, the fine sand filling the impressions is moistened, and more wet fine sand is added to it; and a cast is thus fixed in the moulds, to be more and more firmly fixed by each deposition from successive tidal waves.

Thus may be witnessed the actual conditions and the circumstances daily occurring that tend to preserve foot-prints and other impressions made on the sea-shore, and which have operated in past time to similarly preserve the impressions then made on tracts alternately exposed and covered by the tidal wave. The merit of having first discerned the nature and cause of the numerous small hemispheric pits and tubercular casts in relief on the surface of certain sandstone slabs, is due to John Cunningham, Esq., F.G.S., architect, of Liverpool.[1] Since that light was thrown on their nature, they have been recognised under various modifications, as impressions of soft rain, of the big-dropped thunder-shower, of rain driven obliquely by the gale, and making impressions with the side of the cup highest opposite the point whence the wind blew, of frozen rain or hail, &c. Whenever a stratum is proved to be a "sedimentary" one,—*i. e.*, to be due to the precipitation of its constituent particles from water, in which they had been previously suspended,—we have evidence of some expanse of water,—proof, in fact, of the existence of that element, with all its properties of condensation by cold, and expansion and vaporization by heat and exposure. Evaporation makes the raw material of rain. No wonder, then, that impressions of rain-drops should be seen on the oldest sedimentary rocks. Conditions are co-ordinated in meteoric as in organic phenomena; one being given, the rest may be deduced.

The oldest rocks in which rain-drop impressions have been observed are those of the Cambrian age at Longmynd, Wales, described and figured by Mr Salter.[2] Many of the micaceous flags of the same formation are covered with ripple, or current marks. They show borings of worms, and a trace of a trilobite (*Palæopyge*) nearly allied to the *Dikelocephalus*—the oldest known trilobite of America (Lower Silurian or Cambrian at St Croix, Minnesota).

It is in "Potsdam sandstones" of the same geological antiquity that the impressions have been discovered which the writer has interpreted to be those of a large entomostraceous Crustacean, in evidence of which the following sample, applicable to a single species, may be given, in illustration of the ichnologist's mode of work.

Protichnites septem-notatus (fig. 64).

The subject so named consists of a series of well-defined impressions, continued in regular succession along an extent of 4 feet; and traceable, with an inferior degree of definition, along a further extent of upwards of 2 feet.

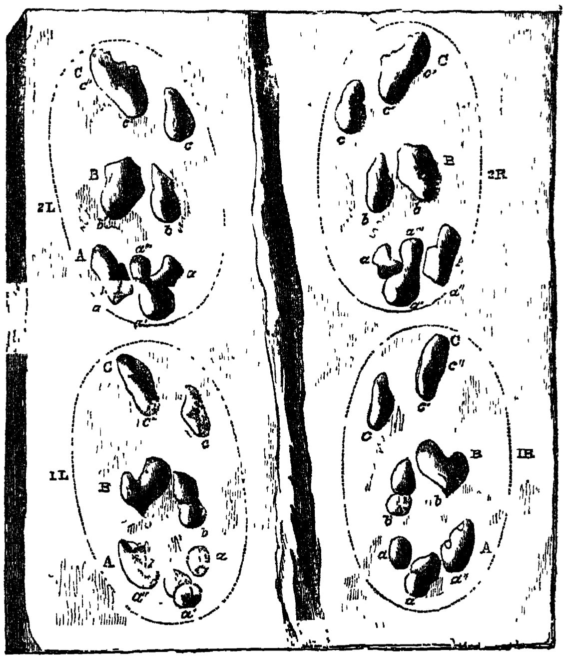

Fig. 64.

Protichnites 7-notatus (Cambrian).

In the extent of 4 feet there are thirty successive groups of foot-prints on each side of a median furrow, which is alternately deep and shallow along pretty regular spaces of about $2\frac{1}{2}$ inches in extent. The number of prints is not the same in each group; where they are best marked, as in fig. 64, 1 L, we see 3 prints in one group, *a*, *a′*, *a″*, 2 prints in the next, *b*, *b′*, and 2 in the third, *c*, *c′*, which is followed by a repetition of the group of 3 prints, *a*, *a′*, *a″*, making the numbers in the three successive groups 3, 2, 2; the three groups of impressions being recognisably repeated in succession along the whole series of tracks on both sides of the median groove.

The principal foot-prints are disposed in pairs, placed with different degrees of obliquity, in each of the three groups, towards the median track; the innermost print in the second, B, and third, C, pairs, which are best marked, being usually rather more than half the size of the outer print, *b′* and *c′*.

The two foot-prints of the same pair are a little further apart from each other, in the three succeeding pairs, as at *a′*, *a″*, *b*, *b′*, *c*, *c′*, especially in the second and third groups of each set; the two forming the pair *a′*, *a″* again approximating in the next series, and the pairs *b*, *b′* and *c*, *c′* diverging in the same direction and degree; and this alternate approximation and divergence is repeated throughout the entire series of the present tracks.

But what strikes the ichnologist, heretofore conversant chiefly with the foot-prints of bipeds or quadrupeds, is the occurrence in

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[1] Communicated by Dr Buckland to the meeting of the British Association at Newcastle, 1838; and subsequently by Mr Cunningham to the Geol. Soc. (*Proc. of the Geol. Soc.*, vol. iii., 1839, p. 99.)

[2] *Quar. Jour. of the Geol. Soc.*, vol. xii., 1856, p. 250, pl. iv., fig. 4.

Ichnology. the present series of the third impression a, which complicates the most approximated pair A, being placed in front and a little to the inner side of the hindmost impression, a', of that pair. The superadded impression a, is about the same size as the innermost in each pair, the average diameter of that impression being 5 lines.

Taking this view of the impressions, it appears that whilst the innermost in each pair, a', b, c, are of equal size, the outermost, a'', b', c', 1 L, progressively increase in size, from the most approximated to the most divergent of the three pairs; that of the first, a'', being narrow in proportion to its length, that of the second, b', as broad as long, and the outermost, c', c'', of the third pair being oblong, but larger than that in the first pair. In some places where the most approximated pair of impressions, a', a'', are deeply marked, they are complicated by a fourth shallow and very small pit, a''', 2 L, midway between the third, a, and the outermost, a'', of the pair of impressions.

There are no clear or unequivocal marks of toes or nails on any of the impressions which form the lateral pairs or triplets. Their margins are not sharply defined, but are rounded off, and sink gradually to the deepest part, which is a little behind the middle of the depression. There is a slight variation in the form and depth of the answerable impressions, but not such as to prevent their correspondence being readily appreciable through the whole of the extent here described; that is to say, the innermost of each of the three pairs here described as first, A, second, B, and third, C, may be identified with the corresponding innermost impression on the opposite side, and with the same impression of the same pair in the three preceding and the three succeeding pairs.

The impressions selected for fig. 64 clearly demonstrate that the animal, progressing in an undulating course, made at each action of its locomotive members, answering to the single step of the biped and the double step of the quadruped, not fewer than, in *Protichnites 7-notatus*, fourteen impressions, seven on the right and seven on the left; and in *Protichnites* 8-*notatus*, sixteen impressions, eight on the right and eight on the left; these seven and eight impressions respectively being arranged in three groups,—viz., in *Protichnites* 7-*notatus*, three, two, and two, in *Protichnites* 8 *notatus*, three, two, and three,—the groups being re-impressed, in successive series, so similarly and so regularly as to admit of no doubt that they were made by repeated applications of the same impressing instruments, capable of being moved so far in advance as to clear the previous impressions and make a series of new ones at the same distance from them as the sets of impressions in the series are from each other. What then was the nature of these instruments? To this three replies may be given, or hypotheses suggested:—They were made either, first, as in the case of quadrupedal impressions, each by his own limb, which would give seven and eight pairs of limbs to the two species respectively; or, secondly, certain pairs of the limbs were bifurcate, as in some insects and crustaceans, another pair or pairs being trifurcate at their extremities; and each group of impressions was made by a single so subdivided limb, in which case we have evidence of a remarkably broad and short, and, as regards ambulatory legs, hexapod creature; or, thirdly, three pairs of limbs were bifurcate, and the supplementary pits were made by small superadded limbs, as in some crustaceans; or, fourthly, a single broad fin-like member, divided at its impressing border into seven or into eight obtuse points, so arranged as to leave the definite pattern described, must have made the series of three groups by successive applications to the sand.

The latter hypothesis appears to be the least probable,—first, as being most remote from any known analogy; and, secondly, because there are occasional varieties in the groups of foot-prints which would hardly accord with impressions left by one definitely subdivided instrument or member. Thus in the group of impressions marked 1 L in fig. 64, the outer impression, c', is single, but in the preceding set it is divided; whilst the impressions a, a', are confluent in that set, and are separate in 1 L. The same variety occurs in the outer pair, c', c'', in *Protichnites* 8-*notatus*.

Yet, with respect to the hypothesis that each impression was made by its own independent limb, there is much difficulty in conceiving how seven or eight pairs of jointed limbs could be aggregated in so short a space of the sides of one animal. So that the most probable hypothesis is, that the creatures which have left these tracks and impressions on the most ancient of known sea-shores belonged to an articulate and probably crustaceous genus, either with three pairs of limbs employed in locomotion, and severally divided to accord with the number of prints in each of the three groups, or bifurcated merely, the supplementary and usually smaller impressions being made by a small and simple fourth, or fourth and fifth pair of extremities.

The great entomostraceous king-crab (*Limulus*), which has the small anterior pair of limbs near the middle line, and the next four lateral pairs of limbs bifurcate at the free extremity, the last pair of lateral limbs with four lamelliform appendages, and a long and slender hard tail, comes the nearest to my idea of the kind of animal which has left the impressions on the Potsdam sandstone.

Reptilia.

The shape of the pits, so clearly shown in the ice-rubbed slabs, impressed by *Protichnites* 8-*notatus*, accords best with the hard, subobtuse, and subangular terminations of a crustaceous ambulatory limb, such as may be seen in the blunted legs of a large *Palinurus* or *Birgus*; and it is evident that the animal of the Potsdam sandstone moved directly forwards after the manner of the *Macroura* and *Xiphosura*, and not sideways, like the brachyurous Crustaceans.

The appearances in the slab impressed by the *Protichnites multinotatus* favour the view of the median track having been formed by a caudal appendage, rather than by a prominent part of the under surface of the trunk

The imagination is baffled in the attempt to realize the extent of time past since the period when the creatures were in being that moved upon the sandy shores of that most ancient Silurian sea; and we know that, with the exception of the microscopic forms of life, all the actual species of animals came into being at a period geologically very recent in comparison with the Silurian epoch.

The deviations from the living exemplars of animal types usually become greater as we descend into the depths of time past: of this the Archegosaur and Ichthyosaur are instances in the reptilian class. and the *Pterichthys* and *Coccosteus* in that of fishes. If the vertebrate type has undergone such inconceivable modifications during the Secondary and Devonian periods, what may not have been the modifications of the articulate type during a period probably more remote from the secondary period than this is from the present time. In all probability no living form of animal bears such a resemblance to that which the Potsdam foot-prints indicate as to afford an exact illustration of the shape and number of the instruments, and of the mode of locomotion, of the silurian *Protichnites*.

Since the foregoing interpretation of the silurian Ichnites of North America was published, similar impressions have been observed in rocks of the like high antiquity in Scotland, as at Binks, Eskdale, which have received the name of *Protichnites Scoticus*.[1]

CLASS I.—REPTILIA.

Sub-Class 1.—AMPHIBIA.

(*Batrachia.*)

Genus BATRACHOPUS (*Batrachopus primævus*, King.)—In 1844 the scientific world was startled with the announcement by Dr King of Greensburg, Pennsylvania, of the fact that he had discovered unquestionable fossil footmarks of reptiles in the sandstone of the coal measures, in Westmoreland county, near that town. No reptilian footprints or saurian remains had previously been found lower in the series than the *new red sandstone*. Dr King states the impressions to be "near 800 feet beneath the topmost stratum of the coal formation."

Sir C. Lyell, in *Silliman's Journal*, July 1846, describes his visit to Greensburg, where he examined these footmarks, and sustained Dr King's observation and description of them. He considered them to be allied to the labyrinthodont foot-prints which have been referred to the genus *Cheirotherium*. He says,—"They consist, as before stated, of the tracks of a large reptilian quadruped, in a sandstone in the middle of the carboniferous series, a fact full of novelty and interest; for here in Pennsylvania, for the first time, we meet with evidence of the existence of air-breathing quadrupeds capable of roaming in those forests where the Sigillaria, Lepidodendron, Caulopteris, Calamites, ferns, and other plants flourished."

These foot-marks were first observed standing out in relief from the lower surface of slabs of sandstone resting on thin layers of fine unctuous clay, which also exhibited the cracks due to shrinking and drying. Now these cracks, where they traversed the foot-prints, had produced distortion in them, for the mud must have been soft when the animal walked over it and left the impressions; whereas, when it afterwards dried up and shrunk, it would be too hard to receive such indentations, and could only affect them in the way of subsequent dislocation.

[1] Harkness and Salter "On the Lowest Rocks of Eskdale," *Quarterly Journal of the Geological Society*, vol. xii., pp. 238, 243, fig. 2.

No less than twenty-three footsteps, the greater part so arranged as to imply that they were made successively by the same animal, were observed by Dr King in the same quarry.

Everywhere there was a double row of tracks, and in each row they occur in pairs, each pair consisting of a hind and fore foot, and each being at nearly equal distances from the next pair. The hind foot-print is about one-third larger than the fore foot-print: it has five toes, but the front one only four; some of them exhibit a stunted rudiment of the innermost toe or "pollex," which is the undeveloped one. The outermost toe in the hind foot-print is shorter and rather thicker than the rest, and stands out like a thumb on the wrong side of the hand.

With this general resemblance to the foot-prints of Labyrinthodon, from the new red sandstones of Europe, there are well-marked distinctions. In the first place, the right and left series of impressions are wider apart, indicative of a broader-bodied animal. The front print in *Batrachopus* has only four well-developed toes instead of five, as in *Labyrinthodon*; it is also proportionably larger, —the fore foot in *Labyrinthodon* being less than half the size of the hind foot. The distance between the fore and hind print of each pair, and of one such pair from the next on the same side, is nearly the same in *Batrachopus* and *Labyrinthodon*.

Genus SAUROPUS, Rogers.—Very similar foot-prints were discovered and described by Mr Isaac Lea in a formation of red shales, at the base of the coal measures at Pottsville, 78 miles N.E. of Philadelphia. These are of older date than the preceding, inasmuch as a thickness of 1700 feet of strata intervenes between the foot-prints at Greensfield and these older Pottsville impressions.

Professor H. D. Rogers, in 1851, announced his discovery in the same red shales, between the Devonian and carboniferous series, of three species of four-footed animals, which he deems to have been rather saurian than batrachian, seeing that each foot was five-toed; one species, the largest of the three, presented a diameter for each foot-print of about two inches, and showed the fore and hind feet to be nearly equal in dimensions. It exhibits a length of stride of about 9 inches, and a breadth between the right and left footsteps of nearly 4 inches. The impressions of the hind feet are but little in the rear of the fore feet. With these foot-marks were associated shrinkage cracks, such as are caused by the sun's heat upon mud, and rain-drop pittings, with the signs of the trickling of water on a wet beach,—all confirming the conclusions derived from the foot-prints, that the quadrupeds belonged to air-breathers, and not to a class of animals living in and breathing water.

ORDER I.—GANOCEPHALA.

Genus APATEON, Von M.; ARCHEGOSAURUS,[1] Goldf.—Certain fossils, discovered in the sphærosideritic clay-slate forming the upper member of the Bavarian coal measures; and also in splitting spheroidal concretions from the coal-field of Saarsbruck, near Treves, had been referred to the class of fishes (*Pygopterus Lucius*, Agassiz). But a specimen from the Brandschiefer of Munster-Appel presented characters which were recognised by Dr Gergens to be those of a salamandroid reptile.[2] Dr Gergens placed his "salamander" in the hands of H. von Meyer for description, who communicated the result of his examination in a later number of the under-cited journal.[3] In this notice the author states that the salamander affinities of the fossil in question, for which he proposes the name of *Apateon pedestris*, "are by no means demonstrated."[4] "Its head might be that of a fish as well as that of a lizard, or of a Batrachian." "There is no trace of bones or limbs." M. von Meyer concludes by stating that, in order to test the hypothesis of the *Apateon* being a fossil fish, he has sent to Agassiz a drawing with a description of it.

Three years later, better preserved and more instructive specimens of the problematical fossil were obtained by Professor von Dechen from the Bavarian coal-fields, and were submitted to the examination of Professor Goldfuss of Bonn: he published a quarto Memoir on them, with good figures, referring them to a saurian genus which he calls *Archegosaurus*, or primæval lizard, deeming it to be a transitional type between the fish-like Batrachia and the lizards and crocodiles.[5]

The estimable author, on the occasion of publishing the above Memoir, transmitted to the writer excellent casts of the originals therein described and figured. These casts were presented to the museum of the Royal College of Surgeons, and were described by him in his Catalogue of the Fossil Reptiles, 4to, 1850. The conclusions which the writer formed thereupon as to the position and affinities of the *Archegosaurus* in the reptilian class were communicated in the *Quarterly Journal of the Geological Society*, vol. iv., 1848. One of the specimens appeared to present evidence of persistent branchial arches. The osseous structure of the skull, especially of the orbits, through the completed zygomatic arches, indicated an affinity to the Labyrinthodonts; but the vertebræ and numerous very short

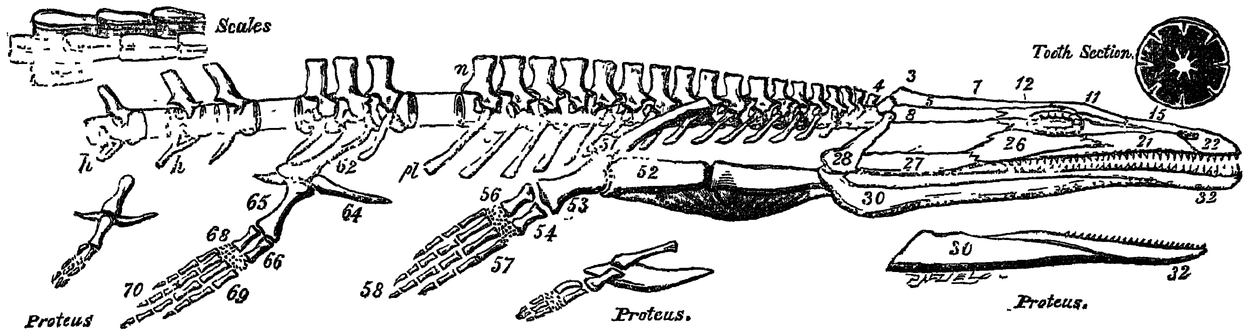

Fig. 65.

Apateon or *Archegosaurus* (Carboniferous).

ribs, with the indications of stunted swimming limbs, impressed the writer with the conviction of the near alliance of the *Archegosaurus* with the *Proteus* and other perennibranchiate reptiles.

This conclusion of the affinity of *Archegosaurus* to existing types of the reptilian class is confirmed by subsequently-discovered specimens, some of which have been acquired by the British Museum, others have been described and figured by H. von Meyer in his *Palæontographica* (Bd. vi, 2to Lief. 1857); more especially by his discovery of the embryonal condition of the vertebral column,—*i. e.*, of the persistence of the notochord, and the restriction of ossification to the arches and peripheral vertebral elements. In this structure the old carboniferous reptile resembled the existing *Lepidosiren*,

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[1] Απατιων, *a cheat*; αρχηγος, *beginning*, σαυρος, *lizard*.

[2] Mainz, Oktober 1843. "In dem Brandschiefer von *Münster-appel* in *Rhein-Baiern* habe ich in vorigen Jahre einen Salamander aufgefunden. Gehört dieser Schiefer der Kohlen-formation? in diesem falle ware der Fund auch in anderen Hinsicht interessant." (Leonhard und Bronn, *Neues Jahrbuch fur Mineralogie*, &c., 1844, p. 49.)

[3] Ibid., 1844, p. 336.

[4] "Ob das—*Apateon pedestris*—ein Salamander-artiges Geschopf war, est keinesweg ausgemacht." (Ibid.)

[5] "Archegosaurus, Fossile-Saurier aus dem Stein kohlengebirge die den Uebergang der Ichthyoden zu den Lacerten und Krokodilen bilden," p. 3. (*Beitrage zur vorweltlichen Fauna des Steinkohlengebirges*, 4to, 1847.)

[6] *Reptilien aus der Steinkohlen Formation in Deutchland, Sechster Band*, p. 61.

Reptilia.

and affords further ground for regarding that remarkable existing animal as one which obliterates the line of demarcation between the fishes and the reptiles.

Coincident with this non-ossified state of the basis of the vertebral bodies of the trunk (fig. 65, *ε*), is the absence of the ossified occipital condyles which characterizes the skull in better developed *Batrachia*. The fore part of the notochord has extended into the basi-sphenoid region, and its capsule has connected it by ligament to the broad flat ossifications of expansions of the same capsule, forming the basi-occipital or basi-sphenoid plate. In fig 63 are represented the chief modifications of the vertebræ, as shown in the neck, thorax, abdomen, sacrum, and tail. The vertebræ of the trunk in the fully-developed full-sized animal present the following stage of ossification:—

The neurapophyses (fig. 65, *n*) coalesce at top to form the arch from the summit of which was developed a compressed, sub-quadrate, moderately high spine, with the truncate or slightly convex summit expanded in the fore and aft direction so as to touch the contiguous spines in the back; the spines are distinct in the tail. The sides of the base of the neural arch are thickened and extended outwards into diapophyses, having a convex articular surface for the attachment of the rib, *pl*; the fore-part is slightly produced at each angle into a zygapophysis looking upwards and a little forward; the hinder part was much produced backwards, supporting two thirds of the neural spine, and each angle developed into a zygapophysis, with a surface of opposite aspects to the anterior one. In the capsule of the notochord three bony plates were developed, one on the ventral surface, and one on each side, at or near the back part of the diapophysis. These bony plates may be termed cortical parts of the centrum, in the same sense in which that term is applied to the element which is called "body of the atlas" in man and Mammalia, and "sub-vertebral wedge-bone" at the fore part of the neck in Enaliosauria.

As such neural or inferior cortical elements co-exist with seemingly complete centrums in the *Ichthyosaurus*, thus affording ground for deeming them essentially distinct from a true centrum, the term "hypopophysis" has been proposed for such independent inferior ossifications in and from the notochordal capsule; and by that term may be signified the sub-notochordal plates in *Archegosaurus*, which co-exist with proper hæmapophyses (*h*) in the tail. In the trunk they are flat, subquadrate, oblong bodies, with the angles rounded off; in the tail they bend upwards by the extension of the ossification from the under to the side parts of the notochordal capsule; sometimes touching the lateral cortical plates. These serve to strengthen the notochord and support the intervertebral nerve in its outward passage. The ribs (*pl*) are short, almost straight, expanded and flattened at the ends, round and slender at the middle. They are developed throughout the trunk and along part of the tail, co-existing there with the hæmal arches, as in the Menopome.[1] The hæmal arches (*h*), which are at first open at their base, become closed by extension of ossification inwards from each produced angle, converting the notch into a foramen. This forms a wide oval, the apex being produced into a long spine; but towards the end of the tail the spine becomes shortened, and the hæmal arch reduced to a mere flattened ring.

The size of the canal for the protection of the caudal blood-vessels indicates the powerful muscular actions of that part, as the produced spines from both neural and hæmal arches bespeak the provision made for muscular attachments, and the vertical development of the caudal swimming organ.

The skull of the *Archegosaurus* appears to have retained much of its primary cartilage internally, and ossification to have been chiefly active at the surface; where, as in the combined dermo-neural ossifications of the skull in the sturgeons and salamandroid fishes,—*e.g. Polypterus, Amia, Lepidosteus*, these ossifications have started from centres more numerous than those of the true vertebral system in the skull of saurian reptiles This gives the character of the present extinct order of *Batrachia*.

The skull is much flattened or depressed, triangular, with rounded angles, and the front one more or less produced according to the species; and in some species according to the age of the individual. The base is concave; the sides nearly straight, or slightly concave. The basi-occipital appears to have retained its primordial soft, unossified state.

Of the ex-occipitals, in a distinctly ossified state, no clear view has yet been had. The super-occipital (fig. 65, 4) is represented, as in the salamandroid fishes, by a pair of flat bones, more probably developed in the epicranial membrane and integument than in the cartilaginous protocranium.

The pair of bones external to these, and forming the prominent angles of the occipital region, represent the "par-occipitals."

The lower peripheral surface of the basi-sphenoidal cartilage is ossified with a concave border towards the notochord behind, to the capsule of which it seems to have been attached. The ali-sphenoids were doubtless cartilaginous, and the protocranium there unaltered, as it was apparently in the ex-occipital region.

The peripheral ossifications above representing the "parietal" (7), form a pair of oblong flat bones, with the "foramen parietal" in the mid-suture. External to these, and wedged between them, the super- and par-occipitals, are the pair of bones answering to the "mastoids" (8). They give attachment externally and below to the tympanic (28), and to a subsidiary bony plate, holding the position of that development of the mastoid which roofs over the temporal fossa in the *Chelonia*. it may be termed "supra-squamosal" (the bone between 8 and 27 in fig. 65). The frontal bones (11), divided by a mid-suture, like the parietals, increase in length, and are continued far in advance of the orbits. The bone (12) which occupies the position of the post-frontal in *Chelonia* is ossified from two centres, one articulating with the mastoid (8), the other, which is external to it, with the supra-squamosal. This other bone may be termed the "post-orbital," as proposed by Von Meyer The post-frontal extends forward above the orbit to meet the pre-frontal, separating the frontal (11) from the orbit, as in the sturgeon (*Acipenser*), *Polypterus*, and *Lepidosteus*, and also in some *Chelones*.

The pre-frontal extends far forward, terminating in a point between the nasal (15) and lacrymal. The nasals (15), divided by the median suture, extend to the external nostrils, their prolongation varying with the species and age of the individual.

Thus far the ossification of the superficies of the skull of *Archegosaurus* closely conforms to that of the salamandroid ganoid fishes above cited; and the homologous bones are determinable without doubt.

The lacrymal bone obviously answers to the front large suborbital scale-bone in fishes; its large size and forward extension in *Archegosaurus* is a mark of that affinity.

The upper jaw consists of pre-maxillary (22), maxillary (21), and palatine bones. The pre-maxillaries are divided by a median suture, as in *Lepidosteus* and *Crocodilus*, and are short bones, the breadth exceeding the length in *A. latirostris*, and also in the young of *A. Decheni*; but in the old animal opposite proportions prevail. In *A. Decheni* each pre-maxillary contains eight teeth; in *A. latirostris* not less than eleven. The maxillary (21) which extends from the pre-maxillary to beneath and beyond the orbit, presents a great length, varied according to species and age; it is of small vertical extent, and terminates in a point, which reaches the tympanic. Anteriorly it unites with the pre-maxillary, and enters into the formation of the back boundary of the nostril; mesially it unites above with the lacrymal and suborbital, and below forms the outer boundary of the choanal aperture, joining the vomer anteriorly, and the palatine posteriorly. The palatine is a long narrow bone, rather expanded at both extremities; it forms anteriorly the hinder border of the choanal aperture, and mesially throughout a great part of its extent the outer boundary of the great palatal vacuity. It supports a row of teeth, of which one or two at the fore part are of large size.

Between the orbit and the maxillary extends an oblong flat bone (26), forming the lower or outer border of the orbit, uniting with the pre-frontal and lacrymal anteriorly, with the maxillary below, and with the tympanic (9) and another bone behind. In this position, and in its connections, it agrees with the malar of the crocodile, and also with the suborbital bone or bones of fishes. The latter are unequivocally muco-dermal bones, and may not be the homologues of the endo-skeletal malar bone of saurians, birds, and mammals.

To which of the bones, therefore, suborbital or malar, the one in question of the *Archegosaurus* answers, may be doubtful. The writer inclines to view it as a dermal ossification, and to conclude that, as in the higher *Batrachia*, the true malar and the zygomatic arch are not developed. Admitting the doubt on this point, the bone (26) may be termed the "suborbital."

With regard to the next bone (27), the same question, whether it answers to the squamosal in the crocodile, or whether it is a dermal ossification, applies.

If a homology with a determinate endo-skeletal bone in the crocodile and higher vertebrates were to be predicated, it would be as the "squamosal." Essentially it indicates the tendency to excessive dermal ossification of the skull, like that which extends into the superficial temporal fascia from the squamosal and mastoid in the *Chelonia*; this separate ossification in *Archegosaurus* roofs over the temporal fossa. It appears like a posterior repetition of the supernumerary surface-bones called post-orbital and paramastoid, and, like them, corresponds in position with the posterior suborbital scale-bones in *Amia* and *Lepidosteus*.

The hinder angles of the skull are formed by the tympanic; in

[1] "Principal Forms of the Skeleton," Orr's *Circle of the Sciences*, p. 187, fig. 11.

young individuals the tympanic does not extend backward beyond the par-occipital, but as age advances it projects further backward. It appears to abut internally against the pterygoid.

The two rami of the mandible were loosely united at a short symphysis, not exceeding the breadth or depth of the jaw at that point; the depth gradually augments to near the articular end, but never exceeds a sixth, and is usually only an eighth of the length of the jaw, no definite coronoid process being developed, the upper and lower borders are nearly straight as far as the deepest part. The lower border behind this part rises rather abruptly to an angle, which is just below the articular pit. The angular element (30) presents a convexity answering to the point of ossification whence some faint ridges radiate upon its outer surface. The dentary (32), if it does not form the articular surface, begins very near it, and each ramus appears to be composed of these two bones. The dentary develops the coronoid rising. Neither articular nor splenial element has been clearly demonstrated. If an articular element has existed, it has been very small.

From fishes the lower jaw of *Archegosaurus* differs in the great length or forward extension of the angular piece (30); but it resembles the piscine type in the simplicity of its composition. The angular piece is, however, longer in the Ganoids,—*e.g.*, *Amia*, *Polypterus*, *Lepidosteus*,—than in other fishes; and in *Lepidosiren* its proportions are almost those of the *Archegosaurus*. It offers similar proportions to those in *Archegosaurus*, in the mandible of the *Axolotl* and *Proteus* (fig. 65)

The teeth have the simple conical pointed shape. They are implanted in the premaxillary, maxillary, mandibular, and vomerine bone, and in a single row in each.

In the short premaxillaries there are from 8 (*A. Decheni*) to 12 (*A. latirostri*); they are rather larger than the maxillary teeth. These follow in an unbroken series to beneath and beyond the orbit, and are about 30 in number; but their interspaces are such as would lodge double that number in the same extent of alveolar border.

The vomerine teeth are in a single row, parallel with and near to the maxillary row; one or two behind the choane are much larger than the rest, which resemble the maxillary teeth in size. The mandibular teeth extend backward to the coronoid rising, and decrease in size, the front ones being the largest.

Each tooth is implanted by a simple base in a shallow cup-shaped socket, with a slightly raised border, to which the circumference of the tooth becomes anchylosed. The tooth is loosened by absorption and shed to make way for a successor. These are developed on the inner, hind, and fore part of the base of the old tooth.

The teeth are usually shed alternately. They consist of osteodentine, dentine, and cement. The first substance occupies the centre; the last covers the superficies of the tooth, but is introduced into its substance by many concentric folds, extending along the basal half. These folds are indicated by fine longitudinal, straight striæ along that half of the crown. The section of the tooth at that part (see fig. 65, tooth-section) gives the same structure which is shown by a like section of a tooth of the *Lepidosteus oxyurus*.[1]

The same principle of dental composition is exemplified in the teeth of most of the ganoid fishes of the carboniferous and Devonian systems, and is carried out to a great and beautiful degree of complication in the "old red" Dendrodonts.

The repetition of the same principle of dental structure in one of the earliest genera of *Reptilia*, associated with the defect of ossification of the endo-skeleton and the excess of ossification in the exo-skeleton of the head and nape, decisively illustrate the true affinities and low position in the reptilian class of the so-called *Archegosauri*.

Resting upon and protected by the throat-plate in the middle line, there is a longish slender bone, which must belong to the median series of the hyoid system, either basi- or uro-hyal; it is most probably homologous with the uro-hyal of *Amphiuma* and other Perennibranchiates.

That two pairs of longish slender bones projected outward and backward from the median series, is shown by more than one specimen of *Archegosaurus* (vol. xii., fig. 10). The anterior pair is the longest; these are situated as if they had been attached, one to each side of the broad "throat-plate," which may have represented a basi-hyal. The anterior pair are homologous with the corresponding longer pair of appendages to the broad basi-hyal of *Amphiuma*, and are cerato-hyals. The shorter posterior pair answer to the branchi-hyals in *Amphiuma* and other Perennibranchs. There is no such pair in the hyoidean arch of any known Saurian.

Just external to the ends of the above lateral elements of the hyoid apparatus feeble traces of arched series of bony nuclei were detected by Goldfuss, and interpreted by him as remains of partially ossified branchial arches In this determination the writer agrees with Goldfuss. In all those specimens possessing them they present the outline of two or three arches in dots, or slightly curved series of dots or points. In the small relative size of these indications of branchial arches, the *Archegosaurus* agrees with the *Amphiuma*.

No doubt, in the fully-grown *Archegosaurus*, the lungs would be equal to the performance of the required amount of respiration, but the retention of such traces of the embryonal water-breathing system in the adult leads to the inference that the animal must have affected a watery medium of existence for as great a proportion of its time as is observed to be the case in the existing perennibranchiate reptiles; in which, notwithstanding the degree of development of the lungs, the great proportion of the respiratory functions seems to be performed by the gills.

The additional marks of affinity to fishes which the *Archegosaurus* presents in its persistent notochord, its cartilaginous basi-occipital, its dermal ossifications on the head, and its minute body-scales (fig. 65, scales), remove it further from the saurian reptiles, and exhibit it more strongly in the light of an osculant form between the Batrachians and the Ganoids

Throat-Plates.—The under surface of the body between the head and trunk, is defended by broad bony plates, three in number. One is median and symmetrical, of an elongate lozenge shape, with the angles rounded off, slightly convex externally, a little produced along the middle of the anterior half into something like a low *quasi*-keel. The outer surface is sculptured by radiating furrows, except at so much of the marginal part as is overlapped by the lateral pieces, and by the scapular arch. The lateral throat-plates are attached to the anterior half of the sides of the median one, are shaped like beetles' elytra, and converge forwards. Their centre of ossification is towards their outer and back part, from which the external ridges and grooves radiate towards the inner border

Von Meyer[2] compares these dermal shields to the ento- and episternal elements of the plastron of Chelonia; their truer homology seems to the writer to be with the median and lateral large throat-plates or scales of *Megalichthys* and *Sudis gigas*. The entosternal element is the only endo-skeletal piece uncombined with a dermal ossification in most Chelonia. The epi-sternal, like the hyo- and hypo-sternals, appear to be abdominal ribs, with superadded dermal ossifications in *Chelonia*.

The scapulæ (51) are instructively exhibited in the very young specimen of the *Archegosaurus* figured in t. xiv., fig. 4, of Von Meyer's treatise. The coracoids being doubtless wholly cartilaginous at that stage, are not discernible in the specimen referred to. The upper slender end of the scapula is opposite the side of the vertebral column, about the fifth neurapophysis from the head, and it curves gently downward and forward, expanding at its humeral end.

This expansion is more sudden in the fully-developed animal, giving the bone the shape of a rudder, and the direction of the scapula is changed. At least in the specimens (the great majority) in which the skeleton is seen from above, the slender dorsal end of the scapula is seen overlying, or near the hinder border of, the lateral throat-plate, and it extends outward and backward to its expanded humeral end.

The coracoids (52) are a pair of flat reniform plates, with the convex border turned forward, the concave one backward, they seem to have overlapped the smooth margins of the posterior half of the median throat-plate. It is most probable that, as in *Amphiuma*, a portion of the broad coracoid remained in the cartilaginous state, and that the full reniform plate answers to the ossified part of that coracoid which it resembles in shape and relative position

The position of the slender scapulæ, styliform and rib-like, as in the Perennibranchiates, is instructively shown in t. xviii., figs. 1 and 2, of M. von Meyer's treatise. The coracoids, as in *Amphiuma*, form the chief part of the articular cavity for the humerus.

The perennibranchiate affinities of *Archegosaurus* are shown as clearly by the scapular as by the hyoidean arch. The fore-limb does not exceed half the length of the head The humerus (53) is a short thick bone, slightly constricted at the middle, expanded and rounded at both ends, the proximal one being the largest. For some time the bone is hollow and open at each end; when ossification finally closes the terminal apertures, it shows that the ends were connected to the coracoid and to the fore arm by interposed ligamentous matter,—not, as in true Saurians, by a synovial joint. Of the two bones of the fore arm the ulna is a little longer and larger than the radius (54). Both bones present the simplest primitive form, gently constricted in the middle, with the proximal

1 Wyman, *American Journal of the Natural Sciences*, Oct. 1843.

2 "Die kehlbrust platten konnte man der unpaarigen Platte und dem ersten Platten-paar im Bauchpanzer der Schildkroter vergleichen." (*Op. cit.*, p. 100.)

Reptilia.

ends a little concave, the distal ones a little convex. The space between the antibrachium and the metacarpus plainly bespeaks the mass of cartilage representing, as in *Amphiuma*, the carpal segment (56) in *Archegosaurus*. No trace of a carpal bone is found save in the largest and oldest examples, in which five or six small roundish ossicles are aggregated near the ulnar side of the carpus. Four digits are present; and considering the pollex to be, as usual, wanting, the second digit, answering to the medius of pentadactyle feet, is the largest, and includes at least four phalanges (58); these, with the metacarpals (57), are long, slender, terminally expanded, and truncate. They obviously supported a longish, narrow, pointed paddle. The outermost or little finger was the shortest, and has the shortest metacarpal and first phalanx.

It is true that in *Mystriosaurus* the fore limbs are relatively as short as in *Archegosaurus*; and the oolitic crocodile recalls the arrest of development of the same limbs in the marsupial Potoroos; but in *Archegosaurus*, not only is the small size of the fore limbs, but also their type of structure, especially that of their scapular arch, closely in accordance with that in the *Perennibranchiata*, as shown in the tridactyle fore limb of the *Proteus anguinus*, of which a figure is added to that of the *Archegosaurus* in fig. 65.

The ilium (62), like the scapula, is expanded at its articular or femoral end. It is less long and slender; one border is straight, the other concave, by the expansion toward that border of the femoral end. Two shorter bones on each side complete the pelvis below. One is of a simple form, straight, thicker in proportion to its length than in the ilium: it may be ischium.

The other bone is shown, with its fellow, in t. xiii., fig. 6, and xviii., figs. 8 and 9, of Von Meyer's treatise. That author compares the pair of bones to the *Aptychus* in shape; they may be the pubic bones. On this hypothesis, they are restored to their true position at 64 (pubis) in fig. 65. The femur (65) is slightly expanded, and truncate at both ends; it is not longer than the ilium. The tibia (66) and fibula are separate bones, like those of the fore arm; the margins, which are turned toward each other, are most concave. They are rather more than half the length of the femur.

The foot-bones are separated by a fibro-cartilaginous tarsal mass (68) from those of the leg. The form of the phalanges, expanded and truncate at both ends, bespeaks their simple ligamentous joints, and that they supported, like the fore limb, a fin or limb adapted simply for swimming. The argument for the saurian affinities of *Archegosaurus*, based by V. Meyer on the short fore-limbs of *Mystriosaurus*, already invalidated by the difference of structure, is controverted by the fact, that the hind limbs of *Archegosaurus*, like those of the Perennibranchs, are not only as simple in structure, but also as short, as the fore limbs.

In 1852 Sir Charles Lyell and Mr Dawson, in the course of their investigations of the coal strata of Nova Scotia, remarkable for the erect fossil trees in certain parts, discovered in the hollow of the trunk of one of these trees (*Sigillaria*, 2 feet in diameter), which was wholly converted into coal, some small bones, which Professor Wyman of Boston surmised to have belonged to a batrachian reptile. By the professor's advice they were brought to England and submitted to the writer, who has described and figured them[1] as batrachian, under the name *Dendrerpeton Acadianum*, and with close affinities, from the plicated structure of the teeth, the sculpturing of some broad cranial plates, and the structure and proportions of certain limb-bones, to the genus *Apateon* or *Archegosaurus*.

Genus Raniceps.—In about the centre of the great carboniferous basin of Ohio, United States, at the mouth of the "yellow creek," is a seam of coal 8 feet in thickness, the lower four inches of which is "cannel coal." In this has been found the skull, part of the vertebral column, scapular arch, and fore limbs of a reptile referred by Professor Wyman[2] to the batrachian sub-class, under the name of *Raniceps*. Two closely-allied fossils, also referred to *Batrachia*, have been found in the same formation and locality.

Order II.—Labrinthodontia.

Genus Baphetes, Ow.

Sp. *Baphetes planiceps*.—In January 1854 the writer communicated to the Geological Society of London a description of part of a fossil cranium of an animal, from the Pictou coal, Nova Scotia, measuring 7 inches across the orbit. From the characters then specified, the fossil was determined to be the fore part of the skull of a sauroid Batrachian of the extinct family of the Labyrinthodonts. It agreed with them in the number, size, and disposition of the teeth; in the proportions and mode of connection of the premaxillaries, maxillaries, nasals, prefrontals and frontals; and in the resultant peculiarly broad and depressed character of the skull. The traces of the nostrils were less definite and satisfactory than the remains of the orbits; but the latter were decisive against a piscine nature. The fossil also presents the same well-marked external sculpturing as in the Labyrinthodonts; and amongst the genera that have been established in that family, the form of the end of the muzzle, or upper jaw, in the Pictou coal specimen, best accorded with that in the *Capitosaurus* and *Metopias* of Von Meyer and Burmeister. But the orbits had been evidently larger and of a different form than in the reptiles so called; and, for the convenience of distinction and reference, the writer proposed to name the fossil *Baphetes planiceps* (βάπτω, *I dip* or *dive*), in reference to the depth of its position and the shape of its head.

Being thus introduced at the carboniferous period to the labyrinthodont order, which attained its full development in the triassic period, we shall proceed to notice the more decisive evidences and typical illustrations of that extinct order of *Batrachia*.

The name of this sub-class is from the Greek word *batrachos*, signifying a frog; and it is represented in the present animal-population of England by a few diminutive species of frogs, toads, and newts, or water-salamanders. But, at the period of the deposition of the new red sandstone, in the present counties of Warwick and Cheshire, the shores of the ancient sea, which were then formed by that sandy deposit, were trodden by reptiles having the essential bony characters of the *Batrachia*, but combining these with other bony characters of crocodiles, lizards, and ganoid fishes; and exhibiting all under a bulk which, as made manifest by the fossils and foot-prints, rivalled that of the largest crocodiles of the present day. The form of the largest Labyrinthodonts, if we may judge by the great breadth and flatness of the skull, must, however, have more resembled that of the toad or land-salamander.

The Batrachians have no fixed type of external form like the higher orders of reptiles, but some, as the broad and flat-bodied toads and frogs, most resemble the Chelonians, especially the soft-skinned mud-tortoises (*Trionyx*); other Batrachians, as the *Cæcilia*, resemble Ophidians; a third group, as the newts and salamanders, represent the Lacertians; and among the perennibranchiate reptiles there are species (*Siren*) which combine with external gills the mutilated condition of the apodal fishes.

Thus it will be perceived that, even if the entire skeleton of one of the new red sandstone Batrachians had been obtained, there is no fixed or characteristic general outward form in the batrachian order whereby its affinity to that group could have been determined. The common characters by which the Batrachians, so diversified in other respects, are naturally associated into one group or sub-class of reptiles, besides being taken from the condition of the circulating and generative systems, and other perishable parts, are, however, fortunately as strongly manifested in modifications of the skeleton, and principally in the skull. This is joined to the atlas by the medium of two tubercles, developed exclusively from the exoccipitals; the bony palate is formed chiefly by two broad and flat bones, called "vomerine" by Cuvier, and generally supporting teeth. It is only in the Batrachians among reptiles that examples are found of two or more rows of teeth on the same bone, especially on the lower jaw (*Cœciliæ*, *Sirenes*). With regard to vertebral characters, no such absolute batrachian modifications can be adduced as those above cited from the anatomy of the cranium. Some Batrachians, as is well known, have the vertebræ united by ball-and-socket joints, as in most recent reptiles; others by biconcave joints, as in a few recent and most extinct Saurians. Some species have ribs, others want those appendages; the possession of ribs, therefore, even if longer than those of the *Cœciliæ*, by a fossil reptile combining all the essential batrachian characters of the skull, would not be sufficient ground for pronouncing such reptile to be a Saurian.

[1] *Quarterly Journal of the Geological Society*, vol. ix., 1853.

[2] *American Journal of Science and Arts*, March 1857.

Much less could its saurian nature be pronounced from the circumstance of its possessing large conical striated teeth,—as the ordinary characters of size, form, number, and even presence or absence of teeth, varies much in existing Batrachians, the location of teeth on the vomerine bones being the only dental character in which they differ from all other orders of reptiles.

The writer's first acquaintance with the remarkable fossils under consideration was founded on the examination, in 1840, of portions of teeth from the new red sandstone of Coton End quarry, Warwickshire. The external characters of these teeth corresponded with those which had previously been discovered by Professor Jaeger in the German Keuper formation in Wirtemberg, and on which the genus *Mastodonsaurus* had been founded (fig. 66).

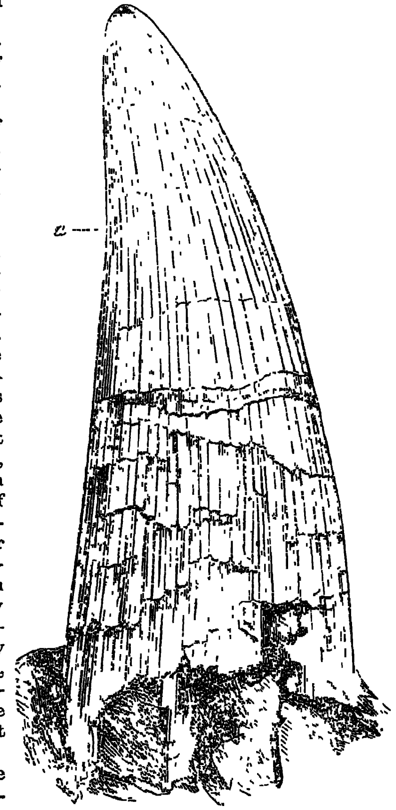

Fig. 66.
Canine tooth of the *Labyrinthodon Jagaeri* (nat. size).

The results of a microscopic examination of the teeth of the *Mastodonsaurus* from the German Keuper, and of those from the new red sandstone of Warwickshire, have been detailed in the art. ODONTOLOGY (vol. xvi., p. 412). They proved that the teeth from both localities possessed in common a very remarkable and complicated structure (fig. 67), to the principle of which,—viz., the convergence of numerous inflected folds of the external layer of cement towards the pulp cavity, a very slight approach was made in the fang of the tooth of the *Ichthyosaurus*, and that a closer approximation to the labyrinthic structure in question was made by the teeth of several species of fishes, and by those of *Archegosaurus*, while the teeth of existing Batrachians were simple like those of most Saurians.

Thus, inasmuch as the extinct animals in question manifested in the intimate structure of their teeth an affinity to fishes, it might be expected that, if they actually belonged to the class of reptiles, the rest of their structure would manifest the characters of the lowest order,—viz., the *Batrachia*, the existing members of which pass, though not by the dental character alluded to, yet by so many other remarkable degradations of structure, towards fishes. Now it has happened that, in the same formation in Wirtemberg from which the labyrinthic teeth of the so-called *Mastodonsaurus* had been derived, a fragment of the posterior portion of the skull has been obtained, showing the development of a separate condyle on each ex-occipital bone; whence Professor Jaeger, recognising the identity of this structure with the batrachian character above mentioned, founded upon the fossil a new genus of *Batrachia* which he called "*Salamandroides giganteus*." Subsequent discoveries, however, satisfied the professor that the bi-condylous fragment of skull, representing the genus *Salamandroides*, belonged to the same reptile as the teeth on which he had founded the genus *Mastodonsaurus*. The following fossils, from the new red sandstone of Warwickshire, gave additional proof of the batrachian nature of the genus to which those fossils belong, with the establishment of five distinct species, one of which is most probably identical with the *Mastodonsaurus salamandroides* of Professor Jaeger. In reference to the generic denomination *Mastodonsaurus*, it unavoidably recalls the idea of the mammalian genus *Mastodon*, or else a mammilloid form of tooth, whereas all the teeth of the reptile so called are originally, and most of them are permanently, of a cuspidate and not of a mammilloid form; secondly, because the second element of the word, *saurus*, indicates the genus to belong to the saurian and not to the batrachian order of reptiles. For these reasons, the writer has proposed to designate the genus in question *Labyrinthodon*, in allusion to the peculiar and characteristic structure of the teeth (fig. 67).

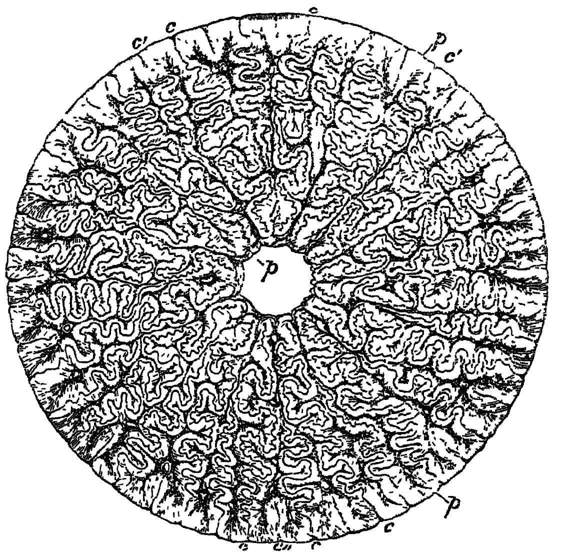

Fig. 67.
Transverse section of a tooth of the *Labyrinthodon* (magn.)

The specimens from British localities are referable to five species, —viz., 1. *Labyrinthodon salamandroides*; 2. *L. leptognathus*; 3. *L. pachygnathus*; 4. *L. ventricosus*; and 5. *L. scutulatus*; and we shall here briefly notice the characters exhibited by the bones assignable to the second, third, and fifth species.

Labyrinthodon leptognathus.—The remains of this species consist of fragments of the upper and lower jaws, two vertebræ, and a sternum. They were found in the new red sandstone quarries at Coton End, near Warwick.

A dorsal vertebra from Coton End presents further evidence of the batrachian nature of the *Labyrinthodon*. It has concave articular cavities at the extremities of the body,—a condition now known among existing reptiles only in the Geckos, and in the lower or perennibranchiate division of Batrachians. It is a common structure in extinct Saurians, but the depth of the vertebral articular cavities in the *Labyrinthodon* exceeds that in the amphicelian Crocodilians and in most Plesiosaurs. The body of the vertebra is elongate and sub-compressed, with a smooth but not regularly curved lateral surface, terminating below in a slightly-produced, longitudinal, median ridge; and it exhibits the same exceptional condition in the reptilian class as do the vertebræ of existing Batrachians, in having the superior arch or neurapophysis anchylosed with the centrum. From each side of the base of the neural arch a thick and strong transverse process extends obliquely outwards and upwards.

A symmetrical bone, resembling the episternum of the *Ichthyosaurus* was associated with the preceding remains. It consists of a stem or middle, which gradually thickens to the upper end, where cross pieces are given off at right angles to the stem, and support on each a pretty deep and wide groove indicating strongly the presence of clavicles, and thus pointing out another distinction from crocodiles, in which clavicles are wanting. Most Batrachians possess these bones.

The modifications of the jaws, and more especially those of the bony palate of the *Labyrinthodon leptognathus*, prove the fossil to have been essentially Batrachian, but with affinities to the higher Sauria, leading, in the form of skull and the sculpturing of the cranial bones, to the crocodilian group, in the collocation of the larger fangs at the anterior extremities of the jaws to the *Plesiosaurus*, and in one part of the dental structure, in the form of the episternum, and the bi-concave vertebræ, to the *Ichthyosaurus*. Another marked peculiarity in this fossil is the anchylosis of the base of the teeth to distinct and shallow sockets, by which it is made to resemble the Sphyræna and certain other fishes. From the absence of any trace of excavation at the inner side of the base of the functional teeth, or of alveoli of reserve for the successional teeth, it may be concluded that the teeth were reproduced, as in the lower Batrachians and in many fishes, in the soft mucous membrane which covered the alveolar margin, and that they subsequently became fixed to the bone by anchylosis, as in the pike and Lophius. This anatomical fact militates strongly against the idea that the *Labyrinthodon* is a Saurian.

Labyrinthodon pachygnathus.—The remains of this species, which have been obtained, consist of portions of the lower and upper jaws, an anterior frontal bone, a fractured humerus, an ilium with a great part of the acetabulum, the head of a femur, and two ungual phalanges. A portion, nine and a half inches long, of a right ramus of a lower jaw, in addition to the characters common to it and the fragment of the lower jaw of the *L leptognathus*, in the structure of the angular and dentary pieces, shows that the outer wall of the alveolar process is not higher than the inner, as in frogs and toads, the salamanders and menopome, in all of which the base of the teeth is anchylosed to the inner side of an external alveolar plate. The smaller serial teeth are about forty in number, and gradually diminish in size as they approach both ends, but chiefly so towards the anterior part of the jaw. The sockets are close together, and the alternate ones are empty. The great laniary teeth were apparently three in each symphysis, and the length of the largest is considered to have been one and a half inch. The base of each tooth is anchylosed to the bottom of its socket, as in scomberoid and sauroid fishes; but the *Labyrinthodon* possesses a still more ichthyic character in the continuation, preserved in this specimen, of a row of small teeth anterior and external to the two or three larger tusks. The premaxillary bone presents the same peculiar modification as in the higher organized Batrachia, the palatal process of the premaxillary extending beyond the outer plate both externally and, though in a less degree, internally, where it forms part of the boundary of the anterior palatal foramen, whence the outer plate rises in the form of a compressed process from a longitudinal tract in the upper part of the palatal process; it is here broken off near its margin, and the fractured surface gives the breadth of the base of the outer plate, stamping the fossil with a Batrachian character conspicuous above all the saurian modifications by which the essential nature of the fossil appears at first sight to be masked.

In the pre-frontal bone there are indications of crocodilian structure. Its superior surface is slightly convex and pitted with irregular impressions; and from its posterior and outer part it sends downwards a broad and slightly concave process, which appears to be the anterior boundary of the orbit. This process presents near its upper margin a deep pit, from which a groove is continued forwards; and in the corresponding orbital plate of the crocodile there is a similar but smaller foramen.

From these remains of the cranium of the *L. pachygnathus*, it is evident that the facial or maxillary part of the skull was formed in the main after the crocodilian type, but with well-marked batrachian modifications in the premaxillary and inferior maxillary bones. The most important fact which they show is, that this sauroid Batrachian had subterminal nostrils, leading to a wide and shallow nasal cavity, separated by a broad and almost continuous palatal flooring from the cavity of the mouth; indicating, with their horizontal position, that their posterior apertures were placed far behind the anterior or external nostrils: whereas in the air-breathing Batrachia the nasal meatus is short and vertical, and the internal apertures pierce the anterior part of the palate It may be inferred, therefore, that the apparatus for breathing by inspiration must have been present in the *Labyrinthodon* as in the crocodile; and hence still further, that the skeleton of the *Labyrinthodon* will be found to be provided with well-developed costal ribs, and not, as in most of the existing Batrachians, with merely rudimentary styles. Since the essential condition of this defective state of the ribs of Batrachians is well known to be their fish-like mode of generation and necessary distension of the abdomen, it is probable that the generative economy of these fossil reptiles, in which the more complete ribs would prevent the excessive enlargement of the ovaria and oviducts, may have been similar to that of saurian reptiles.

A fragment of a vertebra of *L. pachygnathus* presents analogous characters to the vertebra of the *L. leptognathus* previously noticed.

Of the few bones of the extremities which have come under the writer's inspection, one presents all the characteristics of the corresponding part of the humerus of a toad or frog, viz , the convex, somewhat transversely extended articular end, the internal longitudinal depression, and the well-developed deltoid ridge. The length of the fragment is two inches, and the breadth is thirteen lines. The ridges are moderately thick and compact, with a central medullary cavity. In its structure, as well as in its general form, the present bone agrees with the batrachian, and differs from the crocodilian type.

In the right ilium, about 6 inches in length, and in the acetabulum, there is a combination of crocodilian and batrachian characters. The acetabular cavity is bounded on its upper part by a produced and sharp ridge, as in the frog, and not emarginate at its anterior part, as in the crocodile.

As the fragment of the ilium was discovered in the same block as the two fragments of the cranium and the portion of the lower jaws, it is probable that they may have belonged to the same animal; and if so, as the portions of the head correspond in size with those of the head of a crocodile six or seven feet in length, but the acetabular cavity with that of a crocodile 25 feet in length, then the hinder extremities of the *Labyrinthodon* must have been of disproportionate magnitude compared with those of existing Saurians, but of approximate magnitude with some of the living anourous Batrachians That such a reptile, of a size equal to that of the species whose remains have just been described, existed at the period of the formation of the new red sandstone, is abundantly manifested by the remains of those singular impressions to which the term *Cheirotherium* has been applied. Other impressions, as those of the *Cheirotherium Hercules*, correspond in size with the remains of the *Labyrinthodon salamandroides*, which have been discovered at Guy's Cliff The head of a femur from the same quarry in which the ilium was found is shown to correspond in size with the articular cavity of the acetabulum. The two toe-bones, or terminal phalanges, resemble those of Batrachians in presenting no trace of a nail, and from their size they may be referred to the hind feet of the *L pachygnathus*.

An entire skull of the largest species discovered in the new red sandstones of Wurtemberg; a lower jaw of the same species found in the same formation in Warwickshire, some vertebræ, and a few fragments of bones of the limbs, have served, with the indications of size and shape of the trunk of the animal yielded by the series of consecutive foot-prints, as the basis of the restoration of the *Labyrinthodon salamandroides*, at the Crystal Palace. It is to be understood, however, that, with the exception of the head, the form of the animal is necessarily more or less conjectural.

Labyrinthodon scutulatus—The remains to which this specific designation has been applied compose a closely and irregularly aggregated group of bones imbedded in sandstone, and manifestly belonging to the same skeleton; they consist of four vertebræ, portions of ribs, a humerus, a femur, two tibiæ, one end of a large flat bone, and several small osseous dermal scutæ. The mass was discovered in the new red sandstone at Leamington, and was transmitted to the writer in the summer of 1840.

The vertebræ present bi-concave articular surfaces similar to those of the other species. In two of them the surfaces slope in a parallel direction obliquely from the axis of the vertebræ, as in the dorsal vertebræ of the frog, indicating a habitual inflexion of the spine, analogous to that in the humped back of the frog. The neurapophyses are anchylosed to the vertebral body. The spinous process rises from the whole length of the middle line of the neurapophysial arch, and its chief peculiarity is the expansion of its elongated summit into a horizontally-flattened plate, sculptured irregularly on the upper surface A similar flattening of the summit of the elongated spine is exhibited in the large atlas of the toad. The body of the vertebra agrees with that of the *L. leptognathus.* The humerus is an inch long, regularly convex at the proximal extremity, and expanded at both extremities, but contracted in the middle. A portion of a somewhat shorter and flatter bone is bent at a subacute angle with the distal extremity, and resembles most nearly the anchylosed radius and ulna of the Batrachia

The femur wants both the extremities; its shaft is subtrihedral and slightly bent, and its walls are thin and compact, including a large medullary cavity. The tibiæ are as long, but thicker and stronger than the femur. They had lost their articular extremities, but exhibited that remarkable compression of their distal portion which characterizes the corresponding bone in the Batrachia; they likewise have the longitudinal impression along the middle of the flattened surface. Were more of the skeleton of the above-defined species of *Labyrinthodon* known, they might present differences of subgeneric value. Such differences in the forms and proportions of the skull, and in the form and relative position of the orbits, of specimens that have been discovered subsequently in the triassic sandstones of Germany, have been so interpreted.

In the *Labyrinthodon* (*Mastodonsaurus*) *Jaegeri*—the largest of the species—the skull is triangular, the two condyles projecting from the middle of the base; the sides are straight, and converge to the obtuse apex. The orbits are oval, narrowest anteriorly, and are situated nearly midway between the fore and back part of the skull. The nostrils are very small, and are as wide apart as the orbits.

Labyrinthodon (*Trematosaurus*) *Braunii*, Von Meyer.—The name *Trematosaurus* was given by Braun to a labyrinthodont reptile, in reference to the parietal foramen, at that time deemed to be peculiar to it, but now known to be common to all the family. The genus was founded on an unusually perfect skull discovered in the richly fossiliferous bunter-sandstein of Bernburg. It is about one foot long, and, relatively to its basal breadth, it is longer and narrower than in *L Jagaeri*, the sides converging at a more acute angle. The orbits are elliptical, situated in the middle of the skull, and

Reptilia.

wider apart than in *L. Jagaeri*; the nostrils are relatively nearer together, their interspace being only half that in the *L. Jagaeri*.

Labyrinthodon (Metopius[1]*) diagnosticus*, H. von M.—In this species the skull is broader in proportion to its length than in the foregoing ;the sides are convex as they converge to the obtuse muzzle. The orbits are small, of a wide elliptical form, situated in the anterior third of the skull; they are twice as wide apart as are the nostrils. The parietal foramen is near the occipital ridge. The remains of this species are from the upper beds of the keuper standstone in Wirtemberg

The *Labyrinthodon (Capitosaurus) arenaceus*, Münster, is distinguished by a much broader and almost truncate muzzle. The orbits are elliptic, and situated almost wholly in the hinder third of the cranium; their interspace is the same as that between the nostrils, which are relatively as large as in *L. Braunii*.

The name *Zygosaurus* appears to have been applied with better grounds, by Eichwald, to a labyrinthodont reptile from the Permian cupriferous beds at Orenburg. It has the parabolic skull of *L. Jagaeri* and *L. diagnosticus*; the orbits large, and divided by an interval less than their own diameter. The temporal fossæ are relatively larger, and bounded by stronger zygomatic arches, and seem not to have been roofed over by bone. The dentition is strictly labyrinthodont.

Odontosaurus Voltzii is a genus and species founded by Von Meyer on a portion of a lower jaw, containing fifty teeth lodged in rather a deep groove, but apparently presenting the labyrinthic structure. The specimen is from the bunter sandstone of Soultz-les-Bains.

Xestorrhytias Perrini.—By this name M. von Meyer would indicate certain flat cranial bones, sculptured like those of *Labyrinthodon*, but with a peculiarly polished ganoid-like surface, from the muschelkalk of Lunéville.

In all the foregoing forms of Labyrinthodonts, represented by complete crania, with the exception perhaps of *Zygosaurus*, the supplemental osseous plates roofing over the temporal fossæ are present, as in *Archegosaurus*, viz., the "post-orbital" and the "super-squamosal" bones. In all of them the occipital condyles are distinct, forming a pair; and in all the vomer is divided and bears teeth. The structure and disposition of the entire dental system is strictly labyrinthodont.

The relation of these remarkable reptiles to the saurian order has been advocated to be one of close and true affinity, chiefly on the character of the extent of ossification of the skull, and of the outward sculpturing of the cranial bones. But the true nature of some of these bones appears to have been overlooked, and the glance of research for analogous structures has been too exclusively upward. If directed downward from the Labyrinthodonts to the *Archegosauri* and certain ganoid fishes, it suggests other conclusions.

The conformity of pattern in the dermal, semidermal, or neurodermal bones of the outwardly well-ossified skull of *Polypterus*, *Lepidosteus*, *Sturio*, and other salamandroid-ganoid fishes, with well-developed lung-like air-bladders, and of the same skull-bones in the *Archegosaurus* and the Labyrinthodonts; the persistence of the notochord (*chorda dorsalis*) in *Archegosaurus*, as in *Sturio*; the persistence of the notochord and branchial arches in *Archegosaurus*, as in *Lepidosiren*; the absence of occipital condyle or condyles in *Archegosaurus*, as in *Lepidosiren*; the presence of labyrinthic teeth in *Archegosaurus*, as in *Lepidosteus* and *Labyrinthodon*; the large median and lateral throat-plates in *Archegosaurus*, as in *Megalichthys*, and in the modern *Arapaima* and *Lepidosteus*;—all these characters point to one great natural group, peculiar for the extensive gradations of development, linking and blending together fishes and reptiles within the limits of such group. The salamandroid (or so-called "sauroid") Ganoids—*Lepidosteus* and *Polypterus*—are the most piscine, the true Labyrinthodonts are the most reptilian, of the group. The *Lepidosiren* and *Archegosaurus* are intermediate gradations, one having more of the piscine, the other more of the reptilian characters. The *Archegosaurus* conducts the march of development from the fish proper to the labyrinthodont type; the *Lepidosiren* conducts it to the perennibranchiate batrachian type. Both illustrate the artificiality of the supposed class distinction between fishes and reptiles, and the naturality of the "Hæmacrymes," or cold-blooded Vertebrata, as the one natural and truly definite group. There is nothing in the known structure of the so-named *Archegosaurus* or *Mastodonsaurus* that truly indicates a belonging to the saurian or crocodilian order of reptiles. The exterior ossifications of the skull and the canine-shaped labyrinthic teeth are both examples of the salamandroid modification of the ganoid type of fishes.

The small proportion of the fore limb of the *Mystriosaurus* in nowise illustrates this alleged saurian affinity; for though it be as short as in *Archegosaurus*, it is as perfectly constructed as in the crocodile, whereas the short fore limb of *Archegosaurus* is constructed after the simple type of that of the *Proteus* and *Siren*. But the futility of this argument of the sauroid affinities is made manifest by the proportions of the hind limb of *Archegosaurus*. As in *Proteus* and *Amphiuma*, it is as stunted as the fore limb; whereas in *Mystriosaurus*, as in other Teleosaurians, the hind limbs are relatively larger and stronger than in the existing crocodiles. M. von Meyer leaves the hind limb out of sight in his advocacy of the saurian nature of the so-called *Archegosaurus*. One regrets that Von Meyer's original name *Apateon*, though proposed to express his scepticism of the alleged nature of the fossil submitted to him in 1844 by Dr Gergens, was not retained by Professor Goldfuss. It is still more to be regretted that a compound name should in any case be adopted or constructed, where the proof of the affinity it may be meant to indicate is not perfect. *Archegosaurus*, like *Mastodonsaurus*, will become at length mere arbitrary terms; but until then, they will really recall or express little more than the mistaken views of the inventors of those names in respect of the true affinities of the remarkable extinct piscine reptiles to which they have been applied.

Fig. 68 gives a reduced view of a portion of new red sandstone, with three pairs of foot-prints in relief.

Consecutive impressions of such prints have been traced for many steps in succession in quarries of that formation in Warwickshire, Cheshire, and also in Lancashire, more especially at a quarry of a whitish quartzose sandstone at Storton Hill, a few miles from Liverpool. The foot-marks are partly concave and partly in relief; the former are seen upon the upper surface of the sandstone slabs, but those in relief are only upon the lower surfaces, being in fact natural casts, formed on the subjacent foot-prints as in moulds. The impressions of the hind foot are generally 8 inches in length and 5 inches in width; near each large footstep, and at a regular distance—about an inch and a half—before it, a smaller print of the fore foot, 4 inches long and 3 inches wide, occurs. The footsteps follow each other in pairs, each pair in the same line, at intervals of about 14 inches from pair to pair. The large as well as the small steps show the thumb-like toe alternately on the right and left side, each step making a print of five toes.

Foot-prints of corresponding form, but of smaller size, have been discovered in the quarry at Storton Hill, imprinted on five thin beds of clay, lying one upon another in the same quarry, and separated by beds of sandstone. From the lower surface of the sandstone layers the solid casts of each impression project in high relief, and afford models of the feet, toes, and claws of the animals which trod on the clay.

Similar foot-prints were first observed in Saxony, at the village of Hessburg, near Hillburghausen, in several quarries of a gray quartzose sandstone, alternating with beds of red sandstone, and of the same geological age as the sandstones

[1] This generic term has been applied to another fossil by Eichwald.

of England that had been trodden by the same strange animal. The German geologist who first described them proposed the name of *Cheirotherium* (*cheir*, the hand, *therion*, beast) for the great unknown animal that had left the foot-prints, in consequence of the resemblance, both of the fore and hind feet, to the impression of a human hand; and Dr Kaup conjectured that the animal might be a large species of the opossum kind. The discovery, however, of fossil skulls, jaws, teeth, and a few other bones, in the sandstones exhibiting the foot-prints in question, has rendered it more probable that both the foot-prints and the fossils are evidences of the same kind of huge extinct batrachian reptiles.

All the labyrinthodont remains from the Warwick and Leamington sandstones agree in their essentially batrachian nature with those from the German keuper, and other new red or triassic strata. The impressions of the *Cheirotherium* resemble those of the foot-prints of a Batrachian; but are not identical with those of any known Batrachian or other reptile. They show a papillose integument like that on the sole of certain Geckos, and which may be another mark of sauroid departure from the modern batrachian type. In the attempt to solve the difficult problem of the nature of the animal which has impressed the new red sandstone with the cheirotherian foot-prints, we cannot overlook the fact, that we have in the *Labyrinthodons* also batrachian reptiles, differing as remarkably from all known Batrachia, and from all other reptiles in the structure of their teeth; both the footsteps and the fossils are, moreover, peculiar to the new red sandstone; the different size of the foot-prints referred to different species of *Cheirotheria* correspond with the different size of ascertained species of *Labyrinthodon;* and the present facts best support the hypothesis, that the foot-prints called "cheirotherian," are those of labyrinthodont reptiles.

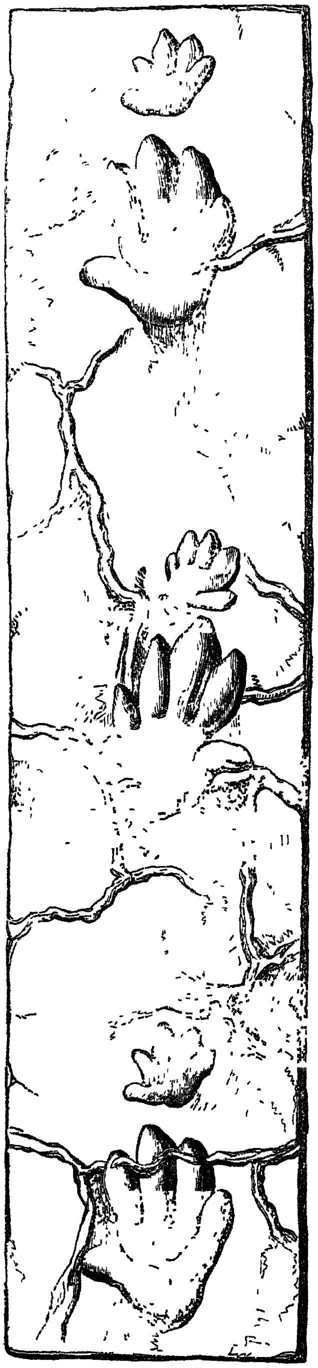

Fig. 68.
Foot-prints of *Labyrinthodon* (*Cheirotherium*).

Sub-class 2.—SAURIA.

ORDER I.—THECODONTIA.

Genus PROTOROSAURUS, Von Meyer.

Sp. *Protorosaurus Speneri*, Von M.—The first fossil Saurian on record is that which records the circumstance by its generic name, and honours its describer by the specific one. The slab of "copper-slate" from the Permian beds of Eisenach in Thuringia, displaying, either in fossils or impressions, the skull, vertebral column, and bones of the fore foot of the reptile in question, was figured and described by Spener, a physician at Berlin, in 1710.[1] The original specimen is now in the museum of the Royal College of Surgeons, London. It was obtained from a copper-mine near Eisenach, at a depth of 100 feet from the surface.

A second specimen, showing the two fore limbs, a hind limb, and part of the trunk, was described by Link in 1718.[2] Cuvier gives copies of portions of two other specimens in his *Ossemens Fossiles*.[3]

The healthy, honest mind of Spener is shown by the conclusions which he formed from the state of preservation of his specimen—"omnia, enim, minutissima etiam apophyses, spinæ," &c.,—and from its association with equally well-preserved remains of fishes, and even of the delicate leaves of plants, against the notions of those fossils merely simulating, and never having been, the living organisms which they represented—notions which were then advocated under the sounding phrase of "plastic force," as they have lately been under that of "prochronism." Spener's only doubt was, whether the reptile had been a crocodile or a lizard; but he inclined to the former view, on account of the proportions of the head to the trunk. He then enters upon speculations as to how a crocodile could have come into Germany; and shows the usual effect of a mind biassed by a hypothetical diluvial catastrophe, not demonstrated by observation and inductive research, and to the extent of such bias benumbed in the exercise of the faculty for the acquisition of natural truth.

The seven cervical vertebræ are proportionally larger than in any known recent or fossil terrestrial or aquatic Saurian; they resemble in this respect the cervical vertebræ of Pterodactyles; the tail is long, and its vertebræ differ from those of all other known reptiles, recent or fossil, in having the spinous processes bifurcate, diverging in the direction of the axis of the body.[4]

The muscular power of the neck is indicated by traces of bone tendons. The dorsal vertebræ exceed eighteen in number, and have higher spines than in the modern Monitors; the dorsal ribs are long, and longitudinally impressed. The hind limb is much longer than the fore limb, and the leg is longer, in proportion to the thigh and foot, than in the Monitors. The teeth are sharp-pointed, slender; there appear to be at least twenty in both upper and lower jaws in Spener's specimen.

The writer concludes, from the length and strength of the tail and the peculiar provision for muscular attachments in that part, and from the proportions of the hind limbs, that the *Protorosaurus* was of aquatic habits, and that the strength of its neck and head, and the sharpness of its teeth, enabled it to seize and overcome the struggles of the active fishes of the waters which deposited the old Thuringian copper-slates.

Genus THECODONTOSAURUS.

Sp. *Thecodontosaurus antiquus*.—In 1836 certain reptilian remains from the "dolomitic conglomerate" at Redland, near Bristol, were described by Messrs Riley and Stutch-

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[1] *Miscellanea Berolinensia*, 4to, i., p. 99, figs. 24 and 25.

[2] *Acta Eruditorum*, 1718, p. 188, pl. ii.

[3] Ed. 8vo, 1836, pl. ccxxxvii., figs. 1 and 2.

[4] A character first pointed out in the writer's "Report on British Fossil Reptiles," *Trans. of Brit. Assoc.*, 1841, p. 155.

Reptilia. bury.[1] The matrix has been referred to the Permian period; it is now thought by some good observers to be not older than the triassic.

The teeth in these reptilian fossils are lodged in distinct sockets in *Thecodontosaurus*; they are arranged in a close-set series, slightly decreasing in size towards the posterior part of the jaw; each ramus of the lower jaw contained twenty-one teeth. These are conical, rather slender, compressed and acutely pointed, with an anterior and posterior finely-serrated edge, the serratures being directed towards the apex of the tooth, the outer surface is more convex than the inner one; the apex is slightly recurved; the base of the crown contracts a little to form the fang, which is subcylindrical

Genus PALÆOSAURUS, Riley and Stutchbury.—In the same formation as contained the jaw and teeth of the *Thecodontosaurus* two other teeth were separately discovered, differing from the preceding and from each other; the crown of one of these teeth measuring 9 lines in length and 5 lines in breadth It is compressed, pointed with opposite trenchant and serrated margins, but its breadth as compared with its length is so much greater than in the *Thecodontosaurus*, that upon it has been founded the genus *Palæosaurus*, and it is distinguished by the specific name of *platyodon*, from the second tooth, which is referred to the same genus under the name of *Palæosaurus cylindrodon*. The portion of the tooth of the *Palæosaurus cylindrodon* which has been preserved shows that the crown is subcompressed and traversed by two opposite finely-serrated ridges, as in the *Thecodontosaurus*; its length is 5 lines, its breadth at the base 2 lines.

The vertebræ associated with the two kinds of teeth above described are biconcave, with the middle of the body more constricted, and terminal articular cavities rather deeper than in *Teleosaurus*; but they are chiefly remarkable for the depth of the spinal canal at the middle of each vertebra, where it sinks into the substance of the centrum; thus the canal is wider, vertically, at the middle than at the two ends of the vertebra: an analogous structure, but less marked, obtains in the dorsal vertebræ of the *Rhynchosaurus* from the new red sandstone of Shropshire.

Besides deviating from existing lizards in the thecodont dentition and biconcave vertebræ, the Saurians of the dolomitic conglomerate also differ in having some of their ribs articulated by a head and tubercle to two surfaces of the vertebra, as at the anterior part of the chest in crocodiles and Dinosaurs. The shaft of the rib was traversed, as in the Protorosaur and Rhynchosaur, by a deep longitudinal groove. Some fragmentary bones indicate obscurely that the pectoral arch deviated from the crocodilian, and approached the lacertian or enaliosaurian type, in the presence of a clavicle and in the breadth and complicated form of the coracoid. The humerus appears to have been little more than half the length of the femur, and to have been, like that of the *Rhynchosaurus*, unusually expanded at the two extremities. The femur is chiefly remarkable for a third process or trochanter, just above the middle of the shaft, which shows a medullary cavity. The distal condyles are flattened, the outer one being the larger; there is a deep depression between them posteriorly, and a very light one anteriorly. The tibia, fibula, and metatarsal bones manifest, like the femur, the fitness of the Saurians for progression on land. The ungual phalanges are sub-compressed, curved downwards, pointed, and impressed on each side with the usual curved canal.

The general conclusions which may be drawn from the knowledge at present possessed of the osteology of the *Thecodontosaurus* and *Palæosaurus* are, in their thecodont type of dentition, biconcave vertebræ, double-jointed ribs, and proportionate size of the bones of the extremities, they are allied to the *Teleosaurus*; but that they combine a dinosaurian femur, a lacertian form of tooth, and structure of the pectoral and probably pelvic arch with these crocodilian characters, having distinctive modifications, as the moniliform spinal canal, in which, however, the almost contemporary Rhynchosaur participates. It would be interesting to ascertain whether the caudal vertebræ are characterized, as in the Thuringian Protorosaur, by double diverging spinous processes.

Genus BELODON, Von Meyer.

Sp. *Belodon Plieningeri*.—The reptile from the upper white keuper sandstone of Wirtemberg, described by Plieninger,[2] agrees in its essential characters so closely with the thecodont Saurians of the Bristol conglomerate as to add to the probability of both belonging to the same lower mezozoic period. Reptilia.

Three vertebræ are modified to afford adequate attachment to the iliac bones in *Belodon*, and this additional evidence of affinity to *Dinosauria* may have characterized also the English Thecodonts.

Genus CLADYODON, Ow.

Sp. *Cladyodon Lloydii*.—In the Memoir on the Triassic Red Sandstones of Warwick, by Murchison and Strickland, published in 1840, in the 2d series of the *Geological Transactions*, vol. v., a tooth, which is an extremely rare fossil in those English formations, was figured in pl. xxviii., fig. 6.

Having had the opportunity of studying the original specimen and fragments of some others of seemingly the same species from the new red sandstones of Warwick and Leamington, the writer recognised the affinity of the reptile with those teeth to the thecodont reptiles of the Bristol conglomerate, and indicated what appeared a generic modification of form by the term *Cladyodon*.[3]

The writer has subsequently received other specimens of the teeth characterizing this genus, which may be described as being two-edged, sub-compressed; the sides more or less convex, the edges more or less sharp, and frequently finely serrate; the crown slightly bent sideways, the inner side towards the mouth-cavity. The teeth are sometimes lancet-shaped, through convergence of the edges towards point; sometimes through one edge being convex and the other concave, the crown is slightly curved or sickle-shaped; sometimes through use, the point is blunted. The enamel is very thin, smooth, showing under the lens a slight longitudinal striation, forming wrinkles. The dentine is disposed in concentric layers; is not labyrinthic: the base of tooth shows a conical pulp-cavity. These teeth indicate a Saurian about 12 feet in length.

The writer cannot discern any generic, or even good specific distinctions, between the teeth from the Warwickshire keuper, on which in 1840 he founded the genus *Cladyodon*, and those from the Wirtemberg keuper, on which M. von Meyer in 1844 founded the genus *Belodon*. Both are nearly allied to *Palæosaurus*.

Genus BATHYGNATHUS, Leidy.

Sp. *Bathygnathus borealis*, Leidy.—Allied to the *Cladyodon* and *Belodon* by the shape of the teeth is the Saurian from the new red sandstone of Prince Edward's Island, North America, the generic and specific characters of which have been deduced by Dr Leidy[4] from a portion of lower jaw, containing seven teeth, but with interspaces from which others have been lost. The depth of the dentary bone is 5 inches; a peculiarity which suggested the generic name (*bathus*, deep, *gnathos*, jaw). The precise mode of implantation of the teeth is not described.

The fossil was discovered at a depth of 21 feet from the surface, in a red sandstone supposed to be of the same age as that of Connecticut, so remarkable for the various and singular foot-marks, referable, some to reptiles, and others to large birds.

ORDER II.—CRYPTODONTIA.

Genus RHYNCHOSAURUS, Ow.

Sp. *Rhynchosaurus articeps*, Ow.[5]—The fossils in which the above order, genus, and species of reptile have been based are from the new red sandstone (trias) of Shropshire. They occur at the Grinsill quarries, near Shrewsbury, in a fine-grained sandstone, and also in a coarse burr-sandstone; in the latter the writer found imbedded some vertebræ, portions of the lower jaw, a nearly entire skull,

[1] *Geological Transactions*, 2d series, vol. v., p. 344.

[2] Würtemb. naturf. Jahreshefte, viii., Jahrg. 1857, p. 389. Jaeger's *Phytosaurus* appears to have been founded on casts of the sockets of the teeth of *Belodon*.

[3] *Reports of the British Association*, "Brit. Fossil Reptiles," 1841, p. 155. (See fuller descriptions, with figures, in *Odontography*, pl. 62, A, fig. 4, *a*, *b*.)

[4] *Journal of the Academy of Sciences*, Philadelphia, vol. ii., p. 327, pl. xxxiii.

[5] *Transactions of the Cambridge Philosophical Society*, vol. vii., part iii., 1842, p. 355, pl. 5 and 6.

Reptilia.

fragments of the pelvis and of two femora: in the fine-grained sandstone, vertebræ, ribs, and some bones of the scapular and pelvic arches are imbedded. The bones present a very brittle and compact texture; the exposed surface is usually smooth, or very finely striated, and of a light blue colour. The sandstones containing these bones occasionally exhibit impressions of footsteps which resemble those figured in the Memoir by Messrs Murchison and Strickland (*Geol. Trans.*, 2d series, vol. v., pl. xxviii. fig. 1), but differ in the more distinct marks of the claws, the less distinct impression of a web, the more diminutive size of the innermost toe, and an impression corresponding with the hinder part of the foot, which reminds one of a hind toe pointing backwards, and which, like the hind toe of some birds, only touched the ground with its point. The foot-prints are likewise more equal in size, and likewise in their intervals, than those figured by Messrs Murchison and Strickland: they measure from the extremity of the outermost or fifth toe to that of the innermost or first rudimental toe, about one inch and a half. They are the only foot-prints that have as yet been detected in the new red sandstone quarries at Grinsill. As the fossil bones have always been found nearly in the same bed as that impressed by the footsteps above described, they probably belong to the same animal.

Vertebræ.—Both articular surfaces of the centrum are concave, and are deeper than in the biconcave vertebræ of the extinct Crocodilians; the texture of the centrum is compact throughout.

The neural arch is anchylosed with the centrum, without trace of suture, as in most lizards: it immediately expands and sends outwards from each angle of its base a broad triangular process with a flat articular surface; the two anterior sufaces look directly upwards, the posterior ones downwards; the latter are continued backwards beyond the posterior extremity of the centrum; the tubercle for the simple articulation of the rib is situated immediately beneath the anterior oblique process. So far the vertebræ of the *Rhynchosaurus*, always excepting their biconcave structure, resemble the vertebræ of most recent lizards In the modification next to be noticed, they show one of the vertebral characters of the *Dinosauria.* A broad obtuse ridge rises from the upper convex surface of the posterior articular process and arches forwards along the neural arch above the anterior articular process, and gradually subsides anterior to its base: the upper part of this arched angular ridge forms, with that of the opposite side, a platform, from the middle line of which the spinous process is developed. Nothing of this kind is present in existing lizards; the sides of the neural arch immediately converge from the articular processes to the base of the spine, without the intervention of an angular ridge formed by the sides of a raised platform. The base of the spinous process is broadest behind, and commences there by two roots or ridges, one from the upper and back part of each posterior articular process. The anterior margin of the spinous process is thin and trenchant; the height of the spine does not exceed the antero-posterior diameter of its base; it is obliquely rounded off. The spinal canal sinks into the middle part of the centrum and rises to the base of the spine, so that its vertical diameter is twice as great at the middle as at the two extremities: this modification resembles in a certain degree that of the vertebræ of the *Palæosaurus* from the Bristol conglomerate.

The skull presents the form of a four-sided pyramid, compressed laterally, and with the upper facet arching down in a graceful curve to the apex, which is formed by the termination of the muzzle. The very narrow cranium, wide temporal fossæ on each side, bounded posteriorly by the parietal and the mastoid bones, and laterally by strong compressed zygomata; the long tympanic pedicle, descending freely and vertically from the point of union of the posterior transverse and zygomatic arches, and terminating in a convex pulley for the articular concavity of the lower jaw; the large and complete orbits, and the short, compressed, and bent down maxillæ, all combine to prove the fossil to belong to the lacertian division of the saurian order. The mode of articulation of the skull with the spine cannot be determined in the present specimen, but the lateral compression and the depth of the skull, the great vertical breadth of the superior maxillary bone, the small relative size of the temporal spaces, the vertical breadth of the lower jaw, prove that it does not belong to a reptile of the batrachian order. The shortness of the muzzle, and its compressed form, equally remove it from the Crocodilians. No Chelonian has the tympanic pedicle so long, so narrow, or so freely suspended to the posterior and lateral angles of the cranium.

Reptilia.

The general aspect of the skull differs, however, from that of existing Lacertians, and resembles that of a bird or turtle, which resemblance is increased by the apparent absence of teeth. The pre-maxillary bones, moreover, are double, as in crocodiles and Chelonians, but, with this exception, all the essential characters of the structure of the skull are those of the lizard.

The rami of the lower jaw are remarkable, as in *Bathygnathus*, for their great depth, but not the least trace of a tooth is discernible in the alveolar border of the dentary element.

The cranium has been preserved with the mouth in the naturally closed state, and the upper and lower jaws in close contact. In this state we must suppose that they were originally buried in the sandy matrix which afterwards hardened around them; and since lizards, owing to the unlimited reproduction of their teeth, do not become edentulous by age, we must conclude that the state in which the *Rhynchosaurus* was buried, with its lower jaw in undisturbed articulation with the head, accorded with its natural condition, while living, so far as the less perishable hard parts of its masticatory organs were concerned. Nevertheless, since a view of the inner side of the alveolar border of the jaws has not been obtained, we cannot be quite assured of the actual edentulous character of this very singular Saurian. The indications of a dental system are much more obscure in the *Rhynchosaurus* than in any existing Lacertian; the dentations of the upper jaw are absolutely feebler than in the chameleon, and no trace of them can be detected in the lower jaw, where they are strongest in the chameleon. The absence of the coronoid process in the *Rhynchosaurus*, which is conspicuously developed in all existing lizards, corresponds with the unarmed condition of the jaw, and the resemblance of the *Rhynchosaurus* in this respect to the *Chelys ferox*, would seem to indicate that the correspondence extended to the toothless condition of the jaws. The resemblance of the mouth to the compressed beak of certain sea-birds, the bending down of the curved and elongated pre-maxillaries, so as to be opposed to the deep symphysial extremity of the lower jaw, are further indications that the ancient Rhynchosaur may have had its jaws encased by a bony sheath, as in birds and turtles.

There are few genera of extinct reptiles of which it is more desirable to obtain the means of determining the precise modifications of the locomotive extremities than the *Rhynchosaurus.* The fortunate preservation of the skull has brought to light modifications of the lacertine structure leading towards Chelonia and birds which before were unknown; the vertebræ likewise exhibit very interesting deviations from the lacertian type. The entire reconstruction of the skeleton of the *Rhynchosaurus* may be ultimately accomplished, if due interest be taken in the collection and preservation of the fossils of the Grinsill quarries.

Genus OUDENODON, Bain.

Sp. *Oudenodon Bainii.*—The fossils on which the above genus and species are founded are from a bluish argillo-ferruginous limestone in South Africa, and form part of a collection transmitted to the British Museum by A. G. Bain, Esq.

One portion of the fossil skull includes all that part in advance of the temporal fossæ; the fore part of the temporal ridges, at the upper and back part of this fragment, curve as they diverge from each other to the back part of the orbit. The upper interorbital part of the cranium is nearly flat, with the orbital margins slightly raised, and terminating anteriorly in a low antorbital prominence; the least breadth of the interorbital space is 1 inch. A slight depression divides the antorbital from the supranasal tuberosities. The nasal bones form an almost flat rhomboid surface, from the contracted fore part of which the broad premaxillary part of the upper jaw inclines downward and forward at an open angle. This part is traversed by a low obtuse median ridge, and terminates below in a trenchant edentulous border.

The nostrils are small, oval, and separated from each other by the broad junction of the ascending branch of the premaxillary with them.

The maxillary bone presents the chief peculiarity, being traversed obliquely by a strong angular ridge, commencing a little anterior to the orbit, and terminating at the alveolar border, not far from the maxillo-premaxillary suture. The alveolar border gently curves to this termination, and shows no trace of a tooth or alveolus.

The compound structure of the lower jaw is shown at the fractured back part, where an upper (surangular ?) element, thick and rounded above, is received into an outer and lower element, thin above, and thick and bent below, forming a groove for the reception of the upper element. On the outer side of the jaw, about the middle of the part preserved, there is a longitudinal depression or

Reptilia.

narrow vacuity, above which there is a low ridge. The symphysis is thick, long, and bent up in the form of a beak, terminating by an edentulous sub-trenchant border; its fore and outer part is traversed by a low median ridge.

The length of this portion of the skull is 6 inches; its breadth across the maxillary ridges is 2 inches 10 lines; the extent of the symphysis of the lower jaw is 2 inches 6 lines Besides the evidence from the two nostrils, which removes the *Oudenodon*, like the *Rhynchosaurus*, from the chelonian order, Mr Bain, in a letter announcing the discovery of the fossils in South Africa, mentions the association of other bones with skulls, which gives additional proof of the saurian nature of the edentulous reptiles. He writes:[1]— "There were many skulls entirely without teeth, which we at first thought had belonged to Chelonians or turtles; but afterwards, finding that the animals had distinct narrow ribs, which Chelonians have not, we put them down also for something new, and named them "Oudenodons," or toothless animals.

ORDER III.—DICYNODONTIA.

Genus DICYNODON, Ow.—In 1844 Mr Andrew G. Bain, who had been employed in the construction of military roads in the colony of the Cape of Good Hope, discovered, in the tract of country extending northwards from the county of Albany, about 450 miles east of Cape Town, several nodules or lumps of a kind of sandstone, which, when broken, displayed in most instances evidences of fossil bones, and usually of a skull with two large projecting teeth. Accordingly these evidences of ancient animal life in South Africa were first notified to English geologists by Mr Bain under the name of "Bidentals;" and the specimens transmitted by him were submitted to the writer for examination. The results of the comparisons thereupon instituted went to show that there had formerly existed in South Africa, and from geological evidence, probably, in a great lake or inland sea, since converted into dry land, a race of reptilian animals presenting in the construction of their skull characters of the crocodile, the tortoise, and the lizard, coupled with the presence of a pair of huge sharp-pointed tusks, growing downwards, one from each side of the upper jaw, like the tusks of the mammalian morse or walrus. No other kind of teeth were developed in these singular animals: the lower jaw was armed, as in the tortoise, by a trenchant sheath of horn, some bones of the back, or vertebræ, by the hollowness of the co-adapted articular surfaces, indicate these reptiles to have been good swimmers, and probably to have habitually existed in water; but the construction of the bony passages of the nostrils proves that they must have come to the surface to breathe air.

Some extinct plants allied to the Lepidodendron, with other fossils, render it probable that the sandstones containing the dicynodont reptiles were of the same geological age as those that have revealed the remains of the Rhynchosaurs and Labyrinthodonts in Europe.

The generic name *Dicynodon* is from the Greek words signifying "two tusks or canine teeth." Three species of this genus have been demonstrated from the fossils transmitted by Mr Bain.

Sp. *Dicynodon lacerticeps*, Ow.[2]—This species is founded on a skull 6 inches in length, of which a reduced figure is given in cut 69, in which *C* shows the canine tusks.

Sp *Dicynodon testudiceps*, Ow.—In this species the skull, and the facial part more particularly, is shorter than in *D. lacerticeps*.

Sp. *Dicynodon strigiceps*, Ow.—The shortening of the jaws and blunting of the muzzle are carried to an extreme in this species, in which the nostrils are situated almost beneath the orbits.

Sp. *Dicynodon tigriceps*, Ow.[3]—In this species the length of the skull is 20 inches, its breadth across the widest part of the zygomatic arches being 18 inches. It differs from the *D. lacerticeps* not only in size, but in the relatively larger capacity of the temporal fossæ, and smaller size of the orbits. These cavities in *D. lacerticeps* occupy the middle third of the skull, but in *D. tigriceps* are wholly in the anterior half of the skull. The profile of the skull

Reptilia.

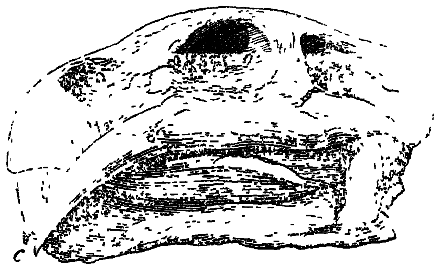

Fig. 69.

Skull and Tusks of *Dicynodon lacerticeps*.

in *D. lacerticeps* begins to slope or curve down from a line parallel with the back part of the orbits, but in *D. tigriceps* it does not begin to bend down until in advance of the orbits.

The vertebræ are bi-concave. The sacrum includes four or five vertebræ, which coalesce with unusually broad iliac bones. Some of the limb bones show a remarkable expansion of the distal end. The complete restoration of these most extraordinary bi-dental reptiles would be an extremely welcome addition to palæontology. No evidence of the genus has yet been met with out of South Africa. The English *Rhynchosaurus* seems, of all known European fossil reptiles, the most nearly akin to *Oudenodon* and *Dicynodon*.

ORDER IV.—ENALIOSAURIA [4]

The creatures called *Enaliosauria* or sea-lizards were vertebrate animals, or had back-bones, breathed the air like land-quadrupeds, but were "cold-blooded," or of a low temperature, like crocodiles and other reptiles. The proof that the Enaliosaurs respired atmospheric air immediately, and did not breathe water by means of gills like fishes, is afforded by the absence of the bony framework of the gill apparatus, and by the presence, position, and structure of the air-passages leading from the nostrils to the mouth, and also by the bony mechanism of the capacious chest or thoracic-abdominal cavity; all of which characters have been demonstrated by their fossil skeletons. With these characters the sea-lizards combined the presence of two pairs of limbs shaped like fins, and adapted for swimming.

The group of reptiles so termed includes all those which have any part of the thoracic-abdominal cavity encompassed by moveable ribs. The first character distinguishes them from the *Batrachia* and *Chelonia* with fin-shaped limbs

The *Enaliosauria*, however, do not form a strictly natural group, being based upon a single character relating to medium of life and locomotion. It is probable that the labyrinthodont reptiles may have had their limbs in structure and shape as paddles; but more important modifications of structure would keep them apart, like the lower *Batrachia* and the *Chelonia*, from the more lizard-like reptiles called *Enaliosauria*.

In this group there are two divisions,—one characterized by having five digits in the fin, the other by having more than that typical number. The pentadactyle division may be subdivided into those in which the ilio-pubic arch is attached to a sacrum and those on which it is freely suspended or not so attached. The polydactyle division presents a general type of structure more conformable with that of which the Archegosaurs and Labyrinthodonts manifest two phases of development, and in which the ascent from the gano-salamandroid fishes reaches its culminating point in *Ichthyosaurus*.

Sub-order 1.—SAUROPTERYGIA.

Genus NOTHOSAURUS, Münster.

Sp. *Nothosaurus mirabilis*, Münster.—In fig. 70 is given an analysis of the chief characters as yet ascertained of the species which may be regarded as the type of its family; by comparing this diagram with that of the *Archegosaurus* (fig. 65), the advance in the organization of the aquatic reptiles will be readily traced and understood.

The skull is no longer defended by a continuous covering of sculptured plate-bones; the vacuities behind the orbits for the temporal muscles are large and widely open. These vacuities are fenced externally by two long and slender horizontal bony bars;

[1] *The Eastern Province Monthly Magazine*, Graham's Town, September 1856.

[2] *Trans Geological Society*, 2d series, vol. vii. (*dis*, two, *kunodos*, canine-teeth).

[3] *Trans. Geol. Soc.*, 2d series, vol. vii., p. 233.

[4] From *ἐν, in, ἅλς, the sea, σαῦρος, a lizard.*

the upper one is formed by the mastoid (fig. 70, 8) and the postfontal (12), the lower one by the malar (27), and squamosal (28); the latter answering to the true zygomatic arch in Mammals. The squamosal abuts by its hinder expanded end against the almost vertical tympanic pedicle, which gives attachment to the lower jaw. This shows the reptilian compound structure: 29 marks the surangular element, 30 the angular one, 32 the dentary In the side-view of the skull in fig. 70, 22 is the premaxillary, 21 the maxillary, 15 the nasal—the cavity below being the nostril, 10 the prefontal—between which and 21 is the lacrymal, 11 the frontal above the orbit. The premaxillary teeth and corresponding premandibular ones are unusually long, strong, and sharp; there are two similar teeth in each maxillary; the remaining serial teeth are smaller, but equally acute. There are no teeth on the palate.

The almost entire and undisturbed vertebral column, from the muschelkalk of Bayreuth, figured by Von Meyer in pl. 23 of his work on muschelkalk Saurians, and attributed by him to *Nothosaurus mirabilis*, gives the earliest indication of that modification of the trunk-bones which reaches its maximum in the *Plesiosaurus* (fig. 72), in which it was first detected by the sagacity of Conybeare [1]

Twenty of the anterior vertebræ of this series, in *Nothosaurus*, which begins with the atlas, have the whole or part of the rib-pit situated on the centrum, as in the first vertebra in fig. 70; the pit is wholly there on fourteen vertebræ, it begins to ascend upon the neural arch in the fifteenth, as in the second vertebræ, given in fig. 70, and is wholly placed there on the twenty-first vertebra.

According, therefore, to the characters by which the writer has proposed [2] to distinguish the cervical from the dorsal vertebræ, *Nothosaurus* has twenty of the former. In the specimen referred to, nineteen consecutive vertebræ show the rib-pit supported

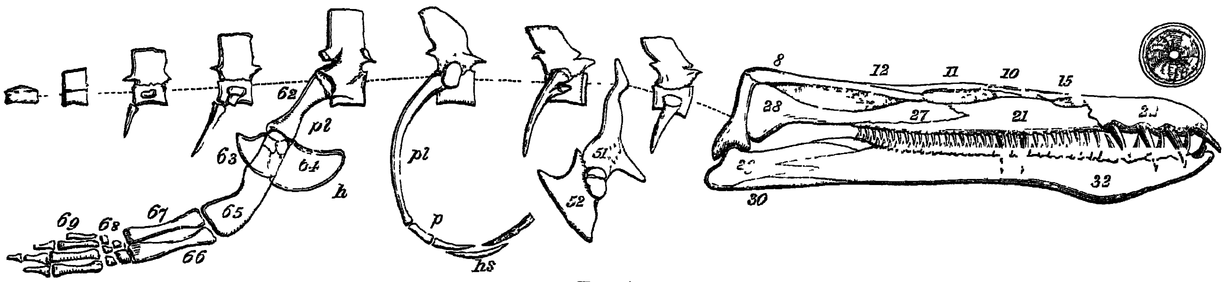

Fig. 70.

Nothosaurus (Trias)

wholly on an outstanding diapophysis from the neural arch, as in the third vertebra in fig. 70, these are to be reckoned therefore as dorsal vertebræ. In the cervical vertebræ the rib-pit is large, vertically reniform, not divided by a groove; its circumference slightly projects in *Nothosaurus*.

There is no clear evidence of any of the cervical ribs being terminally expanded and hatchet-shaped, as in *Plesiosaurus*; those of the back are vertically longer than in *Plesiosaurus*, and more convex.

In the sacral vertebræ, fourth in fig. 70, the rib-pits again begin to sink upon the centrum.

There are two distinct sacral vertebræ in *Nothosaurus*. They are known by their long, straight, terminally-bent, and convergent pleurapophyses, the first of which overlaps a little the second. To the convergent ends of these riblets, the ilium (fig. 70, 62, *pl*) was doubtless ligamentously affixed. In the first caudal vertebra the par- and di-apophyses stand out much farther than in the sacrum; but rapidly shorten in the second and third caudals. The compound process in each supports a short stiliform straight riblet, as in the fifth figured vertebra (fig 70); the anterior and succeeding caudals support hæmal arches and spines, after the disappearance of the pleurapophyses. The hæmal arch disappears in about the eighth vertebra from the end, and finally the neural arch. The terminal centrums are subelongate and subcompressed. Both *Nothosaurus* and *Pistosaurus* had abdominal ribs, of which the median piece (fig 70, *hs*) was subsymmetrical, the two rays diverging at a very open angle, and terminating in a point or a fork, the side-pieces (*p*) seem not to have been so numerous as in *Plesiosaurus*.

The scapula (fig. 70, 51) is a short and strong bone, its blade appearing as a short and narrow sub-compressed process extending from the subquadrate, thick and expanded end which affords the articular surfaces for the coracoid, clavicle, and humerus.

The clavicle, which is an exogenous process in *Plesiosaurus*, is here united by a strong oblique suture to the scapula. It expands into, or sends off from its outer part, a broad, flat, obtuse process, near the suture; then contracts and bends inwards to the episternum, to which it is articulated also by suture.

The coracoid (fig. 70, 52) sends forward a broad and short flattened process, separated by a narrow notch from the scapular part of its head; it then contracts and soon expands into a broad, flat, sub-triangular plate, the broad and straight border of which articulates with that of the opposite coracoid.

A wide unossified interval separates the coracoid from the episternum; their ossification in the direction of this interval gives the peculiar longitudinal or fore-and-aft extent to the coracoids of the Plesiosaur, in which these bones unite with the episternum.

The pelvic arch presents a closer correspondence with that in the *Plesiosaurus* (fig. 72).

The ischium (fig. 70, 63), contracting beyond its articular head, there expands into a flat subtriangular plate.

The pubis (fig. 70, 64) is a subcircular flat bone, with a notch near the articular end.

The bones of the limbs, although evidently those of fins or paddle-shaped extremities, are better developed than in *Plesiosaurus*, and more resemble the corresponding bones in the turtle (*Chelones*). The tuberosities or processes for muscular attachment near the head of the humerus (omitted in the diagram) are better marked, especially that on the concave side of the shaft; the distal end is thicker and less expanded. The whole bone is more curved than in any *Plesiosauri*. The femur (fig. 70, 65) is relatively longer and less expanded at its distal end. The bones of the fore arm, like those of the leg (fig. 70, 66 and 67), are longer than in *Plesiosaurus*. The articular surfaces present the foramina with raised borders, which characterize those in *Plesiosauri*, and which indicate the fibro-cartilaginous nature of the joints.

There is a ligamentous or unossified space at the back part of both carpus and tarsus (fig. 70, 68).

At present there is evidence of but four digits in both the fore and hind paddles of *Nothosaurus*; the metapodial and phalangeal bones are of the elongate flattened simple form, characteristic of supports of a tegumentary fin. One species of *Nothosaurus* (*N. Schimperi*, Von. M.) is from the lower division of the trias, called "grès bizarré" of Soulz-les-Bains; the other representatives of the genus (*N. giganteus*, *N. venustus*, *N Munsteri*, *N. Andriani*, *N. angustifros*, and *N. mirabilis*), are from the muschelkalk of Bayreuth and Luneville.

Genus PISTOSAURUS, Von Meyer.

Sp. *Pistosaurus longæous*—In this genus the facial part of the skull contracts abruptly in front of the orbits; so that, viewed from above, it resembles a long-necked bottle; the orbits are situated in the posterior half of the skull, and the nostrils are lateral. From the muschelkalk of Bayreuth.

Genus CONCHIOSAURUS, Von Meyer.

Sp. *Conchiosaurus clavatus.*—The facial part of the skull is less prolonged than in *Pistosaurus*, and the nostrils are terminal. The teeth are twelve in number on each side, are subequal, with widish intervals with pyriform crown. From the muschelkalk at Laineck, near Bayreuth

Genus SIMOSAURUS,[3] Von Meyer.

Sp. *Simosaurus Gaillardoti.*—The fossils, chiefly cranial, on which this genus is founded, occur in the dolomitic muschelkalk near Ludwigsberg, and in the muschelkalk of Luneville. The skull presents the large temporal fossæ, the divided nostrils, and the general depressed form and composition of that of *Nothosaurus* and *Pistosaurus*. But its facial part is much shorter; the muzzle is neither prolonged nor terminally expanded, but forms the obtuse

[1] *Trans. Geol. Soc.*, vol. vi., 1822, and vol. i., 2d series, p. 381, 1824.

[2] *Report of British Fossil Reptiles*, 1839, pp. 50, 58.

[3] Σιμος, *snub-nosed, flat-nose.*

Reptilia.

end of the short depressed face, of which the premaxillary part is the narrowest. The nostrils, consequently, although distant from the orbits by half the diameter of the latter, are yet nearer the fore end of the skull than in the above-cited macrotrachelian genera. The nostrils are relatively nearer to each other, the intervening bony tract due to the premaxillaries chiefly being, relatively to the breadth of the skull, much narrower in *Simosaurus* than in *Notho-* or *Pisto-saurus*.

The profile of the skull rises from the internasal to the interorbital regions much more than in the Nothosaur, and the depths of the skull, behind the orbit, is greater in proportion to its length. The post-frontals are most clearly produced backwards, along the upper border of the zygoma to the mastoids. The malars are coextended, and connected with the post-frontals, but terminate freely and obtusely a little beyond the co-prolonged hind part of the maxillary, without being met by or joining a squamosal

Most complete and extensive is the ossification of the roof of the mouth in this genus. The pterygoids are expanded into one broad unbroken imperforate flat expanse of bone, from about one-third of the distance from the snout to the occipital condyle; they are united by a median suture, and underlap the whole of the sphenoid. The teeth, compared with *Nothosaurus*, are few and large, and are subequal, save one or two at the fore and hind extremity of the series. The crown expands a little above the fang, is conical, sub-bifurcate, and impressed by a few coarse longitudinal ridges; some are obtuse, others acute; but all are shorter and thicker than in *Notho-* or *Pisto-saurus*.

The vertebræ have flat or very slightly concave articular surfaces on the body; the neural arch articulates therewith by suture. In these characters, and in their general proportions, they resemble those of *Notho-* and *Plesio-saurus*. It is significant of some difference in respect of the arrangement of the vertebræ in the same column, that although specimens from the tail, and from different parts of the back, have been obtained, no cervical vertebra with any probability belonging to this genus has yet been found. The caudal centrum presents two well-defined, rather prominent, hypapophyses for the hæmal arch. The coracoid in the contraction of the body reminded Cuvier of that of the *Ichthyosaurus*, but its expanded median part was differently shaped. The pubis, like that of the *Plesiosaurus*, resembles to a certain degree the pubis in *Chelonia*. The few bones of the limbs which have been found still more resemble, as do those of *Pistosaurus*, the corresponding bones of marine *Chelonia*.

Accordingly, there have been entered in palæontological catalogues an *Ichthyosaurus Lunevillensis* (De la Beche), a *Plesiosaurus Lunevillensis* (Münster), and a *Chelonia Lunevillensis* (Gray and Keferstein); but all these are parts of one and the same genus of Enaliosaurian, the "Saurien des environs de Lunéville" of Cuvier, the "Simosaurus" of H. von Meyer.

Genus PLACODUS.—The cranial structure in this genus of muschelkalk reptile is closely similar to that in *Simosaurus*, but its proportions are different; it is as broad as long; the greatest breadth being behind, whence the sides converge to an obtuse muzzle; the entire figure viewed from above being that of a right-angled triangle, with the corners rounded off The temporal fossæ are the widest, and zygomatic arches the strongest, in the whole class *Reptilia;* the lower jaw presents a like excessive development of the coronoid processes. These developments, for great size and power of action of the biting and grinding muscles, relate to a most extraordinary form and size of the teeth, which resemble paving-stones, and were evidently adapted to crack and bruise shells and crusts of marine Invertebrata.

The teeth of the upper jaw consist of an external or maxillary series, and an internal or palatal series. The maxillary series are supported in a marginal row of alveoli by the premaxillary and maxillary bones; the palatal series are implanted in the palatine and pterygoid bones. The maxillo-premaxillary teeth are five in number on each side, two implanted in the premaxillary, and three in the maxillary. The premaxillary teeth are subequal, smaller than the maxillary teeth; their crowns are subhemispheric in *P. laticeps*, but in *P. Andriani* they present bent, pointed, prehensile character. In *P. laticeps* the first maxillary tooth has a full oval crown, 4½ lines by 4 in diameter; the second measures 5½ lines by 4½ lines in diameter; the third is subcircular, 8 lines in diameter, on the right side. The palatal series begins on the inner side of this tooth, and consists of two teeth on each side. The first tooth has a full elliptical crown, 10 lines by 8; the second tooth, developed in the broad pterygoid bone, presents a full oval shape, 1 inch 9 lines by 1 inch 3 lines in diameter. In *Placodus gigas* and P. *Andriani* the palatal teeth, three in number on each side, are all of large size, slightly increasing from before backwards; they are situated close together, forming on each side a series a little curved with the convexity outwards, and the interspace between the two series is very narrow. The first tooth is triangular, the second and third are quadrangular; each with the angles rounded, and the transverse diameter exceeding the fore and aft or longitudinal one. The maxillary teeth are much smaller than the palatal ones, have a rounded or subquadrate crown, are four in number, and of subequal dimensions. The premaxillary teeth, three in number on each side, are more remote and distinct from the maxillary teeth than in *Placodus rostratus* and *P. laticeps*; their crowns are more elongated and conical than in *P. laticeps;* the prehensile power of the prolonged premaxillary part of the jaw being obviously greater in *Placodus gigas* than in *P. laticeps* or *P. rostratus*. The size of the last tooth in *P. laticeps* surpasses that of any of the teeth in the previously discovered species. In proportion to the entire skull, it is the largest grinding tooth in the animal kingdom, the elephant itself not excepted

All these teeth are implanted by short simple bases in distinct hollow sockets, subject to the same law of displacement and succession as in other reptiles. By some it may be deemed requisite to separate generically the *Placodi* with two teeth from those with three teeth in each palatal series; but the *Placodus rostratus* offers a transitional condition in the small relative size of the first two palatal teeth, and in the rounded form of all the teeth, from the *P. Andriani* to the *P. laticeps*.

We cannot contemplate the extreme and peculiar modification of form of the teeth in the genus *Placodus* without a recognition of their adaptation to the pounding and crushing of hard substances, and a suspicion that the association of the fossils with shell-clad Mollusks in such multitudes as to have suggested special denominations to the strata containing *Placodus* (*e.g*, muschelkalk, terebratulitenkalk, &c), is indicative of the class whence the *Placodi* derived their chief subsistence.

No doubt the most numerous examples of similarly-shaped teeth for a like purpose are afforded by the class of fishes, as, *e g*, by the extinct Pycnodonts, and by the wolf-fish (*Anarrhichas lupus*) and the Cestracion of the existing seas. But the reptilian class is not without its instances at the present day of teeth shaped like paving-stones, of which certain Australian lizards exhibit this peculiarity in so marked a degree that the generic name *Cyclodus* has been invented to express that peculiarity. Amongst extinct reptiles, also, a species of lizard from the tertiary deposits of the Limagne in France presents round obtuse teeth, of which the last, in the lower jaw, is suddenly and considerably larger than the rest.

Nothosaurus, *Simosaurus*, and *Pistosaurus* present the same evidences of lacertian affinities in the division of the nostrils by the median extension of the premaxillary backwards to the nasals, the same thecodont dentition, and the same circumscription of the orbits and temporal fossæ as in *Placodus:* there is also a general family likeness in the upward aspect of these apertures, accompanying an extreme depression of the skull. The muzzle, though varying greatly in length in these genera, presents the same obtuseness; and the alveolar border of the jaws the same smooth outward convexity which we observe in the *Placodus*. The peculiar confluence of the elements of the upper and lower zygomatic arches,—*i.e.*, of post-frontal and malar,—forming the broad wall of bone behind the orbit, is continued still further backwards in the *Simosaurus*. In *Pistosaurus* the elongated post-frontal, malar, and squamosal are united together in one deep zygomatic arch, which has the mastoid and tympanic for its hinder abutment.

It is remarkable that hitherto no vertebræ or other bones of the trunk or limbs have been found so associated with the teeth of *Placodus*, as to have suggested their belonging to the same species. Usually, after the indication of a reptile by detached teeth, the next step in its reconstruction is based upon detached vertebræ. The twelve or more evidences of *Placodus*, afforded by bone as well as tooth, are all portions of the skull.

It is possible that some of the singularly modified vertebræ from the muschelkalk, next to be described, may belong to the *Placodus;* and the same surmise suggests itself in reference to some of the limb-bones from the muschelkalk that cannot be assigned to other known saurian genera.

The obvious adaptation of the dentition of *Placodus* to the crushing of very hard kinds of food, its close analogy to the dentition of certain fishes known to subsist by breaking the shells of whelks and other shell-clad Mollusks, and the characteristic abundance of fossil shells in the strata to which the remains of *Placodus* are peculiar, concur in producing the belief that the species of this genus were reptiles frequenting the sea-shore, and probably good swimmers. But as at present we have got no further than the head and teeth in the reconstruction of this mezozoic form of molluscivorous reptile, the present notice will conclude with a remark suggested by the disposition and form of the teeth. In all the species, under the rather wide range of specific varieties of the dentition, there are two rows of the crushing teeth in the upper jaw, and only one row in the lower jaw, on each side of the mouth; and the lower

Reptilia.

row plays upon both upper rows, with its strongest (middle) line of force directed against their interspace. Thus the crushing force below presses upon a part between the two planes or points of resistance above, on the same principle on which we break a stick across the knee; only here the fulcrum is at the intermediate point, the moving powers at the two parts grasped by the hands. It is obvious that a portion of shell pressed between two opposite flat surfaces might resist the strongest bite, but subjected to alternate points of pressure its fracture would be facilitated [1]

Genus TANYSTROPHÆUS.

Sp. *Tanystrophæus conspicuus*, H. von Meyer.—Certain long,

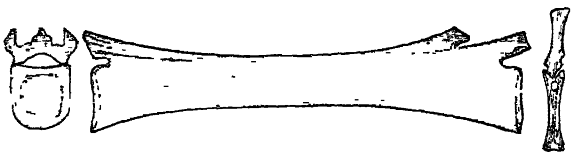

Fig. 71.
Tanystrophæus (Trias).

slender, hollow bones, from the German muschelkalk strata, were referred by Count Munster to the class *Reptilia*, under the name of *Macroscelosaurus*, under the impression that they were bones of the limbs. H. von Meyer subsequently, in more perfect specimens, observing that each slightly expanded extremity of the long bone was terminated by a symmetrical oval concave articular surface, surmounted by a pair of symmetrical lateral incurved plates, resembling confluent neurapophyses, with articular surfaces, and with their sometimes confluent bases arching over a neural canal (as in the left-hand figure in cut 71), recognised their vertebral character; and, adopting the determination of their reptilian nature, but repudiating the idea of their being limb-bones, he discarded Münster's name, and substituted for it that of *Tanystrophæus*,[2] indicative of their peculiar proportions as vertebræ. Although the articular ends are for the most part symmetrical, the long intervening body is not so. It is subcompressed, usually broader and flatter below than above; sometimes more flattened on one side than on the other, giving an irregular, vertically oval, or triangular cross section. A low median ridge is not uncommon on the lower surface towards the ends of the vertebra; and similar less regular ridges project from the sides of the otherwise smooth outer surface. The centrum is excavated by a canal, resembling a medullary one, but more probably filled, in the recent state, as in the long caudal style of the frog, with unossified cartilage. The walls of this cavity are compact, and in thickness about one-sixth of the diameter of the bone. The terminal neural arches support each a low median ridge or rudimental spine, which soon subsides. The trace of neural canal in like manner disappears, or is continued by two distinct slender canals which traverse for a certain extent the substance of the thicker upper wall of the cavity of the vertebral body. A single large vascular canal opens on the wider surface midway between the two ends of the body. There is no trace of transverse processes, rib-surfaces, or hæmapophyses; this, and the absence of the continuous neural canal, indicate these singular vertebræ to belong to the tail. From the long caudo-vertebral style of anourous Batrachia the vertebræ of *Tanystrophæus* differ in having distinct articular surfaces at both ends. The difference of shape and size in the few that have been found also indicates that there were more than two such vertebræ in the tail of the extraordinary animal to which they have belonged. Caudal vertebræ of the normal proportions and structure, from muschelkalk of the same localities with *Tanystrophæus* have been referred to *Nothosaurus*. It is possible, however, that one or other of the remarkable genera—*Simosaurus*, *Placodus*, e g.—may have possessed the peculiar structure in the tail, or some part of it, which the tanystrophæan vertebræ indicate. The first four vertebræ of the neck or trunk of the *Fistularia tabaccaria* are those which most resemble in their proportions the vertebræ above described; but none of the fistularian vertebræ have the articular concavity, and the zygapophyses, at both ends; the first presents them at the fore end, and the last at the hind end, and the modifications of both these finished articular ends pretty closely correspond with those of *Tanystrophæus*; but the second and third vertebræ of *Fistularia* are united with the first and fourth by sutural surfaces with deeply-interlocking pointed processes.

Genus SPHENOSAURUS.

Sp. *Sphenosaurus Sternbergii*, Von M.—The fossil vertebræ on which this genus is founded are imbedded in a sandstone, most like the bunter, from Bohemia or the south of Germany. Of the twenty-three vertebræ so preserved in nearly their natural position, and with their under surface exposed, five belong to the tail, the rest to the trunk. Of these, two are sacral, two lumbar, the rest are dorsal or thoracic, with long and slender ribs connected with them. The neural arch appears to have been suturally united to the centrum with large zygapophyses. The articular end of the centrum is vertical to its axis; both are slightly concave. Between each centrum is a transversely oval, depressed ossicle, homologous with the cervical wedge-bones or hypapophyses in Enaliosaurs. This is the chief peculiarity in *Sphenosaurus*, and recalls a character in the vertebral column of *Archegosaurus*.

Genus PLESIOSAURUS.—The discovery of this genus forms one of the most important additions that geology has made to comparative anatomy. Baron Cuvier deemed the structure of the Plesiosaur "to have been the most singular, and its characters the most anomalous that had been discovered amid the ruins of a former world." "To the head of a lizard it united the teeth of a crocodile, a neck of enormous length, resembling the body of a serpent, a trunk and tail having the proportions of an ordinary quadruped, the ribs of a chameleon, and the paddles of a whale." "Such," writes Dr Buckland, "are the strange combinations of form and structure in the *Plesiosaurus*, a genus, the remains of which, after interment for thousands of years amidst the wreck of millions of extinct inhabitants of the ancient earth, are at length recalled to light by the researches of the geologist, and submitted to our examination, in nearly as perfect a state as the bones of species that are now existing upon the earth."

The first remains of this animal were discovered in the lias of Lyme Regis about the year 1822, and formed the subject of the paper by the Rev. Mr Conybeare (afterwards dean of Llandaff), and Mr (afterwards Sir Henry) De la Beche, in which the genus was established, and named *Plesiosaurus* ("approximate to the Saurians"), from the Greek words, *plesios* and *sauros*, signifying "near" or "allied to," and "lizard," because the authors saw that it was more nearly allied to the lizard than was the *Ichthyosaurus* from the same formation.

The entire and undisturbed skeletons of several individuals, of different species, have since been discovered, fully confirming the sagacious restorations by the original discoverers of the *Plesiosaurus*.

Vertebral Column.—The vertebral bodies have their terminal articular surfaces either flat or slightly concave, or with the middle of such cavity a little convex. In general the bodies present two pits and holes at their under part. The cervical vertebræ consist of centrum, neural arch, and pleurapophyses. The latter are wanting in the first vertebra; but both this and the second have the hypapophyses.

The cervical ribs are short, and expand at their free end, so as to have suggested the term "hatchet-bones" to their first discoverers. They articulate by a simple head to a shallow pit, which is rarely supported on a process, from the side of the centrum; but is commonly bisected by a longitudinal groove, a rudimental indication of the upper and lower processes which sustain the cervical ribs in *Crocodilia*.

The body of the atlas articulates with a large hypapophysis below, with the neurapophysis above, with the body of the axis behind, and with part of the occipital condyle in front; all the articulations save the last become, in *Plesiosaurus pachyomus*, and probably with age in other species, obliterated by anchylosis. The hypapophysis forms the lower two-thirds, the neurapophysis contributes the upper and lateral parts, and the centrum forms the middle or bottom of the cup for the occipital condyle. The second hypapophysis is lodged in the inferior interspace between the bodies of the atlas and axis; it becomes anchylosed to these and to the first hypapophysis. The first pleurapophysis, or rudimental rib, is developed from the centrum of the axis.

As the cervical vertebræ approach the dorsal, the lower part of the costal pit becomes smaller, the upper part larger, until it forms the whole surface, gradually rising from the centrum to the neurapophysis.

The dorsal region is arbitrarily commenced by this vertebra, in which the costal surface begins to be supported on a diapophysis, which progressively increases in length in the second and third dorsal, continues as a transverse process to near the end of the trunk; and on the vertebra above or between the iliac bones, it subsides to the level of the neurapophysis. In the caudal vertebra the costal surface gradually descends from the neurapophysis upon the side of the centrum; it is never divided by the longitudinal groove which, in most *Plesiosauri*, indents that surface in

[1] Previous to the writer's Memoir on *Placodus* in the *Philosophical Transactions* (1858), all palæontologists had referred the genus to the pycnodont order of fishes.

[2] From *τανύω, to elongate, στρέφω, verto.*

the cervical vertebræ. The neural arches remain long unanchylosed with the centrum in all *Plesiosauri*, and appear to be always distinct in some species. The pleurapophyses gain in length, and lose in terminal breadth in the hinder cervicals; and become long and slender ribs in the dorsal region, curving outwards and downwards so as to encompass the upper two-thirds of the thoracic abdominal cavity. They decrease in length and curvature as they approach the tail, where they are reduced to short straight pieces, as in the neck, but are not terminally expanded; they cease to be developed near the end of the tail. The hæmapophyses in the abdominal region are subdivided, and with the hæmal spine or median piece, form a kind of "plastron" of transversely-extended, slightly-bent, median and lateral, overlapping, bony bars, occupying the subabdominal space between the coracoids and pubicals. In the tail the hæmapophyses are short and straight, and remain re-united both with the centrum above and with each other below. The hæmal spine is not developed in this region. This modification has been expressed by the statement that there were no chevron-bones in the Plesiosaur. The tail is much shorter in the *Plesio-* than in the *Ichthyo-saurus*.

The skull is depressed; its length is rather more than thrice its breadth; but the proportions somewhat vary in different species. The cranial part, or that behind the orbits, is quadrate; thence it contracts laterally to near the maxillo-premaxillary suture, where it continues either parallel or with a slight swelling before rounding into the obtuse anterior termination.

The orbits are at or near the middle of the skull, estimating the length of this by that of the lower jaw, they are in advance of the middle in *Plesiosaurus Hawkinsii*. The orbits are rather subtriangular than round, being somewhat squared off behind, straight above, and contracted anteriorly. No trace of sclerotic plates has yet been discerned in any specimen. The temporal fossæ are large subquadrate apertures. The nostrils, which are a little in advance of the orbits, are scarcely larger than the parietal foramen. Beneath them, upon the palate, are two similar-sized apertures, probably the palatal nostrils.

The lower jaw presents an angular, surangular, splenial, and dentary element, in each ramus; the dentary elements being confluent at the expanded symphysis. There is no vacuity between the angular and surangular or any other element of the jaw. The coronoid process is developed, as in *Placodus*, from the surangular, but rises only a little higher than in crocodiles. The alveoli are distinct cavities, and there is a groove along the inner border in both jaws.

When the successional teeth first project in that groove they give the appearance of a double row of teeth. All the teeth are sharp-pointed, long and slender, circular in cross section, with fine longitudinal ridges on the enamel; the anterior teeth are the longest.

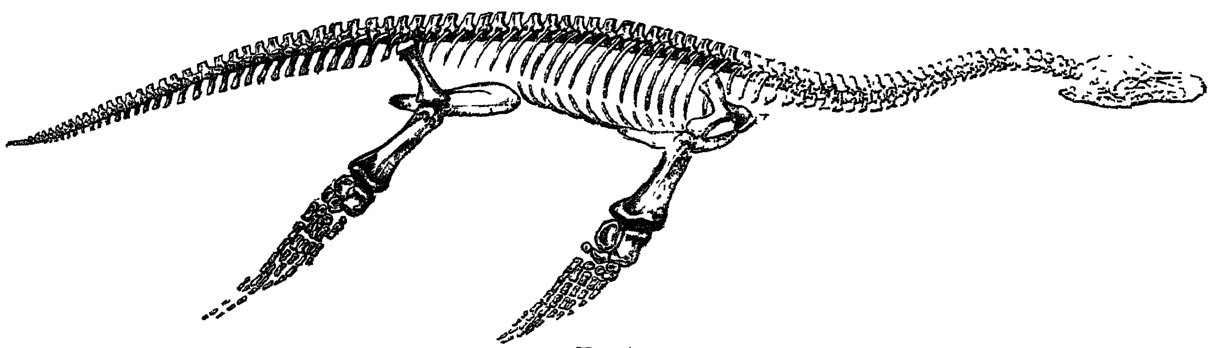

Fig. 72.

Plesiosaurus (Lias).

The scapula is a strong triradiate bone, the longest ray being formed by the acromial or clavicular process which arches forward and inward to abut against the sternum or epicoracoid.

The proper body of the scapula[1] is short and straight, somewhat flattened; the thick articular end, which forms the shortest ray, is subequally divided by the articular surface for the coracoid, and that for the head of the humerus.

The coracoids are chiefly remarkable for their excessive expansion in the direction of the axis of the trunk, extending from the abdominal ribs forward, so as to receive the entosternum, which is wedged into their anterior interspace. The median borders meet and unite for an extent determined by their degree of curvature or convexity, which is always slight.

The coracoids unite anteriorly with the clavicles as well as with the episternum; laterally they articulate with the scapula, combining to form the glenoid cavity for the humerus.

The episternum has the same general form as the median pieces of the abdominal ribs, being, like those pieces, a modified hæmal spine, only more advanced in position; the lateral wings or prolongations are broader and flatter; the median process is short; a longitudinal ridge projects from the middle of the internal surface. The humerus is a moderately thick and long bone, with a convex head, sub-cylindrical at its proximal end, becoming flattened and gradually expanded to its distal end, where it is divided into two indistinct surfaces for the radius and ulna. The shaft in most species is slightly curved backwards, or the hind border is concave, whilst the front one is straight. The radius and ulna are about half the length of the humerus; the former is straight, the latter curved or reniform, with the concavity towards the radius; both are flattened; the radius is a little contracted towards its carpal end, and in some species is longer than the ulna. The carpus consists of a double row of flat rounded discs,—the largest at the radial side of the wrist; the ulnar or hinder side appearing to have contained more unossified matter. The metacarpals, five in number, are elongate, slender, slightly expanded at the two ends, flattened, and sometimes a little bent. The phalanges of the five digits have a similar form, but are smaller, and progressively decrease in size; the expansion of the two ends, which are truncate, makes the sides or margins concave. The first or radial digit has generally three phalanges, the second from five to seven, the third eight or nine, the fourth eight, the fifth five or six phalanges. All are flattened; the terminal ones are nailless; and the whole were obviously included, like the paddle of the porpoise and turtle, in a common sheath of integument. The pelvic arch consists of a short but strong and straight narrow moveable ilium, and of a broad and flat pubis and ischium; the former subquadrate or subcircular, the latter triangular; the fore-and-aft expanse of both bones nearly equals that of the coracoids. All concur in the formation of the hip-joint. The ischium and pubis again unite together near their mesial borders, leaving a wide elliptic vacuity, or "foramen ovale" between this junction and their outer acetabular one. The pelvic paddle is usually of equal length with the pectoral one, but in *P. macrocephalus* it is longer. The bones closely correspond, in number, arrangement, and form, with those of the fore limb. The femur has the hind margin less concave, and so appears more straight. The fibula, in its reniform shape, agrees with its homotype the ulna. The tarsal bones are also smallest on the tibial side. Of existing reptiles, the lizards, and amongst these the old world Monitors (*Varanus*, Fitz.), by reason of the cranial vacuities in front of the orbits, most resemble the Plesiosaur in the structure of the skull. The division of the nostrils, the vacuities in the occipital region between the exoccipitals and tympanics, the parietal foramen, the zygomatic extension of the post-frontal, the palato-maxillary, and pterygo-sphenoid vacuities in the bony palate, are all lacertian characters, as contradistinguished from crocodilian ones.

But the antorbital vacuities between the nasal, pre-frontal, and maxillary bones are the sole external nostrils in the Plesiosaurs; the zygomatic arch abuts against the fore part of the tympanic, and fixes it. A much greater extent of the roof of the mouth is ossified than in lizards, and the palato-maxillary and pterygo-sphenoid fissures are reduced to small size. The teeth, finally, are implanted in distinct sockets. That the Plesiosaur had the "head of a lizard" is an emphatic mode of expressing the amount of resem-

[1] This is omitted in most of the published restorations of the *Plesiosaurus*.

Reptilia.

blance in their cranial conformation. The crocodilian affinities, however, are not confined to the teeth, but extend to the structure of the skull itself.

In the simple mode of articulation of the ribs, the lacertian affinity is again strongly manifested; but to this vertebral character such affinity is limited; all the others exemplify the ordinal distinction of the Plesiosaurs from known existing reptiles. The shape of the joints of the centrums; the number of vertebræ between the head and tail, especially of those of the neck; the slight indication of the sacral vertebræ; the non-confluence of the caudal hæmapophyses with each other, are all "plesiosauroid." In the size and number of abdominal ribs and sternum may perhaps be discerned a first step in that series of development of the hæmapophyses of the trunk which reaches its maximum in the plastron of the Chelonia.

The connation of the clavicle with the scapula is common to the *Chelonia* with the *Plesiosauri*; the expansion of the coracoids—extreme in *Plesiosauri*—is greater in *Chelonia* than in *Crocodilia*, but is still greater in some *Lacertia*. The form and proportions of the pubis and ischium, as compared with the ilium, in the pelvic arch of the *Plesiosauri*, find the nearest approach in the pelvis of marine Chelonia; and no other existing reptile now offers so near, although it be so remote, a resemblance to the structure of the paddles of the Plesiosaur. Amongst the many figurative illustrations of the nature of the Plesiosaur in which popular writers have indulged, that which compares it to a snake threaded through the trunk of a turtle is the most striking; but the number of vertebræ in the Plesiosaur is no true indication of affinity with the ophidian order of reptiles.

The reptilian skull from formations underlying the lias, to which that of *Plesiosaurus* has the nearest resemblance, is the skull of the *Pistosaurus*, from the German muschelkalk.[1] The nostrils have a similar position and diminutive size in *Pistosaurus*, but are somewhat more in advance of the orbits, and the premaxillaries enter into the formation of their boundary: the premaxillary muzzle and the temporal fossæ are also somewhat longer and narrower.

The post-frontals and mastoids more clearly combine with malars and squamosals in forming the zygomatic arch, which is of greater depth in *Pistosaurus*. the parietal foramen is larger: there is no trace of a median parietal crest. On the palate, besides the vacuities between the pterygoids and presphenoids, and the small foramina between the palatines, premaxillaries, and maxillaries, there is in *Pistosaurus* a single median foramen in advance of the latter foramina, between the pointed anterior ends of the pterygoids and the premaxillaries. In *Nothosaurus* the pterygoids extend back, underlapping the basi-sphenoid, as far as the basi-occipital, the median suture uniting them being well marked to their termination; and there is no appearance of vacuities like the pterygo-sphenoid ones in *Plesio-* and *Pisto-saurus*.

The tympanics are relatively longer, and extend farther back in *Pisto-* than in *Plesio-saurus*. There is no trace of lacrymals in *Pistosaurus*; and its maxillaries are relatively larger than in *Plesiosaurus*. In *Pistosaurus* there are 18 teeth on each side the upper jaw, including the 5 premaxillary teeth; in *Plesiosaurus* there are from 30 to 40 teeth on each side. In *Pistosaurus* the teeth are relatively larger, and present a more oval transverse section: the anterior teeth are proportionally larger than the posterior ones than they are in *Plesiosaurus*. The disproportion is still greater in *Nothosaurus*, in some species of which the teeth behind the premaxillary and symphysial terminal expansions of the jaws suddenly become —*e.g.*, in *Nothosaurus mirabilis* (fig. 70)—very small, and form a straight, numerous, and close-set single series along the maxillary and corresponding part of the mandibular bone.

Both *Nothosaurus* and *Pistosaurus* had many neck-vertebræ; and the transition from these to the dorsal series was effected, as in *Plesiosaurus*, by the ascent of the rib-surface from the centrum to the neurapophysis; but the surface, when divided between the two elements, projected further outwards than in most *Plesiosauri*.

In both *Notho-* and *Pisto-saurus* the pelvic vertebra develops a combined process (par- and di-apophysis), but of relatively larger, vertically longer size, standing well out, and from near the fore part of the side of the vertebra. This process, with the coalesced riblet, indicates a stronger ilium, and a firmer base of attachment of the hind limb to the trunk, than in *Plesiosaurus*. Both this structure, and the greater length of the bones of the fore arm and leg show that the muschelkalk predecessors of the liassic *Plesiosauri* were better organized for occasional progression on dry land. More than twenty species of *Plesiosaurus* have been described by, or are known to, the writer: their remains occur in the oolitic, Wealden, and cretaceous formations, ranging from the lias upwards to the chalk, inclusive. A comparison of remains of various *Plesiosauri* has led to a conviction, that specific distinctions are accompanied with well-marked differences in the structure and proportions of answerable vertebræ, but are not shown in small differences of number in the cervical, dorsal, or caudal vertebræ.

Reptilia.

When any region of the vertebral column presents an unusual excess of development in a genus, such region is more liable to variation, within certain limits, than in genera where its proportions are more normal. The differences of the number of cervical and dorsal vertebræ, ranging between 29 and 31 in the *Plesiosaurus Hawkinsii*, *e g.*,—as noted in the description of that species in the writer's *Report on British Fossil Reptiles*, 1839,—indicate the range of variety observed in the only species of which, at that time, the vertebral column of different individuals could be compared.

Genus PLIOSAURUS, Ow.—M. von Meyer regards the number of cervical vertebræ and the length of neck as characters of prime importance in the classification of *Reptilia*, and founds thereon his order called *Macrotrachelen*, in which he includes *Simosaurus*, *Pistosaurus*, and *Nothosaurus*, with *Plesiosaurus*. No doubt the number of vertebræ in the same skeleton bears a certain relation to ordinal groups: the *Ophidia* find a common character therein; yet it is not their essential character, for the snake-like form, dependent on multiplied vertebræ, characterizes equally certain Batrachians (*Cœcilia*) and fishes (*Murœna*). Certain regions of the vertebral column are the seats of great varieties in the same natural group of *Reptilia*. We have long-tailed and short-tailed lizards; but do not therefore separate those with numerous caudal vertebræ, as "Macroura," from those with few or more. The extinct *Dolichsaurus* of the Kentish chalk, with its procœlian vertebræ, cannot be ordinarily separated, by reason of its more numerous cervical vertebræ, from other shorter-necked procœlian lizards. As little can we separate the short-necked and big-headed amphicœlian Pliosaur from the Macrotrachelians with which it has its most intimate and true affinities.

There is much reason, indeed, to suspect that some of the muschelkalk Saurians, which are as closely allied to *Nothosaurus* as *Pliosaurus* is to *Plesiosaurus*, may have presented analogous modifications in the number and proportions of the cervical vertebræ. It is hardly possible to contemplate the broad and short-snouted skull of the *Simosaurus*, with its proportionally large teeth, without inferring that such a head must have been supported by a shorter and more powerful neck than that which bore the long and slender head of the *Nothosaurus* or *Pistosaurus*. The like inference is more strongly impressed upon the mind by the skull of the *Placodus*, still shorter and broader than that of *Simosaurus*, and with vastly larger teeth, of a shape indicative of their adaptation to crushing molluscous or crustaceous shells.

Neither the proportions and armature of the skull of *Placodus*, nor the mode of obtaining the food indicated by its cranial and dental characters, permit the supposition that the head was supported by other than a comparatively short and strong neck. Yet the composition of the skull, its proportions, cavities, and other light-giving anatomical characters, all bespeak the close essential relationship of *Placodus* to *Simosaurus* and other so-called "macrotrachelian" reptiles of the muschelkalk beds. The writer continues, therefore, to regard the fin-like modification of the limbs as a better ordinal character than the number of vertebræ in any particular region of the spine. But whilst retaining the term *Enaliosauria* for the large extinct natatory group of saurian reptiles, the essential distinctness of the groups *Sauropterygii* and *Ichyopterygii*, typified by the *Ichthyosaurus* and *Plesiosaurus* respectively, should be borne in mind.

Sp. *Pliosaurus brachydeirus*, Ow.—The generic characters of *Pliosaurus* are given by the teeth and the cervical vertebræ. As compared with those of *Plesiosaurus*, the teeth are thicker in proportion to their length, are subtrihedral in transverse section, with one side flattened, and bounded by lateral prominent ridges from

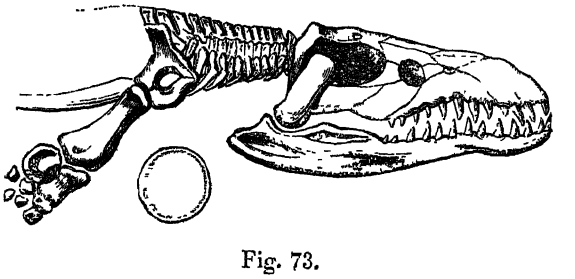

Fig. 73.
Pliosaurus (Kimmeridgian).

the more convex sides, which are rounded off into each other, and alone show the longitudinal ridges of the enamel; these are there very well defined. The vertebræ of the neck, presenting a flat

[1] Von Meyer, *Muschelkalk Saurier*.

articular surface of the shape shown in outline below the neck in fig. 73, are so compressed from before backward as to resemble the vertebræ of the *Ichthyosaurus*, and as many as twelve may be compressed within the short neck intervening between the skull and scapular arch, as shown in fig. 73. For the rest, save in the more massive proportions of the jaws and paddle-bones, the bony framework of *Pliosaurus* closely accords with that of *Plesiosaurus;* and, as the vertebræ of the trunk resume the plesiosaurian proportions, they give little indication of the genus of reptile to which they truly belong, when found detached and apart. Some individuals of *Pliosaurus* appear to have attained a bulk of between 30 and 40 feet. The remains of this modified form of Enaliosaur are peculiar to the Oxfordian and Kimmeridgian divisions of the upper oolitic system. They have been discovered in these beds in Russia (*Pliosaurus Worinskii* and *Spondylosaurus* of Fischer), as well as in those counties of England where the Kimmeridge and Oxford clays have been deposited.

Sub-order 2.—ICHTHYOPTERYGIA.

Genus ICHTHYOSAURUS.—The name (from the Greek *ichthys*, a fish, and *sauros*, a lizard) was devised to indicate the closer affinity of the Ichthyosaur, as compared with the Plesiosaur, to the class of fishes. The Ichthyosaur (fig. 74) is remarkable for the shortness

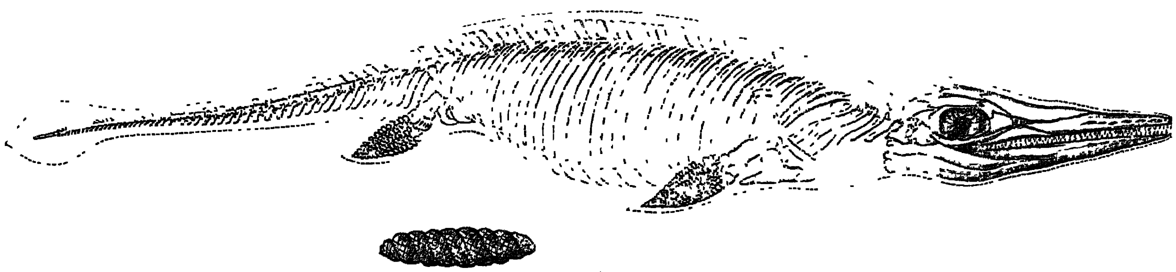

Fig. 74.

Ichthyosaurus (Lias).

of the neck and the equality of the width of the back of the head with the front of the chest, impressing the observer of the fossil skeleton with a conviction that the ancient animal must have resembled the whale tribe and the fishes, in the absence of any intervening constriction or "neck."

This close approximation in the Ichthyosaurs to the form of the most strictly aquatic vertebrate animals of the existing creation, is accompanied by an important modification of the surfaces forming the joints of the back-bone, each of which surfaces are hollow, leading to the inference that they were originally connected together by an elastic bag or "capsule" filled with fluid,—a structure which prevails in the class of fishes, in the Labyrinthodonts and a few extinct aquatic reptiles, in the existing perennibranchiate Batrachia, but not in any of the whale or porpoise tribe.

With the above modifications of the head, trunk, and limbs, in relation to swimming, there co-exist corresponding modifications of the tail. The bones of this part are much more numerous than in the Plesiosaurs, and the entire tail is consequently longer; but it does not show any of those modifications that characterize the bony support of the tail in fishes. The numerous "caudal vertebræ" of the *Ichthyosaurus* gradually decrease in size to the end of the tail, where they assume a compressed form, or are flattened from side to side, and thus the tail, instead of being short and broad as in fishes, is lengthened out as in crocodiles.

The very frequent occurrence of a fracture of the tail, about one-fourth of the way from its extremity, in well preserved and entire fossil skeletons, is owing to that proportion of the end of the tail having supported a tail fin. The only evidence which the fossil skeleton of a whale would yield of the powerful horizontal tail-fin characteristic of the living animal, is the depressed or horizontally-flattened form of the bones supporting such fin. It is inferred, therefore, from the corresponding bones of the *Ichthyosaurus* being flattened in the vertical direction, or from side to side, that it possessed a tegumentary tail fin expanded in the vertical direction. The shape of a fin composed of such perishable material is of course conjectural, as is the outline in fig. 74. Thus, in the construction of the principal swimming organ of the *Ichthyosaurus* we may trace, as in other parts of its structure, a combination of mammalian (beast-like), saurian (lizard-like), and piscine (fish-like) peculiarities. In the great length and gradual diminution of the tail we perceive its saurian character; in the tegumentary nature of the fin, unsustained by bony fin-rays, its affinity to the same part in the mammalian whales and porpoises is shown; whilst its vertical position makes it closely resemble the tail fin of the fish.

The horizontality of the tail fin of the whale tribe is essentially connected with their necessities as warm-blooded animals breathing atmospheric air; without this means of displacing a mass of water in the vertical direction, the head of the whale could not be brought with the required rapidity to the surface to respire; but the Ichthyosaurs, not being warm-blooded or quick breathers, would not need to bring their head to the surface so frequently or so rapidly as the whale; and moreover a compensation for the want of horizontality of their tail fin was provided by the addition of a pair of hind paddles, which are not present in the whale tribe. The vertical fin was a more efficient organ in the rapid cleaving of the liquid element, when the Ichthyosaurs were in pursuit of their prey or escaping from an enemy.

The general form of the cranium of the *Ichthyosaurus* resembles that of the ordinary cetaceous dolphin (*Delphinus tursio*); but the *I. tenuirostris* rivals the *Delphinus gangeticus* in the length and slenderness of the jaws. The essential difference in the sea-reptile lies in the restricted size of the cerebral cavity, and the vast depth and breadth of the zygomatic arches, to which the seeming expanse of the cranium is due; still more in the persistent individuality of the elements of those cranial bones which have been blended into single though compound bones in the sea-mammal. The *Ichthyosaurus* further differs in the great size of the premaxillary and small size of the maxillary bones, in the lateral aspects of the nostrils, in the immense size of the orbits, and in the large and numerous sclerotic plates, which latter structures give to the skull of the *Ichthyosaurus* its most striking features.

The true affinities of the Ichthyosaur are, however, to be elucidated by a deeper and more detailed comparison of the structure of the skull; and few collections now afford richer materials for pursuing and illustrating such comparisons than the palæontological series in the British Museum[1] The two supplemental bones of the skull, which have no homologues in existing Crocodilians, are the post-orbital and super-squamosal; both, however, are developed in *Archegosaurus* and the Labyrinthodonts. The post-orbital is the homologue of the inferior division of the post-frontal in those Lacertians—*e g., Iguana, Tejus, Ophisaurus, Anguis*, in which that bone is said to be divided. But in *Ichthyosaurus* the post-orbital resembles most a dismemberment of the malar. Its thin obtuse scale-like lower end overlaps and joins by a squamous suture the hind end of the malar: the post-orbital expands as it ascends to the middle of the back of the orbit, then gradually contracts to a point as it curves upward and forward, articulating with the super-squamosal and post-frontal. The super-squamosal may be in like manner regarded as a dismemberment of the squamosal; were it confluent therewith, the resemblance which the bone would present to the zygomatic and squamosal parts of the mammalian temporal would be very close; only the squamosal part would be removed from the inner wall to the outer wall of the temporal fossa. The super-squamosal, in fact, occupies the position of the temporal fascia in *Mammalia*, and should be regarded as a supplemental sclero-dermal plate, closing the vacuity between the upper and lower elements of the zygomatic arch, peculiar to certain air-breathing *Ovipara*. It is a broad, thin, flat, irregular-shaped plate, smooth and slightly convex externally, and wedged into the interspaces between the post-frontal, post-orbital, squamosal, tympanic, and mastoid.

The principal vacuities or apertures in the bony walls of the skull of the *Ichthyosaurus* are the following:—In the posterior region the "foramen magnum," the occipito-parietal vacuities, and

[1] The anatomical reader is referred to the writer's "Report on British Fossil Reptiles," *Trans. Brit. Assoc.* 1839, and to the *Annals and Magazine of Natural History*, 1858, p. 388.

Reptilia.

the auditory passages; on the upper surface the parietal foramen and the temporal fossæ; on the lateral surfaces the orbits and nostrils, the plane of the aperture in both being vertical; on the inferior surface the palato-nasal, the pterygo-sphenoid, and the pterygo-malar vacuities. The occipito-parietal vacuities are larger than in *Crocodilia*, smaller than in *Lacertilia*, they are bounded internally by the basi-, ex-, and super-occipitals, externally by the parietal and mastoid. The auditory apertures are bounded by the tympanic and squamosal. The tympanic takes a greater share in the formation of the "meatus auditorius" in many lizards; in crocodiles it is restricted to that which it takes in *Ichthyosaurus*.

The orbit is most remarkable in the *Ichthyosaurus*, amongst reptiles, both for its large proportional size and its posterior position; in the former character it resembles that in the lizards, in the latter that in the crocodiles. It is formed by the pre- and post-frontals above, by the lacrymal in front, by the post-orbital behind, and by the peculiar long and slender malar bar below. In crocodiles and in most lizards the frontal enters into the formation of the orbits, and in lizards the maxillary also. The nostril is a longish triangular aperture, with the narrow base behind; it is bounded by the lacrymal, nasal, maxillary, and pre-maxillary. It is proportionally larger than in the *Plesiosaurus*, and is distant from the orbit about half its own long diameter. Like the orbit, the plane of its outlet is vertical.

The pterygo-palatine vacuities are very long and narrow, broadest behind, where they are bounded, as in lizards, by the anterior concavities of the basi-sphenoid, and gradually narrowing to a point close to the palatine nostrils. These are smaller than in most lizards, and are circumscribed by the palatines, ecto-pterygoid, maxillary, and pre-maxillary. The pterygo-malar fissures are the lower outlets of the temporal fossæ; their sudden posterior breadth, due to the emargination of the pterygoid, relates to the passage of the muscles for attachment to the lower jaw. The parietal foramen is bounded by both parietals and frontals; its presence is a mark of labyrinthodont and lacertian affinities, its formation is like that in *Iguana* and *Rhynchocephalus* The temporal fossæ are bounded above by the parietal internally, by the mastoid and post-frontal externally; they are of an oval form, with the great end forward. In their relative size and backward position they are more crocodilian than lacertian.

In the *Ichthyosaurus communis* there are seventeen sclerotic plates forming the fore part of the eyeball. In a well-preserved example, the pupillary or corneal vacuity, as bounded by those plates, is of a full oval form, 1½ inch in long diameter, the length of the plates (or breadth of the frame) being from 8 to 10 lines. In the same skull the long diameter of the orbit is 4 inches. The deep position of the sclerotic circle in this cavity showed how they had sunk, by pressure of the external mud, as the eyeball became collapsed by escape of the humours in decomposition.

Whenever the antecedent forms an extinct genus of any class are known, the characters of such genus should be compared with those of its predecessors rather than with its successors or with existing forms, in order to gain an insight into its true affinities.

We derive a truer conception of the affinities of the *Ichthyosaurus* by comparison with the Labyrinthodonts and other triassic reptiles, as we do of the *Plesiosaurus* by comparison with the muschelkalk *Sauropterygia*, than of either by comparison with modern Lacertians and Crocodilians. It is commonly said that the *Ichthyo-* or the *Plesiosaurus* resembles more the lizards in such and such characters, and in a less degree the crocodiles, as in such a character. The truer expression would be that the lizards, which are the predominating form of Saurians at the present day, have retained more of the osteological type of the triassic and oolitic reptiles, and that the crocodiles deviate further from them or exhibit a more modified or specialized structure. The posterior position of the nostrils, the small size and position of the palato-pterygoid foramen, are marks of affinity to *Plesiosaurus*, in common with which genus the cranial structure of the *Ichthyosaurus* exhibits a majority of lacertian characters.

In comparing the jaws of the *Ichthyosaurus termirostris* with those of the gangetic Gharrial an equal degree of strength and of alveolar border for teeth result from two very different proportions in which the maxillary and premaxillary bones are combined together to form the upper jaw. The prolongation of the snout has evidently no relation to this difference; and we are accordingly led to look for some other explanation of the disproportionate development of the premaxillaries in the *Ichthyosaurus*. It appears to me to give additional proof of the collective tendency of the affinities of the *Ichthyosaurus* to the lacertian type of structure. The backward or antorbital position of the nostrils, like that in whales, is related to their marine existence. But in the Lacertians in which the nostrils extend to the fore part of the head, their anterior boundaries are formed by the premaxillaries: it appears, therefore, to be in conformity with the lacertian affinities of the Ichthyosaur that the premaxillaries should still enter in the same relation with the nostrils, although this involves an extent of anterior development proportionate to the length of the jaws, the forward production of which sharp-toothed instruments fitted them, as in the modern dolphins, for the prehension of agile fishes.

Reptilia.

That the Ichthyosaurs occasionally sought the shores, crawled on the strand, and basked in the sunshine, may be inferred from the bony structure connected with their fore fins, which does not exist in any porpoise, dolphin, grampus, and whale; and for want of which, chiefly, those warm-blooded, air-breathing, marine animals are so helpless when left high and dry on the sands. The structure in question in the Ichthyosaur is a strong osseous arch, inverted and spanning across beneath the chest from one shoulder-joint to the other; and what is most remarkable in the structure of this "scapular" arch is, that it closely resembles, in the number, shape, and disposition of its bones, the same part in the singular aquatic mammalian quadruped of Australia, called *Ornithorynchus*, and *Platypus*, or duck-mole. The Ichthyosaur, when so visiting the shore either for sleep or procreation, would lie or crawl prostrate, or with its belly resting or dragging on the ground.

The most extraordinary feature of the head was the enormous magnitude of the eye: and from the quantity of light admitted by the expanded pupil, it must have possessed great powers of vision, especially in the dusk. It is not uncommon to find in front of the orbit in fossil skulls, a circular series of petrified thin bony plates, ranged round a central aperture, where the pupil of the eye was placed. The eyes of many fishes are defended by a bony covering consisting of two pieces; but a compound circle of overlapping plates is now found only in the eyes of turtles, tortoises, lizards, and birds. This curious apparatus of bony plates would aid in protecting the eye-ball from the waves of the sea when the *Ichthyosaurus* rose to the surface, and from the pressure of the dense element when it dived to great depths; and they show, writes Dr Buckland (*Bridgewater Treatise*) "that the enormous eye of which they formed the front, was an optical instrument of varied and prodigious power, enabling the *Ichthyosaurus* to descry its prey at great or little distances, in the obscurity of night, and in the depths of the sea."

Of no extinct species are the materials for a complete and exact restoration more abundant and satisfactory than of the *Ichthyosaurus*; they plainly show that its general external figure must have been that of a huge predatory abdominal fish, with a longer tail and a smaller tail-fin, scaleless, moreover, and covered by a smooth or finely wrinkled skin, analogous to that of the whale tribe.

The mouth was wide, and the jaws long, and armed with numerous pointed teeth, indicative of a predatory and carnivorous nature in all the species; but these differed from one another in regard to the relative strength of the jaws, and the relative size and length of the teeth.

Masses of masticated bones and scales of extinct fishes that lived in the same seas and at the same period as the *Ichthyosaurus*, have been found under the ribs of fossil specimens, in the situation where the stomach of the animal was placed; smaller, harder, and more digested masses, containing also fish-bones and scales have been found, bearing the impression of the structure of the internal surface of the intestine of the great predatory sea-lizard. One of these "Coprolites" is figured beneath the skeleton in fig. 74.

In tracing the evidences of creative power from the earlier to the later formations of the earth's crust, remains of the *Ichthyosaurus* are first found in the lower lias, and occur more or less abundantly through all the superincumbent secondary strata up to, and inclusive of, the chalk formations. They are most numerous in the lias and oolite, and the largest and most characteristic species have been found in these formations.

More than thirty species of *Ichthyosaurus* are known to the writer, many of which have been described or defined.

ORDER V.—DINOSAURIA.

Char.—Cervical and anterior dorsal vertebræ, with par- and di-apophyses, articulating with bifurcate ribs; dorsal vertebræ, with a neural platform, sacral vertebræ exceeding two in number; body supported on four strong unguiculate limbs.

The well-ossified vertebræ, large and hollow limb-bones, and tritrochanterian femora of the thecodont reptiles of the Bristol conglomerate, together with the structure of the sacral vertebræ in the allied *Belodon*, indicate the beginning, at the triassic period, of an order of *Reptilia* which acquired its full development and typical characteristics in the oolitic period.

Genus SCELIDOSAURUS, Ow.—By this name is indicated a Saurian with large and hollow limb-bones, with a femur having the third inner trochanter, and with metacarpal and phalangial bones,

adapted for movement on land. The fossils occur in the lias at Charmouth, Dorsetshire.

Genus MEGALOSAURUS, Bkld.—The true dinosaurian characters of this reptile have been established by the discovery of the sacrum, which consists of five vertebræ, interlocked by the alternating position of neural arch and centrum. The articular surfaces of the free vertebræ are nearly flat; the neural arch develops a platform which in the anterior dorsals supports very long and strong spines. The dental characters are described and figured in the article ODONTOLOGY, vol. xvi., p. 433, fig. 48.

The oldest known beds from which any remains of *Megalosaurus* have been obtained are the lower oolites at Selsby Hill, and Chipping-Norton, Gloucestershire. Abundant and characteristic remains occur in the Stonesfield slate, Oxfordshire. Teeth of the *Megalosaurus* have been found in the Cornbrash and Bath oolite; both teeth and bones are common in the Wealden strata and Purbeck limestone. Some of these fossils indicate a reptile of at least 30 feet in length.

Genus HYLÆOSAURUS, Mtll.—Remains of the Dinosaurian so called have hitherto been found only in Wealden strata, as at Tilgate, Bolney, and Battle. The most instructive evidence is that which was exposed by the quarrymen of the Wealden stone at Tilgate, and obtained and described by Mantell in 1832. It consisted of a block of stone measuring 4½ feet by 2½ feet (fig. 75), and included the following parts of the skeleton in almost

Fig. 75.

Hylæosaurus (Wealden).

natural juxtaposition:—10, Anterior vertebræ, the first supporting part of the base of the skull; several ribs, 4, 4; some enormous dermal bony spines, 5, 6, 6, which supported a strong defensive crest along the back; two coracoids, 7, 7; scapulæ, 8, 8; and some detached vertebræ and fragments of bones. The sacrum was dinosaurian, and included five vertebræ.

The teeth were relatively small, close-set, thecodont in implantation, with subcylindrical fang and a subcompressed slightly expanded and incurved crown, with the borders straight, and converging to the blunt apex. They indicate rather a mixed or vegetable diet than a carnivorous one. The skin was defended by subcircular bony scales. The length of the Hylæosaur may have been 25 feet.

Genus IGUANODON, Mtll.—Remains of these large herbivorous reptiles have been found in Wealden and neocomian (greensand) strata. Femora, 4 feet in length, showing the third inner trochanter, have been discovered. The sacrum included five, and in old animals six vertebræ; the claw-bones are broad, flat, and obtuse. There were only three well-developed toes on the hind foot, and singular large tridactyle impressions, discovered by Beccles in the Wealden at Hastings have been conjectured to have been made by the Iguanodon. The characteristic dentition of this genus is described in the article ODONTOLOGY, p. 435, figs. 42, 43, and 44. All trace of dinosaurian reptiles disappears in the lower cretaceous beds.

ORDER VI.—PTEROSAURIA.

The species of this order of reptiles are extinct, and peculiar to the mezozoic period. Their chief characteristic is the development of the pectoral limbs into organs of flight (fig. 76). This is due to an elongation of the antibrachial bones, and more especially to the still greater length of the metacarpal and phalangial bones of the fifth or innermost digit (fig. 76, 5), the last phalanx of which terminates in a point. The other fingers were of more ordinary length and size, and terminated by claws. The number of phalanges is progressive from the first (fig. 76, 1) to the fourth (4), which is a reptilian character. The whole osseous system is modified in accordance with the possession of wings; the bones are light, hollow, most of them permeated by air-cells, with thin compact outer walls. The scapula and coracoid are long and narrow, but strong. The vertebræ of the neck are few, but large and strong, for the support of a large head with long jaws, armed with sharp-pointed teeth. The skull was lightened by large vacuities, of which one (*o*, fig. 76) is interposed between the nostril *n* and the orbit *l*. The

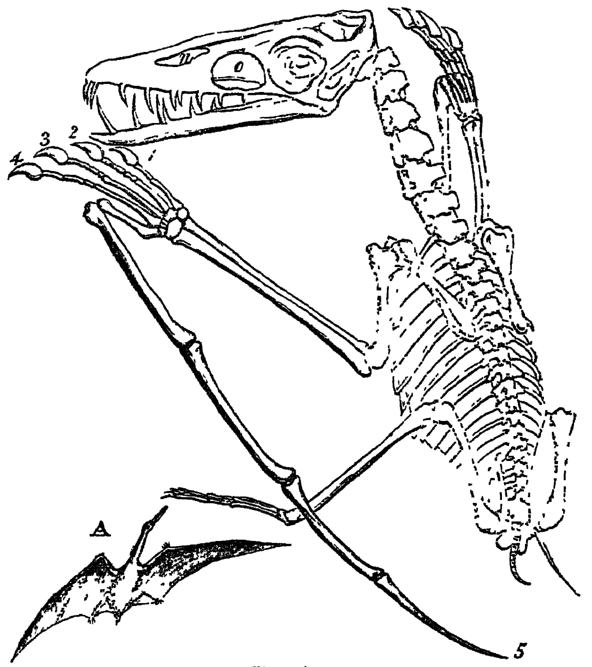

Fig. 76.

Fossil Skeleton of *Pterodactylus crassirostris*: A, Sketch of Living Pterodactyle.

vertebræ of the back are small, and grow less to the tail. Those of the sacrum are few and small, and the pelvis and weak hind limbs bespeak a creature unable to stand and walk like a bird. The body must have been dragged along the ground like that of a bat. But the *Pterosauria* may have been good swimmers as well as flyers. The vertebral bodies unite by ball-and-socket joints, the cup being anterior, and in them we have the earliest manifestation of the "procœlian" type of vertebra. The atlas consists of a discoid centrum, and of two slender neuropophyses; the centrum of the axis is ten times longer than that of the atlas, with which it ultimately coalesces; it sends off from its under and back part a pair of processes, above which is transversely extended convexity articulating with the third cervical vertebra. In each vertebra there is a large pneumatic foramen at the middle of the side. The neural arch is confluent with the centrum. Dentition thecodont.

Genus DIMORPHODON, Ow.

Sp. *Dimorphodon macronyx*, Bkd.—The Pterodactyles are distributed into sub-genera, according to well-marked modifications of the jaws and teeth. In the oldest known species, from the lias, the teeth are of two kinds; a few at the fore part of the jaws are long, large, sharp-pointed, with a full elliptical base; behind them is a close-set row of short, compressed, very small lancet-shaped teeth. In a specimen of *Dimorphodon macronyx*, from the lower lias of Lyme Regis, the skull was 8 inches long, and the expanse of wing about 4 feet. There is no evidence of this species having had a long tail.

Genus RAMPHORHYNCHUS, Von Meyer.—In this genus the fore part of each jaw is without teeth, and may have been encased by a horny beak, but behind the edentulous production there are four or five large and long teeth, followed by several smaller ones. The tail is long, stiff, and slender.

The *Ramphorhynchus longicaudus*, *R. Gemmingi*, and *R. Münsteri* belong to this genus. All are from the lithographic (middle oolitic) slates of Bavaria.

Genus PTERODACTYLUS, Cuv.—The jaws are provided with teeth to their extremities; all the teeth are long, slender, sharp-pointed, set well apart. The tail is very short.

P. longirostris, Ok.—About 10 inches in length; from lithographic slate at Pappenheim. *P. crassirostris*, Goldf.—About 1 foot long; same locality (fig. 76.) *P. Kochii*, Wagn.—8 inches long; from the lithographic slates of Kehlheim. *P. medius*, Mnst.—10 inches long; from the lithographic slates at Meulenhard. *P.*

Reptilia.

grandis, Cuv.—14 inches long; from lithographic slates of Solenhofen. Two small and probably immature Pterodactyles, showing the short jaws characteristic of such immaturity, have been entered as species under the names of *P. brevirostris* and *P. Meyeri*. The latter shows the circle of sclerotic eye-plates.

The fragmentary remains of Pterodactyle from British oolite,—e g, Stonesfield slate, usually entered as *Pterodactylus Bucklandi*,—indicate a species about the size of a raven.

The evidences of Pterodactyles from the Wealden strata indicate species about 16 inches in length of body. Those (*P. Fittoni*, and *P. Sedgwickii*, Ow) from the greensand formation, near Cambridge, with neck-vertebræ 2 inches long, and humeri measuring 3 inches across the proximal joint, had a probable expanse of wing of from 18 to 20 feet. The *P. Cuvieri*, Ow., and *P. compressirostris*, Ow., from the chalk of Kent, attained dimensions very little inferior to those of the greensand Pterodactyles

More evidence is yet needed for the establishment of the pterosaurian genus, on the alleged character of but two phalanges in the wing-finger, and for which the term "Ornithopterus" has been proposed by Von Meyer.

With regard to the range of this remarkable order of flying reptiles in geological time, the oldest well-known Pterodactyle is the *Dimorphodon macronyx*, of the lower lias; but bones of Pterodactyle have been discovered in the coeval lias of Wirtemberg. The next in point of age is the *Ramphorhynchus Banthensis*, from the "Posidonomyen-schiefer" of Banz in Bavaria, answering to the alum shale of the Whitby lias; then follows the *P. Bucklandi* from the Stonesfield oolite. Above this come the first-defined and numerous species of Pterodactyle from the lithographic slates of the middle oolitic system in Germany, and from Cirin, on the Rhone. The Pterodactyles of the Wealden are as yet known to us by only a few bones and bone fragments. The largest known species are those from the greensand of Cambridgeshire. Finally, the Pterodactyles of the middle chalk of Kent, almost as remarkable for their great size, constitute the last forms of flying reptile known in the history of the crust of this earth.

ORDER VII.—CROCODILIA.

Char.—Teeth in a single row, implanted in distinct sockets, external nostril single and terminal or sub-terminal. Anterior trunk vertebræ with par- and di-apophyses, and bifurcate ribs; sacral vertebræ two, each supporting its own neural arch. Skin protected by bony, usually pitted plates.

Sub-order 1.—AMPHICŒLA.[1]

Crocodiles closely resembling in general form the long and slender-jawed kind of the Ganges called Gavial, existed from the time of the deposition of the lower lias.

Their teeth were similarly long, slender, and sharp, adapted for the prehension of fishes, and their skeleton was modified for more efficient progress in water by the vertebral surfaces being slightly concave, by the hind limbs being relatively larger and stronger, and by the orbits forming no prominent obstruction to progress through water. From the nature of the deposits containing the remains of the so-modified crocodiles, they were marine. The fossil crocodile from the Whitby lias, described and figured in the *Philosophical Transactions*, 1758, p. 688, is the type of these amphicœlian species. They have been grouped under the following generic heads:—*Teleosaurus, Steneosaurus, Mystriosaurus, Macrospondylus, Massospondylus*, to which must be added *Pœcilopleuron, Pelagosaurus, Æolodon, Suchosaurus, Goniopholis, Polyptychodon*.

Species of the above genera range from the lias to the chalk inclusive.

Suchosaurus of the Wealden is characterized by the compressed crown and trenchant margins of the teeth; *Goniopholis*, of the Purbeck beds, by some of the dermal scales having the same peg-and-pit interlocking as in the scales of the ganoid fish in fig. 52; *Polyptychodon* of the greensand and chalk, by the well-defined numerous longitudinal ridges of the enamel; from the size of some of these teeth, this crocodile, like the Pterodactyles of the same period, appears to have been the largest of its group; it surpassed all other Amphicœlians in size.

Sub-order 2.—OPISTHOCŒLIA.[2]

The small group of Crocodilia so called is an artificial one, based upon more or less of the anterior trunk vertebræ being united by ball-and-socket joints, but having the ball in front, instead of, as in modern crocodiles, behind Cuvier first pointed out this peculiarity[3] in a Crocodilian from the Oxfordian beds at Honfleur, and the Kimmeridgian at Havre. The writer has described similar opisthocœlian vertebræ from the great oolite at Chipping Norton, from the upper lias of Whitby, and, but of much larger size, from the Wealden formations of Sussex and the Isle of Wight. These specimens probably belong, as suggested by the writer in 1841,[4] to the fore part of the same vertebral column as the vertebræ, flat at the fore part, and slightly hollow behind, on which he founded the genus *Cetiosaurus*. The smaller opisthocœlian vertebræ described by Cuvier have been referred by Von Meyer to a genus called *Streptospondylus*.

In one species from the Wealden, dorsal vertebræ measuring 8 inches across are only 4 inches in length, and caudal vertebræ nearly 7 inches across are less than 4 inches in length. These characterize the species called *Cetiosaurus brevis*.[5]

Caudal vertebræ measuring 7 inches across and 5½ inches in length, from the lower oolite at Chipping Norton, and the great oolite at Enstone, represent the species called *Cetiosaurus medius*.

Caudal vertebræ from the Portland stone at Garsington, Oxfordshire, measuring 7 inches 9 lines across and 7 inches in length, are referred to the *Cetiosaurus longus*. The latter must have been the most gigantic whale-like of Crocodilians, unless it were equalled in bulk by the *Polyptychodon* of the chalk.

Sub-order 3.—PROCŒLIA.[6]

Crocodilians with cup-and-ball vertebræ, like those of living species, first make their appearance in the greensand of North America (*Crocodilus basifissus* and *C. basitruncatus*). In Europe their remains are first found in the tertiary strata. Such remains from the plastic clay of Meudon have been referred to *C. isorhynchus, C. cœlorhynchus, C. Becquereli*. In the calcaire grossier of Argenton and Castelnaudry have been found the *C. Rallinati* and *C. Dodunii*. In the coeval eocene London clay at Sheppy Island the entire skull and characteristic parts of the skeleton of *C. toliapicus* and *C Champsoides* occur. In the somewhat later eocene beds at Bracklesham occur the remains of the gavial-like *C. Dixoni* In the Hordle beds have been found the *C. Hastingsiæ*, with short and broad jaws; and also a true alligator (*C. Hantoniensis*). It is remarkable that forms of procœlian Crocodilia, now geographically restricted—the gavial to Asia, and the alligator to America—should have been associated with true crocodiles, and represented by species which lived, during nearly the same geological period, in rivers flowing over what now forms the south coast of England.

Many species of procœlian Crocodilia have been founded on fossils from miocene and pliocene tertiaries. One of these, of the gavial sub-genus (*C. crassidens*), from the Sewalik tertiary, was of gigantic dimensions.

ORDER VIII.—LACERTILIA.

Char.—Vertebræ procœlian, with a single transverse process on each side, and with single-headed ribs; sacral vertebræ not exceeding two.

Small vertebræ of this type have been found in the Wealden of Sussex. They are more abundant, and are associated with other generic characteristic parts of the species, in the cretaceous strata. On such evidence have been based the *Raphiosaurus subulidens*, the *Coniasaurus crassidens*, and the *Dolichosaurus longicollis*. The last-named species is remarkable for the length and slenderness of its trunk and neck, indicative of a tendency to the ophidian form. But the most remarkable and extreme modification of the lacertian type in the cretaceous period is that manifested by the huge species, of which a cranium 5 feet long was discovered in the upper chalk of St Peter's Mount, near Maestricht, in 1780. The vertebræ are gently concave in front, and convex behind; there are thirty-four between the head and the base of the tail: a sacrum seems to have been wanting. The caudal vertebræ have long neural and hæmal spines, both of which arches coalesce with the centrum, and formed the basis of a powerful swimming tail. The teeth are anchylosed to eminences along the alveolar border of the jaw, according to the acrodont type. There is a row of small teeth on each pterygoid bone. For this genus of huge marine lizard the name *Mosasaurus* has been proposed. Besides the *M Hofmanni* of Maestricht, there

[1] *Amphi*, both, *koilos*, hollow; the vertebra being hollowed at both ends.

[2] *Opisthos*, behind, *koilos*, hollow; vertebra concave behind, convex in front.

[3] *Annales du Muséum*, tom. xii., p. 83, pl. x., xi.

[4] "Report on British Fossil Reptiles," *Trans. Brit. Assoc.* for 1841, p. 96.

[5] They have since been referred to the dinosaurian order under the name of *Pelorosaurus*, but without any evidence of the true sacral characters of that order; the cavities of long bones are common to Crocodilians and Dinosaurs.

[6] *Pros*, front, *koilos*, hollow; vertebra with the cup at the fore part and the ball behind.

Reptilia.

is a *M. Maximiliani*, from the cretaceous beds of North America, and a smaller species, *M. gracilis*, from the chalk of Sussex The *Leiodon anceps* of the Norfolk chalk was a nearly allied marine Lacertian. Many small terrestrial Lacertians have left their remains in European tertiary formations.

ORDER IX.—OPHIDIA.

(*Serpents.*)

The earliest evidence of an ophidian reptile has been obtained from the eocene clay at Sheppy: it consists of vertebræ indicating a serpent of 12 feet in length, the *Palæophis toliapicus*. Still larger, more numerous, and better preserved vertebræ have been obtained from the eocene beds at Bracklesham, on which the *Palæophis typhœus* and *P. porcatus* have been founded. These remains indicate a boa-constrictor-like snake, of about 20 feet in length. Ophidian vertebræ of much smaller size, from the newer eocene at Hordwell, support the species called *Paleryx rhombifer* and *P depressus.* Fossil vertebræ from a tertiary formation near Salonica have been referred to a serpent, probably poisonous, under the name of *Laophis*. A species of true viper has been discovered in the miocene deposits at Sansans, South of France. Three fossil Ophidians from the Œningen slate have been referred to *Coluber arenatus, C. Kargii*, and *C. Owenii*.

ORDER X.—CHELONIA.

(*Tortoises and Turtles.*)

Reference has already been made to the impressions in sandstones of triassic age in Dumfriesshire, referred by Dr Duncan to tortoises. These impressions have been finely illustrated in the great work by Sir William Jardine on the foot-prints at Corncockle Muir. The earliest proof of chelonian life which the writer has obtained has been afforded by the skull of the *Chelone planiceps*, from the Portland stone; and by the carapace and plastron of the extinct and singularly-modified emydian genera *Tretosternon* and *Pleurosternon*[1] (fig. 77). In the first genus the plastron retains the central vacuity; in the second genus an additional pair of bones is interposed between the hyosternals (*hs*) and hyposternals (*ps*). In the specimen figured (fig. 77), the plastron, and the under surface

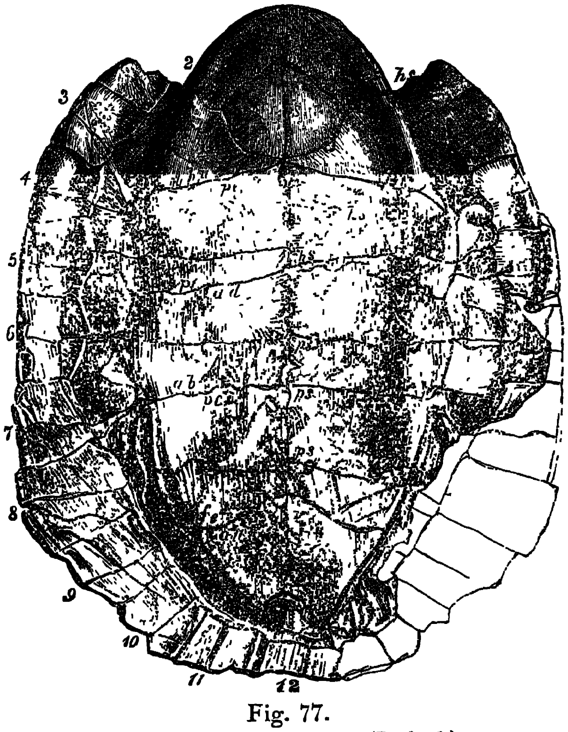

Fig. 77.

Pleurosternon emarginatum (Purbeck).

of the marginal pieces (2 to 12) of the carapace, of *Pleurosternon emarginatum* are shown. This fine Chelonite is now in the British Museum.

True marine turtles (*Chelone Camperi, C. obovata, C. pulchriceps*) have left their remains in cretaceous beds. The emydian *Protemys* is from the greensand near Maidstone. The eocene tertiary deposits of Britain yield rich evidences of marine, estuary, and fresh-water tortoises. More species of true turtle have left their remains in the London clay at the mouth of the Thames than are now known to exist in the whole world; and all the eocene *Chelones* are extinct. One of them (*C. gigas*, Ow.) attained unusual dimensions; the skull, now in the British Museum, measures upwards of a foot across its back part.[2] The estuary genus *Trionyx* (soft turtle) is represented by many beautiful species in the upper eocene at Hordwell; the fresh-water genera *Emys* and *Platemys* by as many species both at Sheppy and Hordwell. In the pliocene of Œningen remains of a species of *Chelydra* have been discovered; this generic form is now confined to America. Remains of land-tortoises (*Testudo*, Brong.) indicate several extinct species in the miocene and pliocene formations of continental Europe. Strata of like age in the Sewalik Hills have revealed the carapace of a tortoise 20 feet in length; it is called by its discoverers, Cautley and Falconer, *Colossochelys atlas*. The same locality has also afforded the interesting evidence of a species of *Emys* (*E. tectum*, Gray) having continued to exist from the (probably miocene) period of the *Sivatherium* to the present day.

ORDER XI.—BATRACHIA.

It is only in tertiary and post-tertiary strata that extinct species, referable to still existing genera or families of this order, have been found. The reptiles with amphibian or batrachian characters, of the carboniferous and triassic periods, combined those characters with others which gave them distinctions of perhaps ordinal value; they illustrated, indeed, rather a retention of more general cold-blooded vertebrate type, with concomitant piscine and saurian features, than any near affinity with the more specially modified reptilian forms to which the name *Batrachia* is given in zoological catalogues of existing species.

Of the tailless or "anourous" Batrachia, toads of extinct species (*Palæophrynos Gessneri* and *P. dissimilis*) have been discovered in the Œningen beds; and frogs, more abundantly, in both miocene and pliocene deposits of France and Germany. Of the salamander family, the most noted fossil is that which was referred, when first discovered at Œningen in 1726, to the human species, as *Homo diluvii testis*. Cuvier demonstrated its near affinities to the water-salamander (*Menopoma*) of the United States · more recently a living species of salamander has been discovered in Japan which equals in size the fossil in question—*Andrias Scheuzeri*.

A retrospect of the foregoing outline of the palæontology of the class of reptiles shows that, unlike that of fishes, it is now on the wane; and that the period when *Reptilia* flourished under the greatest diversity of forms, with the highest grade of structure, and of the most colossal size, is the mezozoic. The manifestation of the more generalized vertebrate structure is illustrated by the affinities to ganoid fishes shown by the *Ganocephala, Labyrinthodontia*, and *Ichthyosauria*; by the affinities of the *Pterosauria* to birds, and by the approximation of the *Dinosauria* to Mammals. It is also shown by the combination of modern crocodilian and lacertian characters in the Thecodonts and sauropterygian Enaliosaurs. Even the Chelonia of the Purbeck period illustrate the same principle, by the more typical number of modified hæmapophyses, or abdominal ribs, entering into the composition of their plastron. The diagram (fig. 78) gives a concise view of the geological relations, or distribution in time, of the principal groups of the class *Reptilia*. In the column opposite the right hand, the dark mark shows that the ganocephalous group represented by the *Archegosaurus* began, culminated, and ended in the carboniferous period. The Labyrinthodonts, culminating in the trias, disappear at the base of the oolitic system. Of the true *Batrachia*, those retaining the tail appear to have been at their maximum during the upper tertiary period, and to have begun to decline after that time; whilst the tailless genera and species are most numerous and various at the present day. The *Ophidia* resemble the *Anoura*, commencing in the older tertiary, and showing their maximum of development at the present day. The true procœlian, and especially the pleurodont lizards, commencing a little earlier in the chalk, have also gone on increasing in number and variety of forms to the present day. The acrodont group was represented by *Mosasaurus*, under the maximum of size, during the cretaceous period. The Thecodonts have but the partial affinity to modern *Lacertilia* which the Labyrinthodonts bear to the modern *Batrachia*. The great ordinal groups of *Enaliosauria, Pterosauria*, and *Dinosauria*, together with the amphi- and opistho-cœlian crocodiles, passed

[1] *Monograph of the Fossil Chelonian Reptiles of the Wealden and Purbeck Limestones*, 4to, 1853, Palæontographical Society.

[2] The upper end of the femur from Sheppy, in t. xxix. of *Monograph of Fossil Reptilia of the London Clay*, Palæontographical Society, 1850, belongs to this species.

away ere the tertiary time had dawned The procœlian crocodiles culminating in the lower and midd'e tertiary times are now on the wane. Perhaps, also, the same might be said of the *Chelonia*, in regard to the size of individuals, and number of species of certain genera; but the number of generic and subgeneric forms of the order now existing, as compared with the known extinct tertiary forms, is signified by the same expansion of the black mark as in the case of the lizards, serpents, frogs, and toads.

Table of Geological Distribution of Reptilia.

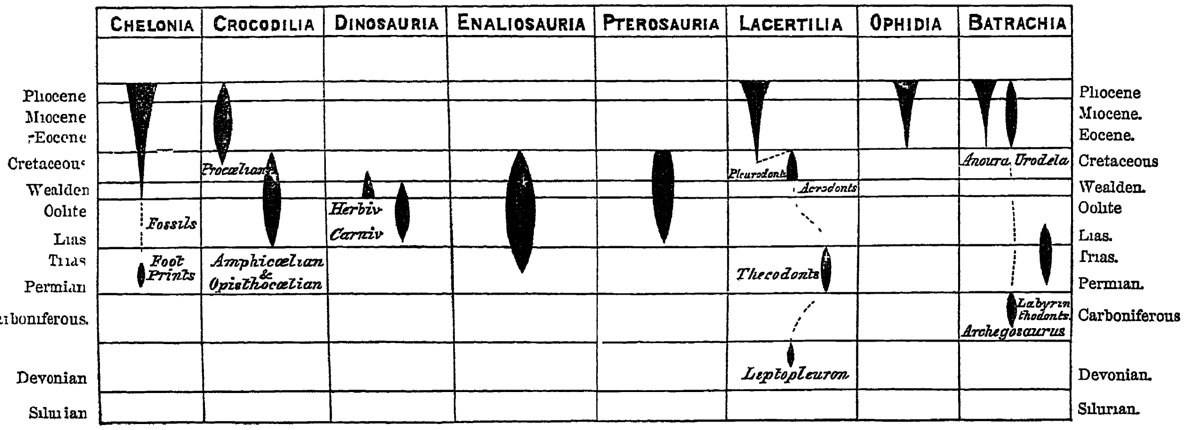

Fig. 78.

Class II.—AVES.

Long before any evidence of birds from actual or recognisable fossil remains is obtained in tracing the progress of life from the oldest fossiliferous deposits upwards, we meet with indications of their existence impressed in sandstones of the triassic or liassic period.

These earliest evidences of the class are by foot-prints in some former tidal shore, preserved in one or other of the ways explained in the section "Ichnology." The fossil bones of birds have not been found save in strata of much later date than the impressed sandstones; and they are much more rare than the remains of mammals, reptiles, and fishes, in any formations except the most recent in certain limited localities,—*e g*, New Zealand.

Sir C. Lyell has well remarked, that "the powers of flight possessed by most birds would insure them against perishing by numerous casualties to which quadrupeds are exposed during floods." The same writer further argues, that "if they chance to be drowned, or to die when swimming on water, it will scarcely ever happen that they will be submerged so as to become preserved in sedimentary deposits."[1] It is true that the carcase of a floating bird may not sink where it has died, but be carried far along the stream. ultimately, however, if not devoured, its bones will subside when the soft parts have rotted, and both the compactness of the osseous tissue, and the facts made known by the ornitholites of the greensand near Cambridge, of the London clay at Sheppy, and of the Montmartre eocene quarry-stone, show that they can be preserved in the fossil state. The length of time during which the carcase of a bird may float, doubtless exposes it the more to be devoured, and so tends to make more scarce the fossil remains of birds in sedimentary strata.

Certain it is that the major part of the remains of extinct birds that have as yet been found are those of birds that were deprived of the power of flight, and were organized to live on land.

The existence of birds at the triassic period in geology, or at the time of the formation of sandstones which are certainly intermediate between the lias and the coal, is indicated by abundant evidences of foot-prints impressed upon those sandstones which extend through a great part of the valley of the Connecticut River, in Connecticut and Massachusetts, North America.

The foot-prints of birds are peculiar, and more readily distinguishable than those of most other animals. Birds tread on the toes only; these are articulated to a single metatarsal bone at right angles equally to it, and they diverge more from each other, and are less connected with each other, than in other animals, except as regards the web-footed order of birds.

Not more than three toes are directed forward:[2] the fourth when it exists, is directed backward, is shorter, usually rises higher from the metatarsal, and takes less share in sustaining the superincumbent weight. No two toes of the same foot in any bird have the same number of joints. There is a constant numerical progression in the number of phalanges (toe-joints), from the innermost to the outermost toe. When the back toe exists, it is the innermost of the four toes, and it has two phalanges, the next has three, the third or middle of the front toes has four, and the outermost has five phalanges. When the back toe is wanting, as in some waders, and most wingless birds, the toes have three, four, and five phalanges respectively. When the number of toes is reduced to two, as in the ostrich, their phalanges are respectively four and five in number; thus showing those toes to answer to the two outermost toes in tridactyle and tetradactyle birds.

The same numerical progression characterizes the two phalanges in most lizards from the innermost to the fourth; but a fifth toe exists in them which has one phalanx less than the fourth toe. It is the fifth toe which is wanting in every bird In some *Gallinacea*, one or two (*Pavo bicalcaratus*) spurs are superadded to the metatarsus; but this peculiar weapon is not the stunted homologue of a toe. Dr Deane and Mr Marsh of Greenfield, United States, first noticed, in 1835, impressions resembling the feet of birds in the sandstone rocks near that town. Dr Hitchcock, president of Amherst College, United States, whose attention was called to these impressions, first made public the fact, and submitted to a scientific ordeal his interpretations of those impressions as having been produced by the feet of living birds, and he gave them the name of *Ornithichnites*.

It was a startling announcement, and a conclusion that must have had strong evidence to support it, since one of the kinds of the tracks had been made by a pair of feet, each leaving a print 20 inches in length. Under the term *Ornithichnites giganteus*, however, Dr Hitchcock did not shrink from announcing to the geological world the fact of the existence, during the period of the deposition of the red sandstones of the valley of the Connecticut, of a bird which must have been at least four times larger than the ostrich[3] The impressions succeeded each other at regular intervals; they were of two kinds, but differing only as a right and left foot, and alternating with each other, the left foot a little to the left, and the right foot a little to the right, of the mid-line between the series of tracks. Each foot-print (fig. 79, *b* and *r*) exhibits three toes, diverging as they extend forwards. The distance between the tips of the inside and outside toes of the same foot was 12 inches. Each toe was terminated by a short strong claw projecting from the mid toe a little on the inner side of its axis, from the other two toes a little on the outer side of theirs. The end of the metatarsal bone to which those toes were articulated rested on a two-lobed cushion which sloped upwards behind. The inner toe (*r*) showed distinctly two phalangeal divisions, the middle toe three, the outer toe (*b*) four. And since, in living birds, the penultimate and ungual phalanges usually leave only a single impression, the inference was just, that the toes of this large foot had been characterized by the same progressively-increasing number of phalanges, from the inner to the outer one, as in birds. And, as in birds also, the toe with the greatest number of joints was not

[1] *Principles of Geology*, ed. 1847, p. 721.
[2] Save in the Swift.
[3] *American Journal of Science* for 1836, vol xxix, pl. i

Aves.

the longest; it measured, *e.g.*, 12½ inches, the middle toe from the same base-line measured 16 inches, the outer toe 12 inches. Some of the impressions of this huge tridactylous footstep were so well preserved as to demonstrate the papillose and striated character of the integument covering the cushions on the under side of the foot. Such a structure is very similar to that in the ostrich. The average extent of stride, as shown by the distance between the impressions, was between 3 and 4 feet; the same limb was therefore carried out each step from 6 to 7 feet forward in the ordinary rate of progression.

These foot-prints, although the largest that have been observed on the Connecticut sandstones, are the most numerous. The gigantic Brontozoum, as Principal Hitchcock proposes to term the species, "must have been," he writes, "the giant rulers of the valley. Their gregarious character appears from the fact, that at some localities we find parallel rows of tracks a few feet distance from one another."

The strata of red sandstone, with the above-described impressions, occupy an area more than 150 miles in length, and from 5 to 10 miles in breadth "Having examined this series of rocks in many places, I feel satisfied that they were formed in shallow water, and for the most part near the shore; and that some of the beds were from time to time raised above the level of the water and laid dry, while a newer series, composed of similar sediment, was forming." "The tracks have been found in more than twenty places, scattered through an extent of nearly 80 miles from N. to S., and they are repeated through a succession of beds attaining at some points a thickness of more than 1000 feet, which may have been thousands of years in forming."[1]

One of the evidences of birds from the Cambridge greensand, transmitted to the writer by their discoverer, Mr Barret, is the lower half of the trifid metatarsal, showing the outer toe-joint much higher than the other two, and projecting backwards above the middle joint; it indicates a bird about the size of a woodcock.

In the conglomerate and plastic clay at the base of the eocene tertiary system at Mendon, near Paris, the leg and thigh bones (tibia and femur) of a bird (*Gastornis Parisiensis*) have been discovered: they indicate a genus now extinct. They belonged to a species as large as an ostrich, but more robust, and with affinities to wading and aquatic birds.[2] In the eocene clay of Sheppy fossil remains of birds have been found, indicating a small vulture (*Lithornis vulturinus*); also a bird, probably of the king-fisher family (*Halcyornis toliapicus*), and a species of the sea-gull family. In the same formation at Highgate remains of a species of the heron family have been found.

The fossil bones of birds from the gypsum quarries at Montmartre were referred or approximated by Cuvier to eleven distinct species. Good ornitholites have been obtained from the Hordwell fresh-water deposits. The most ancient example of a passerine bird is the *Protornis Glarisiensis*, founded on an almost entire skeleton discovered in the schistose rock of Glaris, referable to the older division of the eocene tertiary series. This skeleton is about the size of a lark, and in some respects similar to that bird.

Comparisons of the ornitholites of the eocene tertiaries show that the following ordinal modifications of the class of birds were at that period represented, the *raptorial*, or birds of prey, by species of the size of our ospreys, buzzards, and smaller falcons, and most probably also by an owl; the *insessorial*, or tree-perching birds, by species seemingly allied to the nuthatch and the lark; the *scansorials* or anisodactyles, by species as large as the cuckoo and king-fisher; the *rasorials*, by a species of small quail; the *cursorials*, by a species as large as, but with thicker legs than, an ostrich; the *grallatorial*, by a curlew of the size of the ibis, and by species allied to *Scolopax*, *Tringa*, and *Pelidna*, of the size of our woodcocks, lapwings, and sanderlings; and the *natatorial*, by species allied to the cormorant, but one of them of larger size, though less than a pelican; also by a species akin to the divers (*Merganser*).

The remains of birds become more abundant and varied as we approach the present time; especially in the miocene strata, so richly developed in France, although wanting in Britain. One of the most singularly-modified forms of beak is shown by the flamingo. The fossil skull of a species of this genus (*Phœnicopterus*) has been found in the miocene fresh-water deposits of the plateau of Gergovia, near Clermonte-Ferrand; the entire metatarsal bone of a species of eagle (*Aquila*) or osprey (*Pandion*) in the same deposits at Chaptusal, Allier; and the humerus of a bird allied to and as large as the albatross, in the *molasse coquilliére marine* at Armagne. Remains of a vulture, most probably a *Cathartes*, have been found in the miocene lacustrine deposits of Cantal. Indications of all the other orders of birds, save the great Cursores or *Struthionidæ*, have also been discovered in miocene strata—those of wading birds being the most numerous. Fossil eggs of birds occur in miocene deposits in Auvergne; and impressions of feathers have been discovered in the pliocene calcareous marls at Montebolca. In pliocene brick-earth deposits in Essex has been found a fossil metatarsal of a swan, as large as, and not distinguishable from, the existing wild swan; in the pleistocene clay at Lawford a fossil humerus like that of a wild goose. But most of the ornitholites of this recent tertiary period have been discovered in ossiferous caverns. They belong to birds closely resembling the falcon, wood-pigeon, lark, thrush, teal, and a small wader. The writer has received information of skeletons of birds found deeply imbedded in stratified clay at Aberdeen and Peterhead. The most remarkable additions to the present class have been obtained from the superficial deposits, turbaries, and caves in New Zealand[3] This island is remarkable for the absence of aboriginal species of land-mammals, and for the presence of a small bird with very rudimental wings, and the keelless sternum and loose plumage of the Struthious order, but of a peculiar genus called *Apteryx*: the legs are very robust, and have three front toes and a very small back toe. Birds resembling the *Apteryx* in the shape of the sternum and bony structure of the pelvis and hind limbs, some retaining also the small back toe, others apparently without it, formerly existed in New Zealand under different specific forms ranging in height from 3 feet to 10 feet. They have been referred by the writer to the genera *Dinornis* and *Palapteryx*. The gigantic species are interesting as exhibiting birds equal to the formation of tridactyle impressions as large as those of the Connecticut sandstones called *Ornithichnites* (*Brontozoum*) *gigas* (fig. 79, *r*, *b*). In that cut is given a figure of the leg-bones of *Dinornis giganteus*, in which the tibia (*t*) measures upwards of a yard in length. In the entire skeleton (*A*) of another species, the metatarsus is as thick, but only half as long, as in the *D. giganteus*; the framework of the leg is the most massive of any in the class of birds; the toe-bones almost rival those of the elephant; whence the name *Dinornis elephantopus*, given to this species. Several other species of these

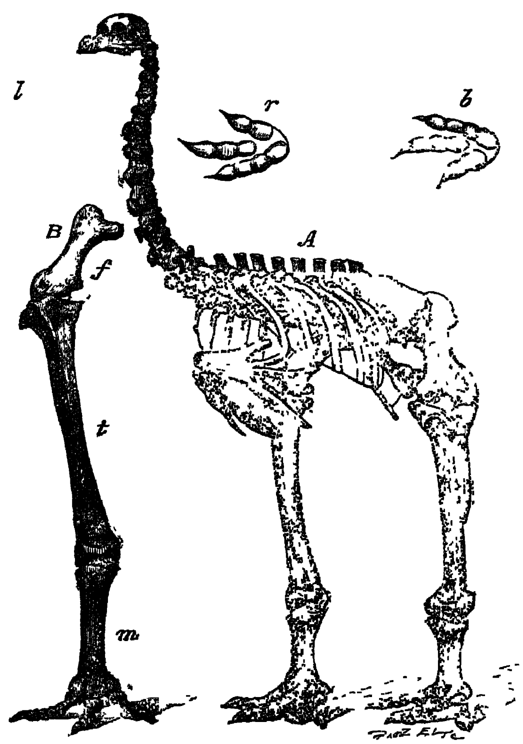

Fig. 79.

A. *Dinornis elephantopus*.
B. Leg-bones of *Dinornis giganteus*.
b, *r*. Impressions called Ornithichnites.

[1] Lyell, *Manual of Elementary Geology*, 8vo, 1855, p. 348.
[2] Owen "On the Affinities of *Gastornis Parisiensis*," *Quarterly Journal of Geological Society*, vol. xii., 1856, p. 204.
[3] These remains are described in eight memoirs by the writer, published in the third and fourth volumes of the *Transactions of the Zoological Society of London*. The description of the first fragment of the bone, indicative of the *Dinornis*, is in vol. iii., p. 39, pl. 3.

extinct tridactyle wingless birds have been determined—*e.g.*, *Dinornis ingens*, *D. struthioides*, *D. rheides*, *D. dromioides*, *D. casuarinus*, *D. robustus*, *D. crassus*, *D. geranoides*, *D. curtus*. With these remains have been found bones of a bird the size of a swan, but of an extinct genus (*Aptornis*); also those of a large coot (*Notornis Mantelli*) which, founded originally on fossil remains, was afterwards discovered living in the Middle Island of New Zealand. Two species of *Apteryx*, not distinguishable from the existing kinds, were contemporaries with the gigantic *Dinornis*, and the writer has received evidence that the *D. elephantopus* afforded food to the natives at probably no very remote period. Some of the smaller kinds of *Dinornis* may yet be found living on the Middle Island.

In Madagascar portions of metatarsal bones, indicating a three-toed bird as large as, but generically distinct from, the *Dinornis giganteus*, have been discovered in alluvial banks of streams; and with them entire eggs, measuring from 13 to 14 inches in long diameter. The contents of one of these eggs is computed to equal those of six ostrich eggs, or of one hundred and forty-eight hen's eggs.

In the neighbouring island of Mauritius the dodo (*Didus ineptus*) has been exterminated by man within the period of two centuries; and in the islands of Bourbon and Rodriguez the "solitaire" (*Pezophaps*) has also become extinct. Both these birds had wings too short for flight.

CLASS III.—MAMMALIA.

(Warm-blooded, Air-breathing, Viviparous Vertebrates.)

Every calcified part of an animal, whether coral, shell, crust, tooth, or bone, can preserve its form and structure when buried in the earth during the changes there gradually operated in it, until every original particle may have been removed and replaced by some other mineral substance previously dissolved in the water percolating the bed containing the fossil. A bone, or other part so altered, is said to be "petrified." Not only are all its outward characters preserved, but even the minutest structure may be, and in most cases is, demonstrable in the fine sections under the microscope.

Fossil bones and teeth have been discovered in every intermediate stage of alteration, from their recent state to that of complete petrifaction. Recent bones consist of a soft,—commonly called animal or organic,—basis, hardened by earthy salts, chiefly phosphate of lime.[1] Fishes have the smallest proportion, birds the largest proportion, of the earthy matter in their bones. The soft part is chiefly a gelatinous substance.

Proportions of Hard and Soft Matter in the Bones of the Vertebrate Animals.

FISHES.

	Salmon.	Carp.	Cod.
Soft	.60·62	40 40	34·30
Hard	.39·38	59·60	65·70
	100·00	100·00	100·00

REPTILES.

	Frog.	Snake.	Lizard.
Soft	.35·50	31·04	46 67
Hard	.64·50	69·96	53·33
	100·00	100·00	100·00

MAMMALS.

	Porpoise.	Ox.	Lion.	Man.
Soft	.35·90	31·00	27 70	31·03
Hard	.64·10	69·00	72·30	68·97
	100·00	100·00	100·00	100·00

BIRDS.

	Goose.	Turkey.	Hawk.
Soft	.32·91	30·49	26·72
Hard	.67·09	69·51	73·28
	100·00	100·00	100·00

The chemical nature of the hardening particles, and of the soft basis of bone, is exemplified in the subjoined table, including a species of each of the four classes of Vertebrata:—

Chemical Composition of Bones.

Ingredients,	Hawk.	Man.	Tortoise.	Cod.
Phosphate of lime, with trace of fluate of lime ..	64·39	59·63	52·66	57·29
Carbonate of lime	7 03	7·33	12·53	4·90
Phosphate of magnesia	0 94	1 32	0 82	2·40
Sulphate, carbonate, and chlorate of soda	0·92	0 69	0·90	1·10
Glutin and chondrin	27 73	29 70	31·75	32·31
Oil	0 99	1 33	1·34	2 00
	100 00	100 00	100 00	100·00

The most common change which bones first undergo is the loss of more or less of their original soft and soluble basis. This effect of long interment is readily tested by applying the specimen to the tongue, when the affinity of the pores of the earthy constituent, after having lost the gelatine, for fluid is so great, that the specimen adheres to the tongue like a piece of dry chalk. Bones and teeth in this state quickly absorb a solution of gelatine, and thus their original tenacity may be restored.[2] Petrified fossils need no such treatment; they are usually harder and more durable than the original bone itself.

The interpretation of such fossil remains requires a comparison of them with the corresponding parts of animals now living, or of previously determined extinct species. In the case of the vertebrate animals, such comparison is limited to the osseous and dental systems. The interpretation of a vertebrate fossil, therefore, presupposes a knowledge of the various modifications of the skeleton and teeth of the existing vertebrate animals; and the more extensive and precise such knowledge may be, the more successful will be the efforts, and the more exact the conclusions, of the interpreter.

The determination of the remains of quadrupeds is beset, as Cuvier truly remarks, with more difficulties than that of other organic fossils. Shells are usually found entire, and with all the characters by which they may be compared with their analogues in the museums, or with figures in the illustrated books, of naturalists. Fishes frequently present their skeleton or their scaly covering more or less entire, from which may be gathered the general form of their body, and frequently both the generic and specific characters which are derived from such internal or external hard parts. But the entire skeleton of a fossil quadruped is rarely found, and when it occurs, it gives little or no information as to the hair, the fur, or the colour of the species. Portions of the skeleton with the bones dislocated, or scattered pell-mell,—detached bones and teeth, or their fragments merely,—such are the conditions in which the petrified remains of the mammalian class most commonly present themselves in the strata in which they occur.

Prior to the time of Cuvier but little progress had been made in the interpretation of such fragmentary remains. The striking success which attended the application of the great comparative anatomist's science to this previously neglected field of study, was referred by Cuvier to principles in the organization of animal bodies, which he termed the "Correlation of Forms and Structures," and the "Subordination of Organs,"—principles which his philosophical biographer, M. Flourens,[3] in common with most contemporary philosophers, has regarded as the most effective and successful instrument in the restoration of extinct animals. They will be exemplified in the course of the present and concluding section of the article PALÆONTOLOGY.

A terminal phalanx modified to fit a hoof may give, as Cuvier declared, the modifications of all the bones of the fore limb that relate to the absence of a rotation of the fore leg, and all the modifications of the jaw and skull that relate to the mastication of food by broad-crowned complex molars.

But there are certain associated structures for the coincidence of which the physiological law is unknown. "I doubt," writes Cuvier, "whether I should have ever divined, if observation had not taught it me, that the ruminant hoofed beasts should all have the cloven foot, and be the only beasts with horns on the frontal bone."[4] We know as little why horns should be in one or two pairs on the frontal bone of those Ungulates only which have hoofs in one or two pairs; whilst in the horned Ungulates with three

[1] That this combination of phosphorus and calcium has ever taken place in nature, save under the influences of a living organism, remains to be proved.

[2] The writer's experience of this effect led him to suggest the application of a similar process to the long-buried ivory ornaments from the ruins of Nineveh in the British Museum; it proved successful.

[3] *Eloge Historique et l'Analyse Raisonnée des Travaux de G. Cuvier*, 12mo, Paris, 1841, p. 42.

[4] *Ossemens Fossiles*, 8vo, ed. 1834, tom. i., p. 184.

hoofs, there should be either one horn, or two horns placed one behind the other in the middle line of the skull; or why the Ungulates with one or three hoofs on the hind foot should have three trochanters on the femur, whilst those with two or four hoofs on the hind foot should have only two trochanters.

"However," continues Cuvier, "since these relations are constant, they must have a sufficing cause; but as we are ignorant of it, we must supply the want of the theory by means of observation.[1] This, if adequately pursued, will serve to establish empirical laws almost as sure in their application as rational ones." "That there are secret reasons for all these relations, observation may convince us independently of general philosophy." "The constancy between such a form of such organ, and such another form of another organ, is not merely specific, but one of class, with a corresponding gradation in the development of the two organs."[2]

"For example, the dentary system of non-ruminant Ungulates is generally more perfect than that of the Bisulcates; inasmuch as the former have almost always both incisors and canines in the upper as well as the lower jaw; the structure of their feet is in general more complex, inasmuch as they have more digits, or hoofs less completely enveloping the phalanges, or more bones distinct in the metacarpus and metatarsus, or more numerous tarsal bones; or a more distinct and better developed fibula; or a concomitance of all these modifications. It is impossible to assign a reason for these relations; but, in proof that it is not an affair of chance, we find that whenever a bisulcate animal shows in its dentition any tendency to approach the non-ruminant Ungulates, it also manifests a similar tendency in the conformation of its feet. Thus the camels, which have canines and two or four incisors in the upper jaw, have an additional bone in the tarsus, resulting from the scaphoid not being confluent with the cuboid; and the small hoofs have correspondingly small phalanges. The musk-deer, which have long upper canines, have the fibula co-extensive with the tibia, whilst the other ruminants have a mere rudiment of fibula articulated to the lower end of the tibia." "There is then a constant harmony between two organs to all appearance quite strangers to each other, and the gradations of their forms correspond uninterruptedly even in the cases where one can render no reason for such relations." "But in thus availing ourselves of the method of observation as a supplementary instrument when theory abandons us, we arrive at astonishing details. The smallest articular surface (*facette*) of a bone, the smallest process, present a determinate character relating to the class, to the order, to the genus, and to the species to which they belong; so that whoever possesses merely the well-preserved extremity of a bone, he may, with application, aided by a little tact (*adresse*) in discerning analogies, and by sufficient comparison, determine all these things as surely as if he possessed the entire animal."[3]

There have been, of course, instances, and will be, where, for want of the "efficacious comparison," and the "tact in discerning likeness," such results have not rewarded the endeavours of the palæontologist; and these shortcomings, and the mistakes sometimes made, even by Cuvier himself, have been cast in the teeth of his disciples, as arguments against the principles by which they believed themselves guided in their endeavours to complete the glorious edifice of which their master laid the foundations.

The writer has, therefore, quoted from the well-known "Preliminary Discourse" to Cuvier's great work on Fossil Remains, with a view to neutralize the efforts of statements reiterated in apparent ignorance of the clear and explicit manner in which Cuvier there defines the limits within which the law of correlation of animal structures may be successfully applied, and indicates the instances in which,—the physiological condition being unknown, and the coincident structures being understood empirically,—careful observation and rigorous comparison must supply the place of the physiologically-understood law.

Those who deny the existence of design in the construction of any part of an organized body, and who protest against the deduction of a purpose from the valves of the veins or the lens of the eye-ball, repudiate the reasoning which the palæontologist carries out from the hoof to the grinder, or from the carnassial molar to the retractile claw, through the guidance of the principle of a pre-ordained mutual adaptation of such parts; but such minds are not, nor have been, those who have contributed to the real advancement of physiology or palæontology.

By reference to the "Table of Strata" (fig. 1), it will be seen that the earliest evidence of a vertebrate animal is of the cold-blooded water-breathing class in the upper Silurian period. Next follows that of a cold-blooded but air-breathing vertebrate, probably from the upper Devonian, but, under the batrachian grade, certainly in the carboniferous period. The warm-blooded air-breathing classes are first indicated, as birds, by foot-marks in a sandstone of probably triassic but not older age; and, as Mammals, by fossil teeth from bone-beds of the upper triassic system in Wirtemberg, and of the same age near Frome, Somersetshire. Mammalian remains have also been found in a coal-field in North Carolina, which may be earlier, but cannot be later, than the lias formation.

Genus MICROLESTES.—The mammalian teeth from German and English trias indicate a very small insectivorous quadruped, to which the above generic name was given by Professor Plieninger. The German specimens were discovered in 1847 in a bone breccia at Diegerloch, about two miles from Stuttgardt, the geological relations of which are well determined as between lias and Keuper sandstone. The teeth of *Microlestes* from Frome, submitted to the writer by the discoverer, Mr Charles Moore, F.G.S., in 1858, are four in number, two being molars of the upper jaw, each with four fangs; one a molar with a narrower crown and two fangs from the lower jaw; and the fourth a small, pointed, front tooth. The crowns of the molars are short vertically in proportion to their breadth; the distinct enamel contrasts with the cement-covered fangs; the grinding surface shows a wide and shallow depression, surrounded by small, low, obtuse cusps, three of equal size being on one side, a larger cusp near one end, and smaller and less regular cusps on the side opposite the three. The lower molar shows a similar type, but with the three marginal cusps less equal in size. The crown of the largest of the upper molars does not exceed one line in its longest diameter. Amongst existing Mammals, some of the small molars of the marsupial and insectivorous *Myrmecobius* of Australia offer the nearest resemblance to these fossil teeth; but a still closer one is presented by the small tubercular molars of the extinct oolitic Mammal called *Plagiaulax* (fig. 88, *m*, 1 and 2).

Genus DROMATHERIUM.—It would appear that the Mammal from the American triassic or liassic coal-bed (*Dromatherium sylvestre*, Emmons) also found its nearest living analogue in *Myrmecobius*; for each ramus of the lower jaw contained 10 small molars in a continuous series, 1 canine, and 3 conical incisors, the latter being divided by short intervals.

Genus AMPHITHERIUM (*Thylacotherium*, Val.)[4]—This genus is

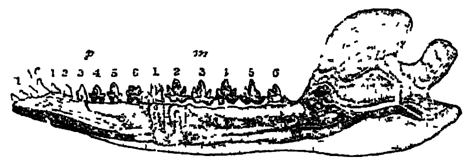

Fig. 80.

Lower Jaw and Teeth of the *Amphitherium Prevostii* (twice nat. size).

founded upon a few specimens of lower jaw, one ramus of which (fig. 80) gave the entire dentition of its side,—viz., three small conical incisors (*i*), one rather larger canine (*c*), six premolars, unicuspid, with a small point at one or both sides of the base (*p*, 1–6), and six quinque-cuspid molars (*m*, 1–6) not departing very far from the type above-described. The molars, and most of the premolars, are implanted by two roots. The condyle of the jaw is convex, and is a little higher than the level of the teeth; the coronoid process is broad and high; the angle projects backward, with a feeble production inward. It is, again, to the marsupial *Myrmecobius*, amongst living forms, that the present genus is most nearly allied. The remains of *Amphitherium* are from the lower oolitic slates of Stonesfield (fig. 82, stratum 8).

Genus AMPHILESTES.[5]—This genus is founded on a ramus of the lower jaw, from the Stonesfield oolitic slate, showing true molars of a compressed form, with a large middle cusp and a smaller, but well-marked, one at the fore and back part of its base; the "cin-

[1] "Puisque ces rapports sont constants, il faut bien qu'ils aient une cause suffisante; mais comme nous ne la connoissons pas, nous devons suppléer au défaut de la théorie par le moyen de l'observation." (Tom. cit., p. 184.)

[2] "En effet, quand on forme un tableau de ces rapports, on y remarque non-seulement une constance spécifique, si l'on peut s'exprimer ainsi, entre telle forme de tel organe, et telle autre forme d'un organe différent; mais l'on aperçoit aussi une constance de classe et une gradation correspondante dans le développement de ces deux organes, qui montrent, presque aussi bien qu'un raisonnement effectif, leur influence mutuelle." (Tom. cit., p. 185.)

[3] Tom. cit., p. 187.

[4] For the full description and demonstration of the mammalian nature of this much-discussed fossil, see Owen, *History of Brit. Fossil Mammals*, 8vo, p. 29.

[5] Owen, *Hist. Brit. Foss. Mam.*, p. 58, fig. 19 (*Amphitherium Broderipii*).

gulum," or basal ridge, peculiar to mammalian teeth, traverses the inner ridge of the crown, where it develops three small cusps, one at the base of the large outer or principal cusp, and the other two forming the anterior and posterior ends of the crown. This form of tooth is unknown in existing Mammalia, but is as well adapted for crushing the cases of coleopterous insects (elytra of which are found fossil in the same oolitic matrix) as are any of the multicuspid molars of small opossums, shrews, and bats. The *Amphilestes Broderipii* was somewhat larger than *Amphitherium Prevostii*.

Genus PHASCOLOTHERIUM.—Although the evidence of the very slight degree of inflection of the angular process of the lower jaw of *Amphitherium* may favour its affinity to the placental Insectivores, yet the range of variety to which that mandibular character is subject in the different genera of existing *Marsupialia* warns us against laying undue stress upon its feeble development in the extinct genus of the oolitic epoch, and incites us to look with redoubled interest at whatever other indications of a marsupial character may be present in the fossil remains of other genera and species of Mammalia that have been detected in the Stonesfield slate.

In the specimen of *Phascolotherium* (fig. 81) presented to the

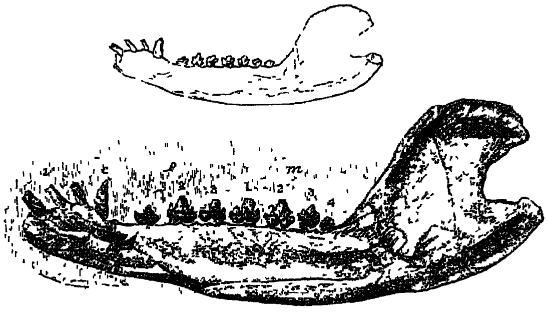

Fig. 81.

Lower Jaw and Teeth of the *Phascolotherium* (nat. size in outline), Lower Oolite.

British Museum by William J. Broderip, Esq., F.R.S., its original describer,[1] which is as perfect in regard to the dentition as the jaw of the *Amphitherium* above described, the marsupial characters are more strongly manifested in the general form of the jaw, and in the extent and position of the inflected angle, while the agreement with the genus *Didelphys* in the number of the premolar and molar teeth is complete. The forms of the crowns of those teeth differ from those in *Didelphys*, and correspond so closely with those in the *Amphilestes Broderipii*, as to show the closer affinity of the Phascolothere with the latter oolitic Insectivora; and, accordingly, whatever additional evidence of marsupiality is afforded by the *Phascolotherium*, may be regarded as strengthening the claims of both *Amphilestes* and *Thylacotherium* to be admitted into the marsupial group. The general form and proportions of the coronoid process of the jaw of *Phascolotherium* resemble those in the zoophagous Marsupials; and especially with that of the *Thylacynus* in regard to the depth and form of the entering notch between this process and the condyle.

The base of the inwardly-bent angle of the lower jaw progressively increases in *Didelphys*, *Dasyurus*, and *Thylacinus*; and judging from the fractured surface of the corresponding part of the fossil, it most nearly resembles the jaw of *Thylacinus*. The condyle of the jaw is nearer the plane of the inferior margin of the ramus in the Thylacine than in the Dasyures or Opossums; and consequently, when the inflected angle is broken off, the curve of the line continued from the condyle along the lower margin of the jaw is least in the Thylacine. In this particular, again, the Phascolothere resembles that Australian Carnivore. In the position of the dental foramen, the Phascolothere, like the Amphithere, differs from the zoophagous Marsupials and placental Carnivora and Insectivora, and resembles the *Hypsiprymnus*, a marsupial Herbivore, that orifice being near the vertical line dropped from the last molar tooth. In the direction of the line of the symphysis, the Phascolothere resembles the Opossums more than the Dasyures or Thylacines. It is probable that the teeth at the fore part of the jaw showed the same correspondence. In the number of the molar series, the Phascolothere differs from *Amphitherium*, *Amphilestes*, and *Myrmecobius*, and resembles the Thylacine and Opossum, but without having the premolars (*p*, 1, 2, 3) distinguished, as in them, from the true molars (*m*, 1, 2, 3, 4), by smaller and more simple crowns. As, however, these two kinds of teeth can only be determined by their order of development and succession, the Phascolothere may well have had three premolars and four true molars.

The difference between these teeth in the lower jaw of *Didelphys* is shown by the addition, in the true molars, of a pointed tubercle on the inner side of the middle cone. In *Phascolotherium* a mere basal ridge or cingulum extends along the inner side of the middle cone. Such a ridge is present in the last molar of *Sarcophilus*, but not in the other molars; but in these there are two small hind cusps on the same transverse line, whilst that cusp appears to be single in *Phascolotherium*. The cingulum, moreover, in the second to the penultimate of the molar series of this fossil, extends so far as to form a small talon at the fore and back part of the crown; thus making five points, which are very distinct in the third to the penultimate tooth inclusive; and by this character the dentition of *Phascolotherium* differs materially from any existing Marsupial, and repeats the type of molar which, as yet, would seem to be peculiar to the Insectivora of the oolitic epoch. There is a feeble indication of this structure in the antepenultimate and penultimate molars of *Thylacinus*, but the hinder division of the crown shows two small cusps on the same transverse line, besides the rudimental hindmost one; and there is no cingulum. Upon the whole, it would seem that, though the affinity may not be close, *Phascolotherium* most resembles *Thylacinus* amongst existing Mammals; but *Thylacinus* is now confined to Tasmania, and is there fast verging to extinction.

The resemblance shown by the lower jaw and its teeth of the Amphithere and Phascolothere to marsupial genera now confined to Australia and Tasmania, leads one to reflect on the interesting correspondence between other organic remains of the Oxfordshire oolite and other existing forms now confined to the Australian con-

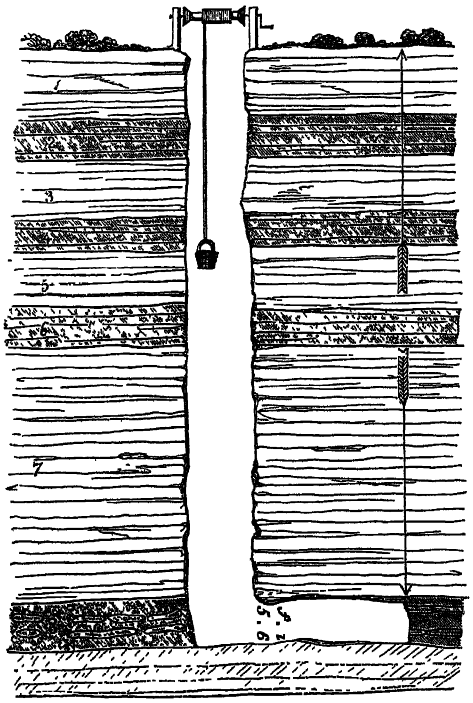

Fig. 82.

(*After Fitton.*)

1. Rubbly limestone (cornbrash).
2. Clay, with Terebratulites.
3. Limestone rock.
4. Blue clay.
5. Oolitic rock.
6. Stiff clay.
7. Oolitic rag, or limestone.
8. Sandy bed containing the Stonesfield slate.

tinent and surrounding sea. Here, for example, swims the Cestracion, or Port-Jackson shark, which has given the key to the nature of the "palates" from our oolites, now recognised as the teeth of congeneric larger forms of cartilaginous fishes. Mr Broderip, in his Memoir above quoted, observes, "that it may not be uninteresting to note that a recent species of *Trigonia* has very lately been discovered on the coast of Australia, that land of marsupial animals. Our specimen lies imbedded with a number of fossil shells of that genus." Not only *Trigoniæ* but *Terebratulæ* exist, and the

[1] *Zoological Journal*, vol. iii., p. 408, pl. xl., 1828.

latter abundantly, in the Australian seas, yielding food to the Cestracion, as their extinct analogues doubtless did to the allied Plagiostomes with crushing teeth, called *Acrodus*, *Psammodus*, &c. *Araucariæ* and cycadeous plants, like those found fossil in oolitic beds, flourish on the Australian continent, where marsupial quadrupeds now abound; and thus appear to complete a picture of an ancient condition of the earth's surface, which has been superseded in our hemisphere by other strata and a higher type of mammalian organization. Fig. 82 represents a section of the strata overlying the slates whence the fossil mammalian jaws, with associated Megalosaurs, Pterodactyles, and other oolitic organisms, have been obtained at Stonesfield in Oxfordshire. The vertical thickness of the strata through which the shaft is sunk to the gallery is 62 feet; on the side opposite the right hand is marked the depth of the horizontal gallery, where the slate is dug which contains the fossils; on the opposite side the strata are numbered in succession.

Genus STEREOGNATHUS.—The last evidence of a mammalian animal discovered in the Stonesfield slate is of peculiar interest, because it exhibits a type of grinding teeth quite distinct from any of the previously acquired jaws from that locality, and affords evidence of a small vegetable-feeding or omnivorous quadruped. It consists of a portion of a lower jaw, imbedded in the characteristic matrix (fig. 83), about 9 lines in extent, and containing three molar teeth (*a*, *b*, *c*). It is nearly straight; the side exposed is convex vertically; a slight bend downwards, and decrease of vertical diameter towards the end, indicates it to be part of a left ramus. This is unusually shallow, broad or thick below, the side passing by a strong convex curve into the lower part; a very narrow longitudinal ridge, continued after its subsidence by a few fine lines, forms a tract which divides the lateral from the under surface; elsewhere the bone is smooth, without conspicuous vascular perforations. The depth or vertical diameter of the ramus is not more than 2 lines. Of the three teeth remaining in this portion of jaw, the middle one is the least mutilated. The crown of this tooth (fig. 84, *B*) is of a quadrate form, 3 millimetres by 3½ millimetres, of very little height, and supports six subequal cusps in three pairs, each pair being more closely connected in the antero-posterior direction of the tooth than transversely.

Fig. 83.

Stereognathus; Portion of Jaw, imbedded in Oolitic Matrix (nat. size).

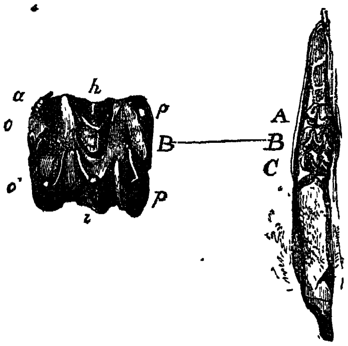

Fig. 84.

Stereognathus; Upper View of portion of Jaw (nat. size), and Magnified View of the Middle Tooth, *B* (Stonesfield Oolite).

The outer side of the crown (fig. 83, *b*), supported by a narrow fang which contracts as it sinks into the socket, shows two principal cusps or cones, and a small accessory basal cusp. The hard and shining enamel which covers these parts of the crown contrasts with the lighter cement that coats the root. The two outer lobes or cones are subcompressed, and placed obliquely on the crown, so that the hinder one (*o'*, fig. 84) is a little overlapped externally by the front one *o*, the fore part of the base of the hinder one being prolonged inwards on the inner side of the base of the front cone. The two middle cones (*h*, *i*) are subcompressed laterally, with the fore part of their base a little broader than the back part. The two inner cones (*p*, *p'*) have their inner surface convex, with their summits slightly inclined forwards. The fore part of the base of the hinder cone is prolonged obliquely towards the centre of the crown, beyond the contiguous end of the base of the front cone, so as to cause an arrangement like that of the two outer cones (*o*, *o'*), the obliquity of the posterior cone of both the outer and the inner pairs being such that they slightly converge as they extend forwards.

This type of tooth differs from that of all other known recent or extinct Mammals. The nearest approach to it is made by the middle true molar of *Pliolophus vulpiceps*, a small extinct herbivorous Mammal from the London clay (fig. 91, *m*, 2).

That the fragment in question is the jaw of a Mammal is inferred from the implantation of the tooth by two or more roots. Most Mammals are known to have certain teeth so implanted. Such complex mode of implantation in bone has not been observed in any other class of animals. Why two or more roots of a tooth should be peculiar to viviparous quadrupeds, giving suck, is not precisely known. That a tooth, whether it be designed for grinding hard or cutting soft substances, should do both the more effectually in the ratio of its firmer and more extended implantation, is intelligible. That a more perfect performance of the preparatory act of digestion should be a necessary correlation, or be in harmony with a more complete conversion of the food into chyle and blood,—and that such more efficient type of the whole digestive machinery should be correlated, and necessarily so, with the hot blood, quick-beating heart and quick-breathing lungs, with the higher instincts, and more vigorous and varied acts of a Mammal, as contrasted with a cold-blooded reptile or fish,—is also conceivable. To the extent to which such and the like reasoning may be true, or in the direction of the secret cause of the constant relations of many-rooted teeth discovered by observation,—to that extent will such relations ascend from the empirical to the rational category of laws.

The interest which the above-described fossil from the Stonesfield oolitic slate excites is not exclusively due to its antiquity, its uniqueness, or its peculiarity; much is attached to its relations as a test in palæontology of the actual value of a single tooth in the determination of other parts of the organization of the animal. According to our opinion of these unseen parts, we frame our expression of the nature and affinities, or of the place in the zoological system, of the extinct species. From the resemblance of the lower molars of *Stereognathus* to those of *Pliolophus*, which, though not close, is closer than to the teeth of any other known animal, it is probable that the *Stereognathus* was hoofed, and consequently herbivorous, or deriving the chief part of its subsistence from the vegetable kingdom. Cuvier has written,—"La première chose à faire dans l'étude d'un animal fossile est de réconnaitre la forme de ses dents molaires; ou determine par la s'il est carnivore ou herbivore, et dans ce dernier cas, on peut s'assurer, jusqu'à un certain point de l'ordre d'herbivores auquel il appartient."[1] In the case in question the form of the molar teeth of one jaw is recognisable, but the herbivority of the fossil is not thereby determined. We can only infer it to be more probable that the fossil was a Herbivore than an Insectivore or a mixed-feeding Carnivore.

Admitting the herbivority of the fossil, it is not certain that it was hoofed; there is nothing in the form and structure of the tooth to prove that. Both form and structure are compatible with the hoofless muticate type of herbivorous Mammal, as shown by the Manatee; it is the small size of the *Stereognathus* which renders it less probable that it was a diminutive kind of Manatee, and more probable that it was a diminutive form of Ungulate. But seeing the manifold diversities of the multi-cuspid form of molar teeth in recent and extinct insectivorous unguiculate quadrupeds, it is not impossible but that the *Stereognathus* may have belonged to that order; there is no known physiological law forbidding it.

The form of the cusps, and their regular symmetrical arrangement in the *Stereognathus*, as compared with the known modifications of multi-cuspid molars in certain small extinct forms of hoofed quadrupeds, constitute the grounds upon which an opinion is formed of its most probably belonging to the same section of *Ungulata*.

Then, is it not true, it may be asked, that by virtue of certain established laws of correlated structures, an extinct animal may be re-constructed from a single tooth or from a fragment of bone? Is the Cuvierian basis, or what has been so regarded, of palæontology unsound? Not necessarily from aught that has been said or written on the subject of the *Stereognathus*. We do not know the comparative anatomy of the family of quadrupeds to which the *Stereognathus* belonged. What we do know of its teeth suggests that that family may have had modifications of the skeleton so far differing from those of any, the modifications of which are known, as to have constituted a type of, perhaps, a marsupial family, but a type as well marked, and as distinct, as the type of skeleton which Cuvier inductively studied in the feline *Carnivora* (fig. 106), and in the ruminant *Herbivora* (fig. 107), and by which preliminary study he was enabled to enunciate that beautiful law of the "correlation of forms and structures" to which allusion has been already made, and which will be illustrated by examples, and its mode of application pointed out, in another part of the present article.

In certain instances of constant coincidences of structure, as demonstrated by comparative anatomy, the sufficient—*i.e.* recognisable,

[1] *Ossemens Fossiles*, 4to, tom. iii., 1822, p. 1.

Mammalia.

intelligible, or physiological—cause of them is not yet known. But, as Cuvier in reference to such instances truly remarks, "Since these relations are constant, there certainly must be a sufficient cause for them." [1] In certain other cases Cuvier believed that he could assign that "sufficient cause," and he selects as such the correlated structures in a feline Carnivore, and in a hoofed Herbivore. The physiological knowledge displayed by him in his explanation of the condition of those correlations is most exact; its application in the restoration of the *Anoplotherium* and *Palæotherium* most exemplary.

In the ratio of the knowledge of the reason of the coincidences of animal structures—in other words, as those coincidences become "correlations"—is our faith in the soundness of the conclusions deduced from the application of such rational law of correlations; and with the certainty of such application is associated a greater facility of its application. A knowledge of the physiological conditions governing the relations of the contents of the cavities of bones to the flight and other modes of locomotion in birds both enabled the writer to infer from one fragment of a skeleton that it belonged to a terrestial bird deprived of the power of flight, and to predict that such a bird, but of less rapid course than the ostrich, would ultimately be found in New Zealand.[2]

This principle, however,—those modes of thought,—which Cuvier affirmed to have guided him in his interpretation of fossil remains, and which he believed to be a true clue in such researches, were repudiated or contested by some of his contemporaries.

Geoffroy St Hilaire denied the existence of a design in the construction of any part of an organized body; he protested against the deduction of a purpose from the contemplation of such structures as the valves of the veins or the converging lens of the eye.

Beyond the co-existence of such a form of flood-gate with such a course of the fluid, or of such a course of light with such a converging medium, Geoffroy affirmed that thought, at least his mode of thinking, could not sanely. or ought not to go.

The present is not the place for even the briefest summary of the arguments which have been adduced by teleologists and anti-teleologists from Democritus and Plato down to Comte and Whewell. The writer would merely remark, that in the degree in which the reasoning faculty is developed on this planet and is exercised by our species, it appears to be a more healthy and normal condition of such faculty,—certainly one which has been productive of most accession to truths, as exemplified in the mental workings of an Aristotle, a Galen, a Harvey, and a Cuvier,—to admit the instinctive impression of a design or purpose in such structures as the valves of the vascular system and the dioptric mechanism of the eye. In regard to the few intellects,—they have ever been a small and unfruitful minority,—who do not receive that impression and will not admit the validity or existence of final causes in physiology, the writer has elsewhere expressed his belief that such intellects are not the higher and more normal examples, but rather manifest some, perhaps congenital, defect of mind, allied or analogous to "colour-blindness" through defect of the optic nerve, or the inaudibleness of notes above a certain pitch through defect of the acoustic nerve.

The truth of a physiological knowledge of the condition of a correlated structure, and of the application of that knowledge to palæontology, is not affected by instances adduced from that much more extensive series of coincident structures of which the physiological condition is not yet known. Nor is the power of the application of the physiologically interpreted correlation the less certain because the merely empirically recognised coincidences have failed to restore, with the same certainty and to the same extent, an extinct form of animal.

Certain coincidences of form and structure in animal bodies are determined by observation. By the exercise of a higher faculty the reason, or a reason, of these coincidences is discovered, and they become correlations; in other words, it is known not only that they do exist, but how they are related to each other. In the case of coincidences of the latter kind, or of "correlations" properly so called, the mind infers with greater certainty and confidence, in their application to a fossil, than in the case of coincidences which are held to be constant only because so many instances of them have been observed.

Because the application of the latter kind of coincidences is limited to the actual amount of observation at the period of such application, and because mistakes have been made through a miscalculation of the value of such amount, it has been argued that a rational law of the correlation of animal forms is inapplicable to the determination of a whole from a part;[3] and it has not only been asserted that the results of such determination are unsound, but that the philosopher who believed himself guided by such law deceived himself and misconceived his own mental processes![4] But the true state of the case is, that the non-applicability of Cuvier's law in certain cases is not due to its non-existence, but to the limited extent to which it is understood.

The consciousness of that limitation led the enunciator of the law to call the attention of palæontologists expressly to the extent to which it could then be applied, as, for instance, to the determination of the class, but not the order; or of the order, but not the family or genus, &c.; and to caution them also as to the extent of the cases in which, the coincidences being only known empirically, he consequently enjoins the necessity of further observation, and of caution in their induction. Cuvier expresses, however, his belief that such coincidences must have a sufficient cause, and that cause once discovered, they then become correlations and enter into the category of the higher law. Future comparative anatomists will have that great consummation in view, and its result, doubtlessly, will be the vindication of the full value of the law in the interpretation of fossil remains as defined by the illustrious founder of palæontology.

Genus SPALACOTHERIUM, Ow.—The next stratum overlying the older oolites in which mammalian remains have been detected, is a member of the newest oolitic series at Purbeck, Dorsetshire, called the "marly" or "dirt-bed." In a series of fossils discovered there by Mr W. R. Brodie, and transmitted for determination in 1854 to the writer, amongst the remains of fishes and small Saurians, constituting the majority of the specimens, were detected three unequivocal evidences of a mammalian species, which were described under the name of *Spalacotherium*[5] *tricuspidens* The specimen here selected (fig. 85) to exemplify the above extinct insectivorous Mammal, is a right ramus of the lower jaw. The posterior half contains four teeth, and extends backward beyond the dental series; but instead of showing the compound structure which that part of the jaw exhibits in the lizard tribe, it continues undivided; the convex surface showing a smooth depression for the insertion of the temporal muscle; the lower boundary answering to that going to the condyle and angle of the jaw, and the upper one to that going to the coronoid process in the ramus of the jaw of the mole and shrew. The crowns of the teeth are long, narrow, and tricuspid, the inner part of the crown being produced into a point both before and behind the longer cusp which forms the chief outer division of the crown. Each of these teeth is implanted by a fang divided externally into two roots, in a distinct socket in the substance of the jaw. The multicuspid crown, the divided root of the tooth, its complex implantation, and the undivided or simple structure of the ramus of the jaw, all concurred, therefore, to prove the mammalian nature of this fossil.

Fig. 85.

Spalacotherium tricuspidens (twice nat. size), Purbeck beds.

The other specimens showed that the *Spalacotherium* had ten molar teeth in each ramus of the lower jaw, preceded by a small canine and incisors. The anterior molars are compressed, increase in height and thickness to the sixth, and from the seventh decrease in size to the hindmost, which seems to be the last of the series. The sharp multicuspid character of so much of the dental series as is here preserved repeats the general condition of the molar teeth of the small insectivorous Mammalia in a striking degree: one sees the same perfect adaptation for piercing and crushing the tough chitinous cases and elytra of insects. The particular modification of the pointed cusps, as to number, proportion, and relative position, resembles in some degree that of the Cape mole (*Chrysochlora aurea*), but both in these respects and in the number of molars, the dentition accords more closely with that of the extinct *Amphitherium*. The chief interest in the discovery of the *Spalacotherium* is derived from its demonstration of the existence of Mammalia about midway between the older oolitic and the oldest tertiary periods.

Both the Oxford oolitic slate and the Purbeck marly shell-beds give evidence of insect life; in the latter formation abundantly. The association of these delicate Invertebrata with remains of plants allied to *Zamia* and *Cycas*, is indicative of the same close interdependency between the insect class and the vegetable kingdom, of which our power of surveying the phenomena of life on the present

[1] *Discours sur les Révolutions de la Surface du Globe*, 4to, 1826, p. 50.
[2] *Transactions of the Zoological Society*, vol. iii., p. 32, pl. 3.
[3] De Blainville, *Ostéographie*, 4to, fasc. 1, 1839, p. 34.
[4] Prof. Huxley, "Lecture on Natural History," &c., Royal Institution of Great Britain, Feb. 15, 1856.
[5] From *σπάλαξ, a mole, θηρίον, a beast.*

Mammalia.

surface of the earth enables us to recognise so many beautiful examples. Amongst the numerous enemies of the insect class ordained to maintain its due numerical relations, and organized to pursue and secure its countless and diversified members in the air, in the waters, on the earth and beneath its surface, bats, lizards, shrews, and moles now carry on their petty warfare simultaneously, and in warmer latitudes work together, or in the same localities, in their allotted task. No surprise need therefore be felt at the discovery that Mammals and Lizards co-operated simultaneously and in the same locality at the same task of restraining the undue increase of insect life during the period of the deposition of the Lower Purbeck beds.

Genus TRICONODON, Ow.

Sp. *Triconodon mordax*.—This name is proposed for a small zoophagous Mammal, whose generic distinction is shown by the shape of the crowns of the molar teeth of the lower jaw, which consist of three nearly equal cones on the same longitudinal row, the middle one being very little larger than the front and hind cone; and these cones are not complicated by any cingulum or accessory basal cusp. The convex condyle is below the level of the alveoli, and there is no angular process projecting beneath it. The coronoid process is broad and high, with its hinder point not extended so far back as the condyle; the depression marking the insertion of the temporal muscle extends nearly to the lower border of the jaw. There are the obscure remains of three broken incisors, and the point of apparently a canine; next come the two stumps or broken roots of a small premolar; then the crown of a second double-rooted premolar, which show a principal cone and a small anterior cusp; the next tooth is wanting; then there is a larger premolar, with the two fangs raised some way out of their socket: the crown of this tooth shows a principal cone, with a small anterior and large posterior talon; it rises, apparently from partial displacement, higher than the succeeding molars; these are three in number, and present the characteristic three-coned structure already described; each cone is smooth, and convex externally. The three cones seem to answer to the three middle or principal cones of the molars of *Amphilestes* and *Phascolotherium*, but the front and hind cones are raised to near equality with the middle cone in *Triconodon*.

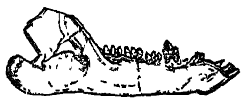

Fig. 86.

Jaw of *Triconodon mordax* (nat. size), Purbeck.

The lower jaw of this species, in the relation of the condyle to the lower border, resembles that of *Phascolotherium* more than that of *Amphitherium*, but it differs from both; there is not the same gradual curve from the condyle to the symphysis as in *Phascolotherium;* and, besides the lower level of the condyle, it is divided by a less deep notch from the coronoid process. This process is larger in proportion to the entire jaw; approaches more nearly to the quadrate or rhomboid form, the upper border being less curved; it affords a more extensive surface of attachment to the principal biting muscles than in most predatory extinct or recent quadrupeds. This character, with the depth and strength of the jaw, suggested the specific name From the shape of the exposed part of the ramus, we may conclude that the part answering to the angle is bent inwards, and that *Triconodon* was a genus of the marsupial order. The specimen was discovered by Mr Beccles in the same "dirt-bed" at Purbeck as that in which *Spalacotherium* was found.

Genus PLAGIAULAX,[1] Fr.—The most remarkable of Mr Beccles' discoveries in the above formation are the mammalian jaws indicative of the genus above named, of which two species have been determined by Dr Falconer.

Sp. *Plagiaulax Becclesii*, Fr.—Two specimens exemplified the

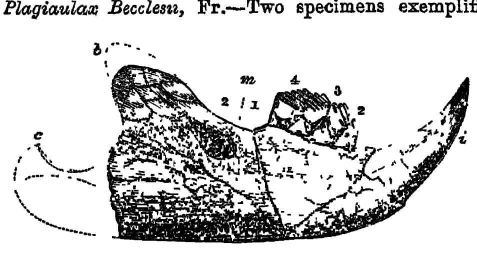

Fig. 87.

Plagiaulax Becclesii (twice nat. size), Purbeck.

shape and proportions of the entire jaw of this species (fig. 87). The foremost tooth (*i*) is a very large one, shaped like a canine, but implanted by a thick root in the fore part of the jaw, like the large lower incisor of a kangaroo or wombat. The three anterior teeth in place have compressed trenchant crowns, and rapidly augment in size from the first (2) to the third (4). They are followed by sockets of two much smaller teeth, shown in other specimens to have subtuberculate crowns resembling those of *Microlestes*. The large front tooth of *Plagiaulax* is formed to pierce, retain, and kill; the succeeding teeth, like the carnassials of Carnivora, are, like the blades of shears, adapted to cut and divide soft substances, such as flesh As in Carnivora, also, these sectorial teeth are succeeded by a few small tubercular ones. The jaw conforms to this character of the dentition. It is short in proportion to its depth, and consequently robust, sending up a broad and high coronoid process (*b*), for the [illegible] grasp of a large temporal muscle, and the condyle (*c*) is placed below the level of the grinding teeth,—a character unknown in any herbivorous or mixed-feeding Mammal; whilst the lever of the coronoid process is made the stronger by the condyle being carried farther back from it than in any known carnivorous or herbivorous animal. The angle of the jaw makes no projection below the condyle, but is slightly bent inwards, according to the marsupial type.

Sp. *Plagiaulax minor*, Fr.—In this species the first premolar (fig. 88, *p*, 1) is preserved, the rest (*p*, 2, 3, and 4) show nearly the same shape and proportions as in *P. Becclesii*. The first molar (*m*, 1) has a broad depression on the grinding surface, surrounded by tubercles, of which three are on the outer border; the marginal tubercles of the second smaller tooth are smaller and more numerous.

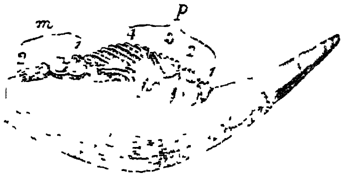

Fig. 88.

Plagiaulax minor (four times nat. size), Purbeck (after Lyell).

In the general shape and proportions of the large premolar (*p*, 4) and succeeding molars, *Plagiaulax* most resembles *Thylacoleo* (fig. 115, *p*, *m*, 1 and 2),—a much larger extinct predaceous Marsupial from tertiary beds in Australia. But the sectorial teeth in *Plagiaulax* are more deeply grooved; whence its name. The single compressed premolar of the kangaroo-rat is also grooved; but it is differently shaped, and is succeeded by four square-crowned double-ridged grinders adapted for vegetable food; and the position of the condyle, the slenderness of the coronoid, and other characters of the lower jaw, are in conformity to that regimen. In *Thylacoleo* the lower canine or canine-shaped incisor projected from the fore part of the jaw close to the symphysis, and the corresponding tooth in *Plagiaulax* more closely resembles it in shape and direction than it does the procumbent incisor of *Hypsiprymnus*. From this genus *Plagiaulax* differs by the obliquity of the grooves on its premolars; by having the analogous teeth vertically grooved; by having only two true molars in each ramus of the jaw, instead of four; by the salient angle which the surfaces of the molar and premolar teeth form, instead of presenting a uniform level line; by the broader, higher, and more vertical coronoid; and by the very low position of the articular condyle.

The physiological deductions from the above-described characteristics of the lower jaw and teeth of *Plagiaulax* are, that it was a carnivorous Marsupial. It probably found its prey in the contemporary small insectivorous Mammals and Lizards, supposing no herbivorous form, like *Stereognathus*, to have co-existed during the upper oolitic period.

In the Woodwardian Museum at Cambridge is a specimen of anchylosed cervical vertebræ of a cetaceous animal as large as a grampus, but presenting specific distinctions from all known recent and fossil species. It is stated to have been found in the brown clay or "till" near Ely; but in its petrified condition, colour, and specific gravity, it is so different from the true bones of the "till," and so closely like the fossils of the Kimmeridge clay, as to make it extremely probable that it has been washed out of that formation.

In a recent visit to Cambridge the writer has identified true cetacean vertebræ which had been discovered associated with bones of *Ichthyosaurus* in the lower greensand (neocomian) near that town. No evidence of the mammalian class has yet been met with in the chalk beds.

The examples of the Mammalia first met with in tertiary strata are the *Coryphodon* and *Palæocyon*, respectively representing the ungulate (herbivorous) and unguiculate (carnivorous) modifications of the class; their remains have been found in the plastic clay and equivalent lignites in England and France.

[1] An abbreviation for *Plagiaulacodon*, from πλάγιος, *oblique*, and αὔλαξ, *groove;* having reference to the diagonal grooving of the premolar teeth.

Mammalia.

Genus CORYPHODON, Ow.—Rarely has the writer felt more misgiving in regard to a conclusion based, in palæontology, on a single tooth or bone, than that to which he arrived after a study of the unique fragment of jaw with one tooth dredged up off the Essex coast, and on which he founded the genus *Coryphodon*.[1]

The marked contraction of the part of the jaw near one end of the tooth seemed, at first view, clearly to show it to be the narrower fore part of the ramus; in that case the tooth would have been a premolar, and of comparatively little value in the determination of a genus or species. But a closer inspection showed the line of abrasion of the summits of the two transverse ridges of the tooth to be on one side, and the general law of the relative apposition and reciprocal action of the upper and lower grinders in tapiroid Pachyderms determined that those oblique linear abrasions must be on the hinder side of the ridges. The smaller characters carried conviction against the showing of the larger and more catching ones. So, in determining the position of the nautilus in its pearly abode, when the animal without its shell was first brought to England in 1831, the reasons afforded by some small and inconspicuous parts in like manner outweighed the first impressions from more obvious appearances, as well as the bias from the general analogies of testaceous Univalves. Some contemporary naturalists asserted, and for a time it was believed, that the nautilus had been put upside down in its shell,[2] just as some contemporary anatomists surmised that the writer had mistaken the fore for the back part of the jaw of his *Coryphœdon*, which, in that case, might only be the known *Lophiodon*. In both instances the conclusions founded on the less obvious characters have proved to be correct. And the writer would remark that, in the course of his experience, he has often found that the prominent appearances which first catch the eye and indicate a conformable conclusion are deceptive, and that the less obtrusive phenomena which require searching out, more frequently, when their full significance is reasoned up to, guide to the right comprehension of the whole. It is as if truth were whispered rather than outspoken by Nature.

Truth, it is sometimes said, lies at the bottom of a well. The first additional glimpse that the writer obtained of the veritable nature of one of our most ancient tertiary Mammals was derived from the inspection of a fossil tooth brought up from a depth of 160 feet, out of the "plastic clay," during the operations of sinking a well in the neighbourhood of Camberwell, near London. It was a canine tooth,[3] belonging, from its size (near 3 inches in length), to a large quadruped, and, from the thickness and shortness of its conical crown, not to a carnivorous but to a hoofed Mammal, most resembling in shape, though not identical with, that of the crown of the canine tooth of some large extinct tapiroid Mammals, which Cuvier had referred to his genus *Lophiodon*, but which has proved to belong to *Coryphodon*.

The last lower molar of *Lophiodon* has three lobes; the molar determined to be the ultimate one, in the fragment of lower jaw above referred to, resembles that of the tapir in the absence of a third or posterior lobe, but the posterior ridge or part of the cingulum is less developed than in the tapir. It presents two divisions in the form of transverse ridges or eminences, the front ridge being the largest, and with its edge most entire. From the outer end of each division a ridge is continued obliquely forward, inward, and downward: the anterior one extends to the antero-internal angle of the base of the crown; the posterior one terminates at the middle of the interspace between the two chief divisions of the crown. The trenchant summit of the anterior ridge is slightly concave toward the fore part of the tooth, as in that of *Lophiodon;* but its outer and inner ends rise higher, and appear as more distinct cones or points; whence the generic name of *Coryphodon*. The posterior division is lower than the anterior one, and is bicuspid; the trenchant margin connecting the outer and inner points does not extend across the crown parallel with the anterior ridge, as in *Tapirus* and *Lophiodon*, but bends back so as to form an angle, the apex of which rises into a third point.

Some lophiodontoid fossils from the lignites of Soissons and Laon, and from the plastic clay of Meudon in France, including the upper molar tooth figured by Cuvier in the chapter of the *Ossemens Fossiles* entitled "Animaux voisins de Tapirs," pl. vii., fig. 6, belong to the genus *Coryphodon*. Cuvier compares this tooth with one from Bastberg, which he figures in pl. vi., fig. 4, and which is certainly the last upper molar of a true *Lophiodon*, and points out truly that the Soissons tooth differs in the external border passing into the posterior one, so that, instead of being quadrangular, its crown is triangular; but he explains this difference on the hypothesis that the Bastberg tooth was a penultimate molar. The reduction of the second or posterior ridge to a semi-circular one, developed at its middle and hindmost part into a prominent cone, so far agrees with the modification of the same part of the last molar of the lower jaw of the *Coryphodon* as to render it very probable that the last upper molar from Soissons, figured by Cuvier in pl. vii., fig. 6, above quoted, also belongs to the genus *Coryphodon*. Cuvier states that the entire skeleton was found, indicative of an animal as long and almost as large as a bull; but that the workmen employed in the sandpit (*sablonière*) preserved only that one tooth. Both the lower molar from Harwich, and the upper one from Soissons, indicate an animal of at least double the size of the American tapir

Mammalia.

Professor Hebert[4] has recently described a very instructive series of teeth and bones from the oldest eocene deposits in France, which he refers to the genus *Coryphodon:* the last molar is identical in form with the tooth from the plastic clay of Essex, on which the genus was originally founded.

Genus PLIOLOPHUS, Ow.—The most complete and instructive example of a Mammal from the next overlying division of the eocene tertiaries, viz., the "London clay," is that which the writer has described[5] under the name of *Pliolophus vulpiceps*. It is a hoofed Herbivore, but presents a dentition not exhibited by any later or existing species of Mammal.

The length of the skull (fig. 89) is 4 inches, its extreme breadth

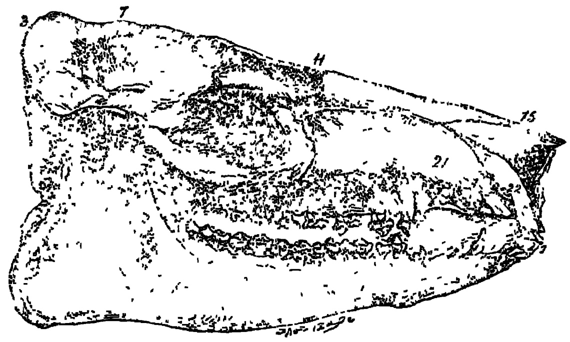

Fig. 89.

Skull of *Pliolophus vulpiceps* (half nat. size), London clay.

2 inches 2 lines, the height of the cranium opposite the first premolar tooth 9 lines. Its shape and characteristics determine the hoofed nature of this species, and its affinities to the Perissodactyla, or the order of Ungulata with toes in odd number. The extent and well-defined boundary of the temporal fossæ by the occipital (3), parietal (7), and post-frontal ridges, and their free communication with the orbits, give almost a carnivorous character to this part of the cranium of *Pliolophus;* but as in the hog, Hyrax, and Palæothere, the greatest cerebral expansion is at the middle and toward the fore part of the fossæ, with a contraction toward the occiput; the brain-case not continuing to enlarge backward to beyond the origin of the zygomata, as in the fox. The zygomatic arches have a less outward span than in the *Carnivora*. In this part of the cranial structure *Pliolophus* resembles *Palæotherium* more than it does any existing Mammal; but the post-frontal processes are longer and more inclined backward. The incompleteness of the orbit occurs in both *Anoplotherium* and *Palæotherium*, as in *Rhinoceros*, *Tapirus*, and the hog tribe; but in the extent of the deficient rim, *Pliolophus* is intermediate between *Palæotherium* and *Tapirus*. The orbit is not so low placed as in *Palæotherium*, *Tapirus*, and *Rhinoceros*, nor so high as in *Hyrax* or *Sus*. The straight upper contour of the skull (7 to 15) is like that in the horse tribe and Hyrax, and differs from the convex contour of the same part in the Anoplothere and Palæothere. The size of the antorbital foramen (*a*) indicates no unusual development of the muzzle or upper lip. In the conformation of the nasal aperture by four bones (two nasals, 15, and two premaxillaries, 22), *Pliolophus* resembles the horse, Hyrax, hog tribe, and Anoplothere, and differs from the rhinoceros, tapir, and Palæothere, which have the maxillaries, as well as the nasals and premaxillaries, entering into the formation of the external bony nostril.

The ungulate and herbivorous character of *Pliolophus* is most distinctly marked by the modifications of the lower jaw, especially by the relative dimensions of the parts of the ascending ramus

[1] *Hist. of Brit. Fossil Mammals*, 8vo, p. 299, figs. 103, 104.

[2] In plate i. of the writer's *Memoir of the Nautilus*, 4to, 1832.

[3] *Hist. Brit Foss. Mamm.*, p. 306, fig. 105.

[4] *Comptes Rendus de l'Acad. des Sciences*, Paris, 26th January 1857 (*Coryphodon Oweni*, Hebert).

[5] *Quarterly Journal of the Geological Society*, vol. xiv., p. 54.

Mammalia.

which give the extent of attachment of the biting (temporal) and grinding (masseteric and pterygoid) muscles respectively. In the shape of the mandible *Pliolophus* most resembles *Tapirus* among existing Mammals, and the *Palæotherium* among the extinct ones in which that shape is known. As in almost every species of eocene quadruped yet discovered, the *Pliolophus* presents the type-dentition of the placental diphyodont series, viz.:—

$$i\,\frac{3-3}{3-3},\ c\,\frac{1-1}{1-1},\ p\,\frac{4-4}{4-4},\ m\,\frac{3-3}{—}=44.$$ [1]

The incisors are preserved in the lower jaw with marks of attrition on their crowns demonstrating corresponding teeth of the same number (6), and of similar size, in the upper jaw, from which the alveolar part of the premaxillaries had been broken away.

The canines are small in both jaws: they are separated by a vacant space from the outer incisors, and by a longer interval from the first premolars. These form a continuous series with the remaining teeth in the upper jaw, but are separated by a space of about half their breadth from the second premolar in the lower jaw. The succeeding teeth (*p*, 1, 2, 3, 4) increase in size to the penultimate molar in the upper, and to the last molar in the lower jaw (*p*, 4, in figs. 90 and 91), which tooth has a third lobe.

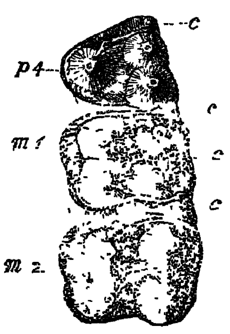

Fig. 90.

True Molars, Upper Jaw (twice nat. size), *Pliolophus*.

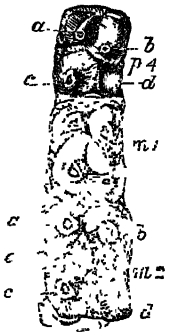

Fig. 91.

True Molars, Lower Jaw (twice nat. size), *Pliolophus*.

In the last premolar upper jaw (fig. 90, *p*, 4) the cingulum is uninterrupted along the outer side from its anterior well-developed talon (*c*) to the back part. The two outer cones resemble those of the true molars; but there is only one inner cone, and the crown of *p*, 4 differs accordingly from that of *m*, 1, in being triangular rather than square. A ridge is continued from the interspace between the anterior talon (*c*), and the outer anterior lobe obliquely inward and backward to the inner lobe, swelling into a small tubercle at the middle of its course.

The first molar (*m*, 1) presents four low thick cones, two internal and two external: each external cone is connected with its opposite internal one by a low ridge, swelling into a tubercle at the middle of its oblique course. The cingulum (*cc*) seems to be continued uninterruptedly round the crown of this tooth, thickest at the fore and back part, and at the interspace of the inner lobes; and developing the small accessory antero-external tubercle. The second molar (*m*, 2) is similar to, but rather larger than, the first; the tubercle on the oblique ridge connecting the two front lobes is less developed. The cingulum is obliterated on the inner side of the posterior lobe.

The last molar is rather narrower behind than *m*, 2; the tubercle on the anterior of the oblique connecting ridges is smaller: that on the posterior ridge is almost obsolete.

In the last lower premolar (fig. 91, *p*, 4) the division and development of the anterior lobe gives rise to a pair of cones, one external (*a*), the other internal (*b*), connected anteriorly by a basal ridge, in front of which is the fore part of the cingulum. The low posterior lobe (*c*) shows the rudiment of a second internal cone (*d*).

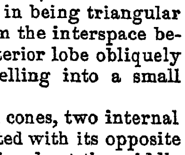

Fig. 92.

True Molar, Lower Jaw (magn.), *Stereognathus ooliticus*.

The first molar (fig. 91, *m*, 1) has a pair of front lobes and a pair of hind lobes, with an oblique ridge continued from postero-internal lobe to the interspace between the front pair.

The second molar (*m*, 2) shows an increase of size; but its chief and most interesting modification is the development of a tubercle (*e*) between the two anterior lobes, making three cones on the same transverse line, and thus repeating the character of the molar tooth of *Stereognathus* (fig. 92, *e*). The oblique ridge from the outer and hinder lobe (*c*) abuts against the intermediate tubercle (*e*). The nearest approach to the above dentition is made by the extinct *Hyracotherium*, also a fossil from the London clay.

The third trochanter on the femur of *Pliolophus*, and the association of three metatarsals in one portion of the matrix, as if belonging to the same hind foot, confirm the essentially perissodactyle affinities of that genus as shown by the skull and teeth. *Pliolophus* and *Hyracotherium* form a well-marked section in the lophiodont family, which seems to have preceded the palæotherian family in the order of appearance, and to have retained more of the general ungulate type than that family. This is shown by the graduation of the tapiroid modification of the molar teeth into one more nearly resembling that of the *Anthracotheria* and *Chœropatami*; by the absence of the postero-internal cone on the ultimate premolar, by which all the premolars are, as in artiodactyles, less complex than the true molars, by the form and position of the nasal bones and the structure of the external nostril.

Genus LOPHIODON, Cuv.—In the year 1800 Cuvier[2] first announced the discovery of the fossil remains of a quadruped allied to and of the size of the tapir, in the lacustrine deposits of the Montagne Noir, near Issel, department of Aude in Languedoc. The outer incisor of the lower jaw was shortened to give room to the longer corresponding incisor above, as in the tapir; the canines offered the same proportional development, but the three first molars (premolars) of the lower jaw presented a more simple structure, having the crown compressed, and forming two cones, the front one being the largest;—in short, a structure, the type of which is presented only by the first of the three premolars (*p*, 2) in the genus *Tapirus*.[3]

Years elapsed ere Cuvier obtained clear evidence of the structure of the upper molars of this new fossil Mammal. Such detached teeth as had been obtained from the fresh-water formations near Issel were referred, owing to the way in which they departed from the type of the upper molar teeth of the *Tapir*, to the genus *Rhinoceros*. This fact is indicative of the annectant affinities of the *Lophiodon* in the perissodactyle series.[4] Besides the character of form, the upper molar series of *Lophiodon* differs, like the lower one, from that in *Tapirus*, in the greater simplicity of the last two premolars; these teeth have a single cone on the inner side in *Lophiodon*; they have there two cones in *Tapirus*, forming the inner terminations of two transverse ridges, as in the true molars. These teeth in the *Lophiodon* differ from those in the *Tapirus* in the greater fore-and-aft expanse of the outer terminations of the transverse ridges, and the less depth of the cleft between them—a more complete coalescence of those parts causing a more entire outer wall of the crown, completes the transition to the Rhinoceros type, towards which the Palæotherium offers the next step.

Genus PALÆOTHERIUM, Cuv.—This extinct genus of quadruped was restored (fig. 93) by Cuvier through a series of admirably instructive steps, ultimately verified by a complete series of fossils, obtained chiefly from the upper eocene gypseous formation at Montmartre and other parts of France. The molar teeth of *Palæotherium* (fig. 94) approach nearer to those of the rhinoceros; but in the number, kind, and general arrangement the entire dentition resembles that of *Pliolophus*. The skull affords indications that the Palæothere possessed a short proboscis. It had three toes on each foot, each terminated by a hoof;

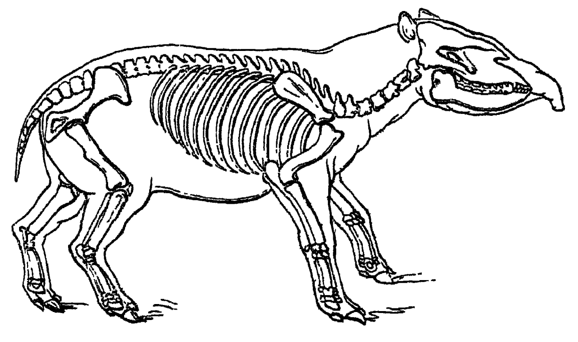

Fig. 93.

Restoration of the *Palæotherium* (Eocene Gyps.)

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[1] See art. ODONTOLOGY, vol. xvi., p. 448, for Cuvier's "Homologies of the Teeth," and explanation of their symbols.

[2] *Bulletin des Sciences*, Paris, Nivose, an. viii., No, 34.

[3] Art. ODONTOLOGY, p. 471, fig. 136, *p*, 2.

[4] Ibid, p. 470.

the middle one being the largest. The femur had a third trochanter, and the dorso-lumbar vertebræ were 21 in number. Several species of *Palæotherium* have been determined, ranging from the size of a sheep (*P. curtum*) to that of a horse (*P. magnum*). Fig. 94 gives the grinding surface of an upper molar of this species from the upper eocene of the Bembridge beds, Isle of Wight. The crown is divided into an anterior (*b*, *d*) and posterior (*a*, *c*) part by an oblique figure (*e*), continued from near the middle of the inner surface of the crown obliquely across two-thirds of the tooth. Each division is subdivided partially into an outer (*ab*) and an inner (*cd*) lobes; the anterior division, by the terminal expansion (*i*) of the fissure (*e*), the posterior one by the fissure (*g*). The lobes (*c* and *d*) are bordered near their base by a ridge. This is the type of grinding surface, in which are superinduced the modifications of that surface in the upper molars of the rhinoceros and horse.

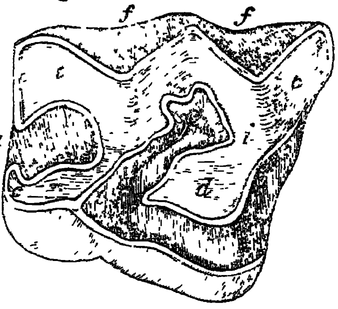

Fig. 94.
Upper Molar, *Palæotherium magnum* (Eocene)

The dental formula of *Palæotherium* is $i\frac{3-3}{3-3}$, $c\frac{1-1}{1-1}$, $p\frac{4-4}{4-4}$, $m\frac{3-3}{3-3}=44$. The canines exceed in length the other teeth and there are consequently vacancies in the dental series for the lodgement of the crowns of the canines when the mouth is shut.

Genus ANOPLOTHERIUM, Cuv.—With the same dental formula as in *Palæotherium*. The present genus, like *Dichodon*, had no interval in the series of teeth; neither the canine nor any other tooth rising above the general level. The grinding surface of the molar teeth somewhat resembles and prefigures the ruminant type; in the upper jaw the crown (fig. 95) is divided into a front (*fc*) and a back (*fd*) lobe by a valley (*e*) extending two-thirds across. A second valley (*gi*) crosses its termination at right angles, forming a curved depression in each division, which it thus subdivides into two lobes, concave towards the outer side of the tooth. There is a large tubercle (*m*) at the wide entry of the valley (*e*). The Anoplothere (fig. 96) was of a lighter and more elegant form than the Palæothere; its limbs terminated each in two digits, with the metapodial bones distinct, and the last phalanx hoofed Some transitory characters of the embryo ruminant were retained throughout life by the Anoplothere. The species restored in fig. 96 was about the size of a fallow-deer it

Fig. 95.
Upper Molar, *Anoplotherium commune* (Eocene Gyps.)

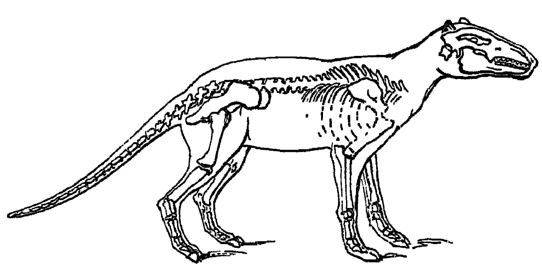

Fig. 96.
Restoration of the *Anoplotherium* (Eocene Gyps.)

had a long and strong tail, and was probably of aquatic habits. Smaller and more delicate species of Anoplotheroids from upper eocene strata have been referred to distinct genera by later palæontologists. The researches of Baron Cuvier, which resulted in the restoration of the *Palæotherium* and *Anoplotherium*, are the most instructive which the palæontologist can study. They form the third volume of the 4to edition of the *Ossemens Fossiles*, 1822–5.

Genus DICHODON, Ow.—The upper eocene beds of Hampshire have yielded evidence of an extinct form of even-toed (artiodactyle) hoofed quadruped, most interesting as a transitional form between the Anoplotheroids and the true Ruminants. Like the *Anoplotherium* the dental series is continuous, without break—a character which is only manifested by mankind among existing Mammals; the crowns of the teeth, in *Dichodon*, being all of nearly equal height, as they are in man. On each side of both upper and lower jaws there are in the *Dichodon* (art. ODONTOLOGY, fig. 118) three incisors (*i*, 1, 2, 3), one canine (*c*), four premolars (*p*, 1, 2, 3, 4), and three true molars (*m*, 1, 2, 3)—in all forty-four teeth, constituting the typical Diphyodont[1] dentition which so many mammalian genera, on their first appearance in the eocene strata, exhibit. It is formalized as follows:—$i\frac{3-3}{3-3}$, $c\frac{1-1}{1-1}$, $p\frac{4-4}{4-4}$ $m,\frac{3-3}{3-3}=44$. From the first incisor to the third premolar the teeth have all a trenchant, and, after the canine, a somewhat trenchant character. The back of the third premolar (*p*, 3), and all the fourth premolar, show the crushing form of crown, which in the true molars, after the wearing down of the first sharp cusps, produces the double crescentic lines of enamel which are now peculiar to the Ruminants amongst hoofed quadrupeds. The extinct species showing the above characters, and on which the genus was founded,[2] was nearly the size of a fallow-deer: it is called *Dichodon cuspidatus*, in reference to the number of sharp points on the unworn molars. The dentition indicates that its food may have been of a peculiar character, perhaps not exclusively of a vegetable nature

In the same upper eocene formation of Hampshire have been found instructive examples of some smaller members of the extinct anoplotheroid family.

Genus DICHOBUNE.—The genus *Dichobune* (from δίχα, *bipartite*; βουνὸς, *collis*) was proposed by Cuvier, in the second edition of his *Ossemens Fossiles*, 4to, tom. iii., 1822, p. 64, for the *Anoplotherium minus* of the original Memoir in the *Annales du Muséum*, tom. iii., 1803, and for the *A. leporinum* of the 4to edition, 1822, tom i., pl. 2, fig. 3; and tom. iii, pp. 70 and 251. It is closely allied to the anoplotherioid genus *Xiphodon;* the dental formula is the same, only there is a slight interval between the canine and the first premolar in both jaws; the first three premolars are subcompressed, subtrenchant, but less elongated from behind forwards than in *Xiphodon*. Besides the two normally-developed and functional digits on each foot, there be one, sometimes two, supplemented digits.

The best illustration of the structure of the upper true molars is afforded by the figure of one of these teeth in the *Proceedings of the Geological Society*, May 20, 1846, published in the *Quarterly Journal*, vol. ii., p. 420. "The anoplotherian character of the tooth is shown by the large size of the lobe (*p*, *x*, fig. 1), and the subgeneric peculiarity by the continuation of its dentinal base with that of the inner and anterior lobe (*id*), at the early stage of attrition presented by the crown of the tooth in question. In the large and typical *Anoplotheria*, the lobe (*p*) preserves its insular form and uninterrupted contour of enamel until the crown is much more worn down than in the present tooth (fig. 1). In this respect, as in the modifications of the lower molar teeth, the genus *Dichobune* shows its closer affinity to the true Ruminants; but the little fold of enamel dividing the lobe *id* from *p* distinguishes the upper molar tooth in question from that of any Ruminant." (P. 421.)

A new and interesting species of this genus, called *Dichobune ovina*, has been founded upon an almost entire lower jaw with the permanent dental series, wanting only the four middle incisors, which now forms part of the palæontological collection in the British Museum. The dental formula, as shown by the mandibular teeth, and by the evidence on their crowns of the presence of the teeth of the upper jaw, is the typical one in diphyodont Mammalia, viz.:—$i\frac{3-3}{3-3}$, $c\frac{1-1}{1-1}$, $p\frac{4-4}{4-4}$, $m\frac{3-3}{3-3}=44$. The canine, with a crown like that of the first premolar, and not longer, is separated from it by an interval of half the breadth of the crown, and by a narrower interval from the outer incisor. The first premolar is divided by an interval of scarce a line's breadth from the second. The rest of the molar series are in contact. The total length of the lower jaw is 5 inches 11 lines ($0^{m}\cdot148$); that of the molar series is 2 inches 11 lines ($0^{m}\cdot075$); that of the three true molars is 1 inch $4\frac{1}{2}$ lines (0^{m} 035). The near equality in height of the crowns of all the teeth, and their general character, show that the animal belonged to the anoplotheroid family. The dentition of the present species differs from that of *Dichodon* in the absence of the accessory cusps on the inner side of the base of the true molars; and both from *Dichodon cuspidatus* and *Xiphodon gracilis* in the minor antero-posterior extent of the premolars; it corresponds with *Dichobune* (as represented by the *D. leporina*, Cuvier) in the proportions of the premolars and in the separation of the canine from the adjoining teeth; to this genus, therefore, the fossil is referable, provisionally, in the absence of knowledge of the molars of the upper jaw, which are the most characteristic; and the writer has proposed to call the

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[1] See art ODONTOLOGY, p. 439.

[2] *Quarterly Journal of the Geological Society*, tom. iv., 1847, p. 36, pl. 4.

Mammalia.

species, from the size of the animal represented by the fossil, *Dichobune ovina*. It is from Hampshire eocene.

Genus XIPHODON.—The genus *Xiphodon* was indicated, and its name proposed, by Cuvier, for a small and delicate, long and slender-limbed anoplotherian animal, which, in his first Memoir (*Annales du Muséum*, tom. iii., p. 55, 1803), he had called *Anoplotherium medium;* but he altered the name, in the second 4to edition of the *Ossemens Fossiles* (tom. iii., pp. 69 and 251, 1822), to that of *Anoplotherium gracile*.

The distinction indicated by Cuvier is now acccepted by palæontologists as a generic one, and a second species (*Xiphodon Geylensis*) has been added by M. Gervais (*Paléontographie Française*, 4to, 1845, p 90) to the type-species, *Xiphodon gracilis*, of which he figures an instructive portion of the dental series of both jaws, obtained from the lignites of Débruge near Apt. The dental formula of *Xiphodon* is the typical one, viz.:—$i\frac{3-3}{3-3}$, $c\frac{1-1}{1-1}$, $p\frac{4-4}{4-4}$, $m\frac{3-3}{3-3}=44$.

The teeth are arranged in a continuous series in both jaws. The canines and first three premolars have the crowns more extended antero-posteriorly, lower, thinner transversely, and more trenchant, than in the type *Anoplotheria* (whence the name *Xiphodon*, or sword-tooth). The feet are didactyle, with metacarpals and metatarsals distinct. The tail is short. The lower true molars have two pairs of crescentic lobes with the convexity turned outwards.

Genus MICROTHERIUM.—Entire crania of *Microtherium*, from the lacustrine calcareous marls of the Puy-de-Dôme, are in the British Museum, and these show that the hinder division of the upper true molars was complicated by the additional (third) cusp.

With regard to *Microtherium*, the unusually perfect fossil skulls of that small Herbivore, which did not exceed in size the delicate chevrotains of Java and other Indo-Archipelagic islands,—*e.g. Tragulus kanchil*,—are of importance in regard to the question of their alleged affinity to the *Ruminantia*, on account of the demonstration they give of the persistent and functional upper incisor teeth. The little eocene even-toed Herbivores, like the larger Anoplotherioids, thus departed from the characters of the true Ruminants of the present day, in the same degree in which they adhered to the more general type of the artiodactyles Had M. de Blainville, who believed them to be Ruminants, possessed no other evidence of the *Microtherium* than of the *Dichobune murina* and *Dichobune obliqua*, Cuv., he would have had the same grounds for referring the *Microtheria*, as the *Dichobunes*, to the genus *Tragulus* or *Moschus* (les Chevrotains); but the entire dentition of the upper jaw of the species *Anoplotherium murinum* and *A. obliquum*, referred by Cuvier to his genus *Dichobune*, must be known before the existence of Ruminants in the upper eocene gypsum of Paris can be inferred.

No doubt the affinity of these small Anoplotheroids to the Chevrotains was very close. Let the formative force be transferred from the small upper incisors to the contiguous canines, and the transition would be effected. We know that the Ruminant stomach of the species of *Tragulus* is simplified by the suppression of the psalterium or third bag. The stomach of the small Anoplotheroids, whilst preserving a certain degree of complexity, might have been somewhat more simplified. The certain information which the gradations of dentition displayed by the above-cited extinct species impart, testifies to the artificial character of the order *Ruminantia* of the modern systems, and to the natural character of that wider group of even-toed hoofed animals for which has been proposed the term ARTIODACTYLA.[1]

Genus HYÆNODON, Laiz.—With the delicate and beautiful Herbivora of the upper eocene and lower miocene periods, there coexisted carnivorous quadrupeds, which, to judge by the character of their flesh-cutting teeth (carnassials), were more fell and deadly in their destructive task than modern wolves or tigers. Of these old extinct Carnivora a species of the remarkable genus *Hyænodon*, of about the size of a leopard, has left its remains in the upper eocene of Hordwell, Hampshire. Fig. 113, art. ODONTOLOGY (vol. xvi., p. 464), shows the dentition of the under jaw of another species of the same genns from miocene beds at Débruge and Alais, France. The carnassial teeth (*m*, 1, 2, 3), instead of being one in number in each ramus of the jaw, as in modern Felines, were three in number, equally adapted by their trenchant shape, to work like scissor-blades on the teeth of the upper jaw, in the act of cutting flesh. After the small incisors came a pair of large piercing and prehensile canines (*c*), followed by four compressed pointed and trenchant premolars (*p*, 1, 2, 3, 4) in each side of the jaw; the whole of this carnivorous dentition conforming to the diphyodont type:—

$$i\frac{3-3}{3-3},\ c\frac{1-1}{1-1},\ p\frac{4-4}{4-4},\ m\frac{3-3}{3-3}=44.$$

Genus AMPHICYON.—With the foregoing predecessor of the digitigrade Carnivora was associated a forerunner of the plantigrade family, viz., a large extinct species having the molars tuberculated, after the pattern of those of the bears; but retaining, like *Hyænodon*, the perfect type of diphyodont dentition. Fig. 114, art. ODONTOLOGY (vol. xvi., p. 464), shows the teeth of one side of the upper jaw of the *Amphicyon giganteus* The first and second molars (*m*, 1 and 2) have each two tubercles on the outer side and one on the inner side; the last tubercular molar (*m*, 3) is of very small size. Fossil remains of *Amphicyon* have been found principally in the miocene deposits at Sansans, south of France. Those of a smaller species from the miocene at Epplesheim, have been referred to the wolverine genus as *Gulo diaphorus*, Kaup.

Mammalia.

The proofs of the abundant mammalian inhabitants of the eocene continent were first obtained by Cuvier from the fossilized remains in the deposits that fill the enormous Parisian excavation of the chalk. But the forms which that great anatomist restored were all new and strange, specifically, and for the most part generically distinct from all known existing quadrupeds. By these restorations the naturalist was first made acquainted with the aquatic cloven-hoofed Anoplothere, and with its light and graceful congeners, the Dichobunes and Xiphodon, with the great Palæotheres, which may be likened to hornless rhinoceroses, with the more tapiroid Lophiodon, with the large peccari-like Pachyderm called Chœropotamus, and with about a score of other genera and species of placental Mammalia.

Almost the sole exception to the generic distinction of these eocene forms from modern ones was yielded by the opossum of Montmartre (*Didelphis Gypsorum*, fig. 97); and what made this discovery the more remarkable was the fact that all the known existing species of that marsupial genus are now confined to America, and the greater part to the southern division of that continent. An opossum appears to have been associated with the peccari-like Hyracotherium in the eocene sand of Suffolk; where likewise, a porcine beast with tusks like ordinary canines (*Chœropotamus*), and some remains of a monkey (*Eopithecus*), have been found. With respect to the *Didelphis Gypsorum*, its generic relations were deduced from characters of the lower jaw and teeth; but these were associated with other parts of the skeleton in the same block of stone. When Cuvier expressed his convictions from the teeth and other parts first exposed and examined, his scientific associates were incredulous. He invited them, therefore, to witness a crucial test. The outline of the back part of the pelvis was exposed, the fore part buried in the matrix. By his delicate use of the graving-tool, Cuvier brought to light the fore-part of the pelvis with the two marsupial bones (fig. 97, *a*, *a*) in their natural position. He thus demonstrated that there had been buried in the soft fresh-water deposits, hardened in after ages into the building-stone of Paris, an animal whose genus at the present day is peculiar to America. It is not uninteresting to remark that the Peccari, the nearest existing ally to the old Chœropotamus, is, like the opossum, now peculiar to America; and that two species of tapir, the nearest living allies to the Lophiodon and Palæothere, exist in South America.

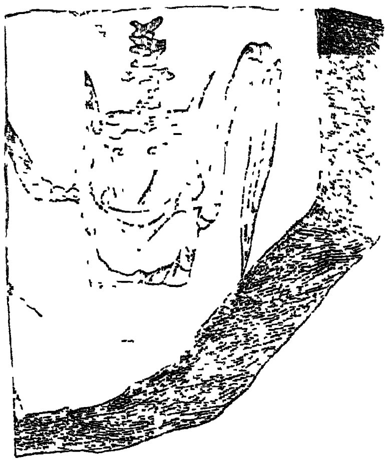

Fig. 97.

Pelvis and Marsupial Bones of *Didelphis Gypsorum* (Eocene, Paris).

The marine deposits of the miocene epoch show the remains of extinct genera of dolphins (*Ziphius* and *Dioplodon*) and of whales (*Balænodon*). Petrified cetaceous teeth and ear-bones, called "cetotolites" (fig. 98) have been washed out of previous strata into the red crag of Suffolk. These fossils belong to species distinct from any known existing Cetacea, and which, probably, like some contem-

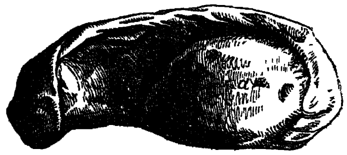

Fig. 98.

Cetotolite or Fossil Ear-bone of *Balænodon gibbosus* (Red Crag, Suffolk).

[1] *Quarterly Journal of the Geological Society*, vol. iv., 1847.

Mammalia. porary quadrupeds, retained fully-developed characters which are embryonic and transitory in existing cognate Mammals. The teeth of these Cetacea were determined in 1840, the ear-bones in 1843. The vast numbers of these fossils, and the proportion of phosphate of lime in them, led Professor Henslow[1] to call the attention of agricultural chemists to the red crag as a deposit of valuable manure. Since that period it has yielded a large supply, worth many thousand pounds annually, of the superphosphates. The red crag is found in patches from Walton-on-Naze, Essex, to Aldbro', Suffolk, extending from the shore to 5 or 15 miles and more inland. It averages in thickness 10 feet, but is in some places 40 feet. Broken-up septarian nodules form a rude flooring to the crag, left by the washing off of the London clay, and called "rough stone." The phosphatic fossils, or "cops," as they are now locally termed, occur in greatest abundance immediately above the "rough-stone." Thousands of cubic acres of earlier strata must have been broken up to furnish the cetacean nodules of the "red crag." This is a striking instance of the profitable results of a seemingly most unpromising discovery in pure science,—the determination of what in 1840 was regarded as a rare, unique, and most problematical British fossil.[2]

Our knowledge of the progression of mammalian life during the miocene period is derived chiefly from continental fossils. These teach us that one or two of the generic forms most frequent in the older tertiary strata still lingered on the earth, but that the rest of the eocene Mammalia had been superseded by new forms, some of which present characters intermediate between those of eocene and those of pliocene genera. The *Dinotherium* and narrow-toothed *Mastodon*, for example, diminish the interval between the *Lophiodon* and the elephant; the *Anthracotherium* and *Hippohyus*, that between *Chœropotamus* and *Hippopotamus*; the *Acerotherium* was a link connecting *Palæotherium* with *Rhinoceros*.

One of the most extraordinary of the extinct forms of the cetaceous order has been restored from fossil remains discovered in formations of the miocene age in Europe and North America. The teeth of this carnivorous whale, for which the generic name *Zeuglodon* seems now to be generally accepted, were first described and figured by the mediæval palæontologist Scilla, in his treatise entitled *De Corporibus Marinis* (4to, 1747, tab. xii., fig. 1), and have since given rise to various interpretations. The originals were obtained from the miocene strata at Malta, and are now preserved in the Woodwardian museum at Cambridge.

The remains of a gigantic species of the same genus, discovered by Dr Harlan in miocene formations of Arkansas, Mississippi, were described and figured by him as those of a reptile, under the name of *Basilosaurus*.[3] Teeth of a smaller species, discovered by M. Grateloup, in miocene beds of the Gironde and Herault, were ascribed by him also to a reptile, under the name of *Squalodon*.[4] In 1839 Dr Harlan brought over his specimens of *Basilosaurus* to London, and submitted them to the writer's inspection, by whom they were determined to be mammalian and cetaceous. The entire skeleton has since been obtained from miocene deposits in Alabama, revealing a length of body of about 70 feet. The skull is very long and narrow; the nostril single, with an upward aspect, above and near the orbits. The jaws are armed with teeth of two kinds, set wide apart; the anterior teeth have sub-compressed, conical, slightly-recurved, sharp-pointed crowns, and are implanted by a single root; the posterior teeth are larger, with more compressed and longitudinally extended crowns (see fig. 65, art. ODONTOLOGY), conical, but with a more obtuse point, and with both front and hind borders strongly notched or serrated. The crown is contracted from side to side in the middle of its base, so as to give its transverse section an hour-glass form (see fig. 66, ODONTOLOGY), and the opposite wide longitudinal grooves which produce this form become deeper as the crown approaches the socket, where they meet and divide the root into two fangs. The name *Zeuglodon* (yoke-tooth) refers to this structure. The mode of succession of the teeth in this genus conforms to the general mammalian type more than does that of any of the existing carnivorous Cetaceans. In the figure given by Dr Carus[5] of a portion of the jaw of *Zeuglodon cetoides*, a deciduous molar (fig. 65, *a*, ODONTOLOGY) is about to be displaced and succeeded, vertically, by a second larger molar. This mode of succession is not known in the *Platanista* or *Inia*, which among existing true Cetacea present teeth most like those of *Zeuglodon*; but it is a mode of succession and displacement affecting certain teeth in the herbivorous Cetacea, or *Sirenia*; and we thus seem to have in the *Zeuglodon* another of those numerous instances of a more generalized character of organization in older tertiary Mammalia. In systematic characters, *Zeuglodon* typifies a distinct family or group, intermediate between *Cetacea* proper and *Sirenia*. Mammalia.

Of the latter family or order, however, represented at the present day by the Dugongs, Manatees, and Stellerians or Arctic Manatees (if the species still survives), there were abundant and more widely distributed representatives during the miocene period, having, upon the whole, the nearest affinity with the existing African Manatee (*Manatus Senegalensis*), but with associated characters of the Dugong (*Halicore*). There were, *e.g.*, two incisive tusks in the upper jaw, and four or five small incisors along the deflected part of each ramus of the lower jaw. The upper molars, with three roots, were thickly enamelled, like those of the Manatee, but with a pattern of grinding surface which led Cuvier to attribute detached specimens to a small species of *Hippopotamus*. The lower molars had two roots. All the bones have the dense or solid structure of those of the *Sirenia*. On the remains of this remarkable amphibious Mammal, discovered by Kaup in 1838, in the miocene beds at Eppelsheim, he founded the genus *Halitherium*. Other remains have been discovered in Piedmont, Asté, and many parts of France, from the "calcaire grossier" of the Gironde, containing Lophiodont fossils, up to the pliocene near Montpellier; at which period the *Halitherium* seems to have become extinct.

Genus MACROTHERIUM, Lartet.—The edentate order, which is so abundantly and variously represented in South America, which has its Orycteropes and Pangolins in Africa, and its Manises in tropical Asia, has no living representative in Europe. Perhaps the most unexpected form of Mammal to be revealed by fossil remains from European tertiary deposits, after a Marsupial, was a member of the edentate order. Cuvier, by whom the evidence of this extinct animal was first made known, prefaces his description of the single mutilated phalangeal bone, on which that evidence was founded, by the remark, that "nothing proves better the importance of the laws of comparative osteology than all the consequences which one may legitimately draw from a single fragment." One willingly admits the proof so afforded of the former existence of animals now unknown; but one may demur to the conclusion that their extinction was due to some sudden catastrophe.

The single mutilated ungual phalanx on which Cuvier based his conclusions in regard to the species in question was discovered, associated with remains of *Rhinoceros*, *Mastodon*, *Dinotherium*, and *Tapir*, in a formation near Eppelsheim, Hesse-Darmstadt, which is now determined to belong to the miocene division of the tertiary series. This phalanx shows two distinctive characters of the edentate order:—*1st*, Its posterior surface for articulation with the antepenultimate phalanx is a double pulley, hollowed out on each side, with a salient crest between, constituting the firm kind of ginglymoid joint peculiar to certain *Edentata*; *2d*, The concave arch formed by that pulley curves furthest backward at its upper part, which would prevent the claw being retracted upward, as in the cat tribe, and constrain the flexion downward—"ainsi c'est necessairement un onguéal d'edenté."[6] To the foregoing characters are joined two others which Cuvier believed to determine "as necessarily" the genus. The species of *Myrmecophaga* have on the upper part of the pointed end of the claw-phalanx a groove, indicative of a disposition to bifurcate; in the species of *Manis* the bifurcation is complete, the cleft extending as far as the middle of the claw-bone. The Pangolins (*Manis*) have not those bony sheaths, which, in the sloths, some ant-eaters and armadillos, rise from the base and cover the root of the claw; there was a like absence of any claw-sheath in the fossil. Thus the fossil claw-bone has no homologue in existing nature save those of the Manis; and, "according to all the laws of co-existence, it is impossible to doubt that the most marked relations of the animal that bore it should have been with that genus of quadrupeds."[7] But what must have been its size? The phalanx was not one of the largest on the foot —for it had not those slight raised borders which one sees in the large claw-bones of the Pangolins. This question, which Cuvier answered by the proportions of the short-tailed Manis, at 24 French feet, has had a more reasonable reply given to it by certain other bones of the skeleton subsequently discovered in the miocene tertiaries of France. These discoveries have likewise rectified and moderated the absolute application of the correlative law to the necessary determination of the genus as well as of the order. The relations of the double-jointed and cleft phalanx to the Edentata is beautifully confirmed; but the additional fossils, and especially some evidences of teeth, have shown that it belonged to a peculiar and now extinct genus intermediate between the *Manis* and the *Orycteropus*. And these relations are deeply interesting on account of the geographical position of both those edentate genera, on

[1] *Proceedings, and Quarterly Jour. Geol. Soc.*, 1843.
[2] *Hist. of Brit. Fossil Mammals*, 8vo, p. 536.
[3] *Medical and Physical Researches*, p. 333.
[4] *Act. Soc. Linn. de Bordeaux*, 1840, p. 201.
[5] *Nova Acta Cæs. Leop. Carol.*, vol. xxii., tab. xxxix. B., fig. 2, p. 340.
[6] *Ossemens Fossiles*, 4to, t. v., pt. i., p. 193.
[7] Ibid., p. 194.

Mammalia.

tracts of land, viz., which are now most contiguous to the continent containing the remains of the extinct osculant genus.

The locality in France is near the village of Sansan, near Auch, department of Gers, Haute-Pyrenées. The formation is a lacustrine deposit of the miocene period.

Portions of two molar teeth have been found, 1 inch 8 lines in greatest transverse diameter; the tooth preserving the same size and shape through the whole length of the portion—viz., 1½ inch. They resemble in shape those of the Orycterope, but are less regular and have not the same tubular tissue. Their microscopic texture appears not to have been analysed; it would be important to determine whether it resembled that of the teeth of the sloths or armadillos. The humerus differs from that of the ant-eaters and armadillos by its greater length in proportion to its breadth, and by the peculiar flattening from before backwards of its lower half, and especially at the condyles, above which it is expanded transversely by both external and internal supra-condyloid ridges. It is not perforated above the inner condyle, as the same bone is in both the *Manis* and *Orycteropus*. In the degree to which it departs from the type of the ant-eaters it approaches that of the Megatheroids and sloths—viz., in its relative length, flattening at the distal end, and the imperforate character of that end. The radius also presents a sloth-like character in its greater proportionate length, which exceeds that of the humerus; and in the compression of its lower slightly-expanded end. In both the Pangolin and Orycterope the radius is shorter than the humerus. The ulna differs likewise from both that of the Pangolin and Orycterope, and still more from that in the Armadillos by the much smaller development of the olecranon, whereby, again, it more resembles that of the sloths. The femur is relatively longer and more slender than that of the terrestrial and fossorial Edentata; it has not the third trochanter which characterizes it in the Orycterope, nor so marked a development of the great and small trochanters as in the Pangolin. In the flattened form of the shaft of the femur, and the position of the rotular surface near one side of the distal end, it resembles the femur of the Megatherium and Mylodon. It is shorter than the humerus; whereas, in both the Pangolin and Orycterope the femur is longer: in this respect the femur of the Macrothere resembles that of the sloths. The great width of the popliteal space dividing the condyles is an endentate and more especially a megatheroid character. The internal condyle is much broader than the external one, as it likewise is in the Megatheroids; it is certainly with the femur of the latter family of the Edentata, rather than with that of the Proboscidians or Pachyderms, that one should compare the femur of the Macrothere: it is not so long or so slender relatively as in the sloths. The tibia is much shorter than the femur, and in the expansion of its proximal end and its relative length to the femur it resembles that of the Megatheroids more than that in the Pangolin or Orycterope; it was not anchylosed to the tibia as in the Armadillos, Glyptodons, and Megatherium, but a distinct bone, as in the Mylodon and sloths.

Genus PLIOPITHECUS, Gerv.—In the same miocene deposits of the south of France as those which contained the *Macrotherium*, fossil remains of two kinds of Quadrumana, resembling a small and large species of *Hylobates*, have been discovered. The smaller of these extinct apes, called *Pliopithecus antiquus* by Gervais, is based upon the lower jaw and dentition. The teeth occupy an extent of 1½ inch; the two incisors are narrower, the canine less, and the last molar is larger than in the siamang (*H. syndactyla*). As in this species the first premolar is uni-cuspid, and the hind talon of the second is more produced than in the chimpanzee and gorilla, and to the degree in which the fore-and-aft diameter of the tooth exceeds the transverse one, it departs farther from the human type; in the degree of the development of the talon or third lobe of the last lower molar, the *Pliopithecus* resembles the tailed monkeys (*Semnopithecus* and *Innus*).

Genus DRYOPITHECUS, Lart.—In the larger miocene ape (*Dryopithecus Fontani*, Lart.) the canine is relatively larger than in the *Hylobates*, and the incisors, to judge by their alveoli, are relatively narrower than in the chimpanzee and human subject. The first premolar has the outer cusp pointed, and raised to double the height of that of the second premolar, and its inner lobe is more rudimental than in the chimpanzee,[1] and departs proportionally from the human type. The posterior lobe or talon of the second premolar is more developed, and the fore-and-aft extent of the tooth greater, than in the chimpanzee, thereby more resembling the second premolar of the siamang, and less resembling that of the human subject. The last (third) molar is undeveloped in the fossil jaw of the *Dryopithecus*, and its amount of departure from the human type, and approach to that of *Innus*, cannot be determined. The canine is more vertical in position than in *Troglodytes* or *Pithecus*, but this character is offered by some of the small South American apes, and cannot be cited as a mark of real affinity. From the portion of humerus associated with the jaw of *Dryopithecus*, the arm would seem to have been proportionally longer and more slender than in the chimpanzee and gorilla, more like that in the long-armed apes (*Hylobates*), and less like the arm of the human subject.

Mammalia.

The characters of the nasal bones, orbits, mastoid processes, relative length of upper limb to trunk, relative length of arm to fore arm, relative length and size of thumb, relative length of lower limb, and, above all, the size of the hallux and shape of the astragalus and calcaneum, must be known before any opinion can be trusted as to the proximity of *Dryopithecus* to the human subject.

Genus MESOPITHECUS Wagn.—In tertiary formations of Greece, at the base of Pentelicon, remains of a Quadrumane have been found, which Professor Wagner[2] regards as transitional between *Hylobates* and *Semnopithecus*: the third lobe of the last molar is, however, as well developed as in the latter genus.

In the pliocene deposits of Montpellier remains of a monkey occur, referred by Christol to a *Cercopithecus*; and in pliocene brick-earth in Essex the writer has determined part of the fossil jaw and teeth of a *Macacus*.

Genus DINOTHERIUM, Cuv. and Kp.—This name was given by Kaup to the huge bilophodont Mammal, first made known by Cuvier under the name of "Tapir gigantesque," after the discovery of the singular shape and armature of the lower jaw. The length of the skull, from *f* to *d*, in fig. 99, is 3 feet 8 inches. The teeth

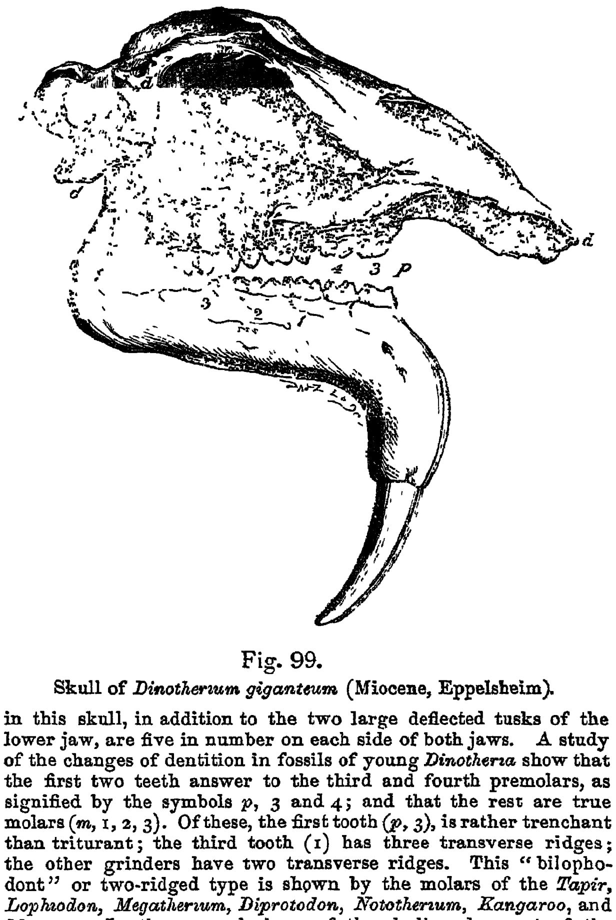

Fig. 99.

Skull of *Dinotherium giganteum* (Miocene, Eppelsheim).

in this skull, in addition to the two large deflected tusks of the lower jaw, are five in number on each side of both jaws. A study of the changes of dentition in fossils of young *Dinotheria* show that the first two teeth answer to the third and fourth premolars, as signified by the symbols *p*, 3 and 4; and that the rest are true molars (*m*, 1, 2, 3). Of these, the first tooth (*p*, 3), is rather trenchant than triturant; the third tooth (1) has three transverse ridges; the other grinders have two transverse ridges. This "bilophodont" or two-ridged type is shown by the molars of the *Tapir*, *Lophiodon*, *Megatherium*, *Diprotodon*, *Nototherium*, *Kangaroo*, and *Manatee*. In the general shape of the skull and aspect of the nostrils *Dinotherium* most resembles *Manatus*. Bones of limbs have not yet been found so associated with teeth as to determine the ordinal affinities of *Dinotherium*. Yet cranial and dental evidences of the genus have been discovered in miocene deposits of Germany, France, Switzerland, and Perim Island, Gulf of Cambay.

Genus MASTODON, Cuv.—The earliest appearance of this genus of proboscidian or elephantoid Mammal is in tertiary strata of miocene age, and by a species in which the fore part of the lower

[1] Compare *Comptes Rendus de l'Acad. des Sciences*, tom. xliii. (July 28, 1856, plate, fig. 7), with *Trans. Zool. Soc.*, vol. iv., plate 32, fig. 3, p. 3.

[2] *Abhanglungen der k. bayer Akademie*, bd. ii., 1854, Munchen.

Mammalia.

jaw was produced into a pair of deep sockets containing tusks; but these are only slightly deflected from the line of the grinding teeth (fig. 100, *C*). This species of *Mastodon*, discovered in the miocene of Eppelsheim, was called *longirostris* by Kaup, but he afterwards recognised it as the same with a species which had been previously called *Mastodon arvernensis* (Croizet and Jobert)[1] Both belong to that section of *Mastodon* in which the first and second true molars have each four transverse ridges,[2] and for which Dr Falconer proposes the name *Tetralophodon*. In the newer tertiary deposits of North America remains of a Mastodon (*M. Ohioticus*) have been discovered, in which the transverse ridges of the grinders are in shape more like those of the Dinothere than in any other Mastodon; the first and second, moreover, are bilophodont, the third trilophodont; but this is followed by two three-ridged molars and a last larger molar with four or five ridges.[3] For the Mastodons with penultimate and antepenultimate grinders with three ridges, Dr Falconer proposes the name *Trilophodon*. In the *Mastodon Ohioticus* the lower jaw has two tusks in the young of both sexes, these are soon shed in the female, but are long retained by the male (fig. 100, *B*). The upper tusks are long and retained in both sexes (fig. 100, *A*).[4]

An almost entire skeleton of a Mastodon (*M. turicencis*) has been discovered in the pliocene deposits of Asté, Piedmont, and has been described and figured by Professor Sismonda,[5] from whose beautiful Memoir fig. 100 is taken. The total length, from the tail to the end of the tusks, is 17 feet. The teeth have the same narrow shape and multi-mammillate structure as in *M. arvernensis*, but in the numerical character of transverse divisions of the crown this species agrees with *M. Ohioticus*. The Mastodons were elephants with the grinding teeth less complex in structure, and adapted for bruising coarser vegetable substances. The genus was represented by species ranging, in time, from the miocene to the upper pliocene deposits, and in space, cosmopolitan with tropical and temperate latitudes. The transition from the mastodontal to the elephantine type of dentition is very gradual.

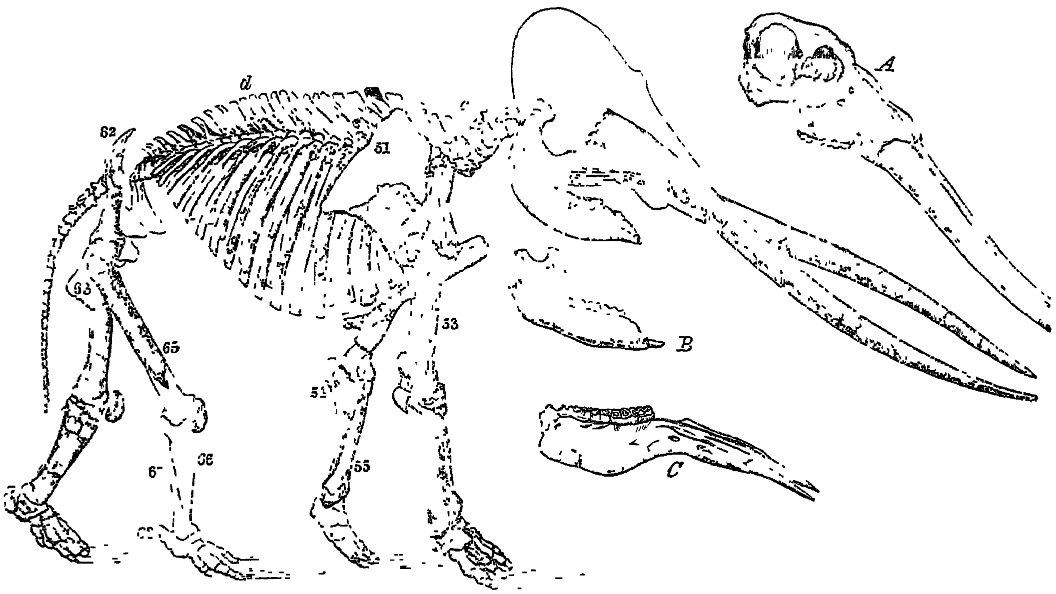

Fig. 100.

Mastodon turicencis (Pliocene): *A, B.*—*M. Ohioticus*; *C.*—*M. longirostris.*

Genus ELEPHAS, L.—The latest form of true elephant which obtained its sustenance in temperate latitudes is that which Blumenbach called *primigenius*, the "Mammoth" of the Siberian collectors of its tusks (fig. 101). Its remains occur chiefly, if not exclusively, in pleistocene deposits, and have even been found in turbary near Holyhead. Its grinders are broader, and have narrower and more numerous and close-set transverse plates and ridges, than in other elephants.[6] The mammoth is more completely known than most other extinct animals by reason of the discovery of an entire specimen preserved in the frozen soil of a cliff at the mouth of the river Lena in Siberia. The skin was clothed with a reddish wool, and with long black hairs. It is now preserved at St Petersburg, together with the skeleton (fig. 101). This measures, from the fore part of the skull to the end of the mutilated tail, 16 feet 4 inches; the height, to the top of the dorsal spines, is 9 feet 4 inches; the length of the tusks, along the curve, is 9 feet 6 inches. Parts of the skin of the head, the eye-ball, and of the strong ligament of the nape which helped to sustain the heavy head and teeth, together with the hoofs, remain attached to the skeleton. These huge elephants, adapted by their clothing to endure a cold climate, subsisted on the branches and foliage of the northern pines, birches, willows, &c.; and during the short summer they probably migrated northward, like their contemporary the musk-buffalo, which still lingers on, to the 70th degree of N. latitude, retreating during the winter to more temperate quarters. The mammoth was preceded in Europe by other species of elephant,—*e.g.*, *Elephas meridionalis* (Nesti), which, during the pliocene period, seem not to have gone northward beyond temperate latitudes. An elephant, hardly distinguishable from the African, also roamed at that period in Europe.[7]

Genus HIPPOPOTAMUS, L.—The discovery, in lacustrine and fluviatile deposits of Europe, of the remains of an amphibious genus of Mammal now restricted to African rivers, gives scope for speculating on the nature of the land which, uniting England with the Continent, was excavated by lakes and intersected by rivers, with a somewhat warmer temperature than at present, to judge by a few S. European shells which occur in the fresh-water formations,—*e.g.*, at Grays, Essex, where remains of the large extinct *Hippopotamus major* have been found. The specimen of lower jaw (fig. 102) was discovered in similar deposits on the Norfolk coasts. Other localities are specified in the writer's *History of British Fossil Mammals*.

The hippopotamus is first met with in pliocene strata. The remains of *H. major* have hitherto been found only in Europe; they are common along the Mediterranean shore, and do not occur north of the temperate zone. In Asia this form of Pachyderm was represented, perhaps at an earlier period, by the genus *Hexaprotodon*,—essentially a hippopotamus, with six incisor teeth, instead of four, in each jaw.

Genus RHINOCEROS, L.—The rhinoceros, like the elephant, was represented in pliocene and pleistocene times, in temperate and northern latitudes of Asia and Europe, by extinct species. One

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[1] *Beitrage zur Naeheren Kenntniss der Urweltlichen Saeugethiere*, 4to, 1857, p. 19. The name *angustidens* was first applied by Cuvier to teeth of this type or species.

[2] First demonstrated by Kaup, *Ossemens Fossiles de Darmstadt*, 4to, 1835.

[3] *Odontography*, p. 617, pl. 144.

[4] Ibid., p. 618.

[5] *Osteografia di un Mastodonte augustidente*, 4to, 1851.

[6] See art. ODONTOLOGY, p. 475, fig. 142.

[7] Falconer "On the Species of Elephant and Mastodon occurring in a fossil state in England," *Proc. Geol. Soc.*, June 1857.

Mammalia.

(*Rhinoceros leptorhinus*) associated with the *Hippopotamus major* in fresh-water pliocene deposits; another (*R. tichorrhinus*) with the mammoth in pleistocene beds and drift. The discovery of the carcase of the tichorrine rhinoceros in frozen soil, recorded by Pallas in his *Voyages dans l'Asie Septentrionale*,[1] showed the same adaptation of this, at present tropical, form of quadruped to a cold cli-

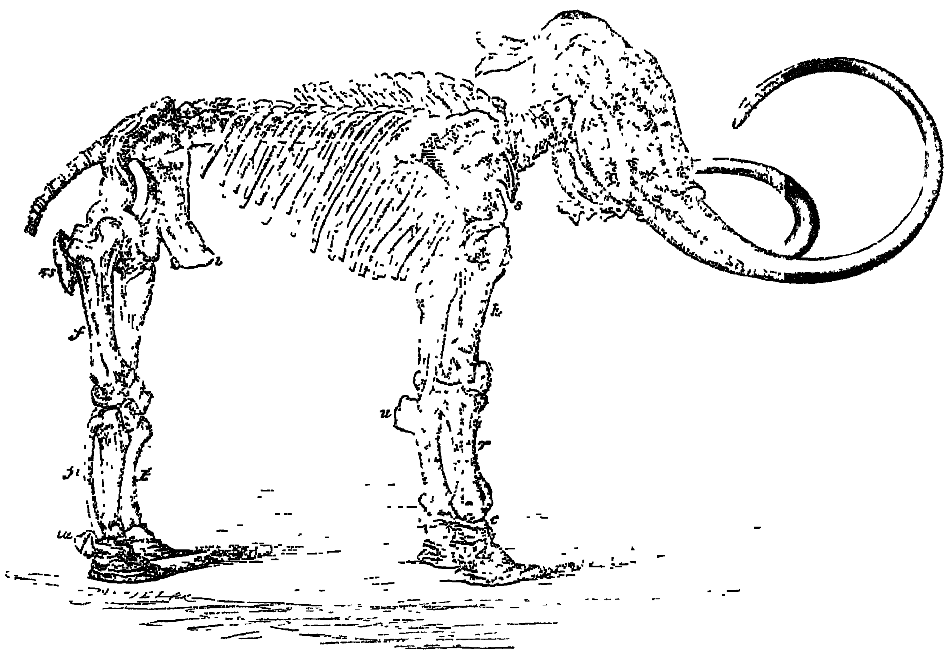

Fig. 101.

Elephas primigenius (Pleistocene).

mate, by a twofold covering of wool and hair, as was subsequently demonstrated to be the case with the mammoth. Both the above-

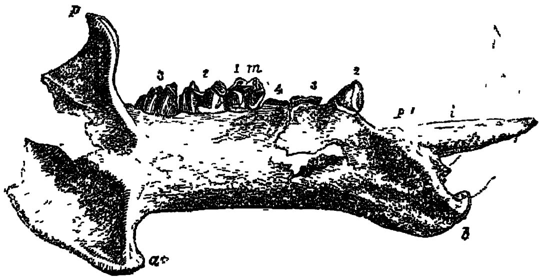

Fig. 102.

Lower Jaw of *Hippopotamus major* (fresh-water Pliocene, Cromer, Norfolk).

named fossil rhinoceroses were two-horned; but they were preceded, in the pliocene and miocene periods, by species devoid of horns, yet a rhinoceros in all other essentials (*Acerotherium*, Kaup). Not fewer than twenty species of extinct rhinoceroses are entered in Palæontological catalogues.

Order RUMINANTIA.

Of other forms of beasts subsisting on the vegetable productions of the earth, and more akin to actual European Herbivora, there co-existed with the foregoing now exotic genera a vast assemblage of species, nearly all of which have passed away. The quadrupeds called "Ruminants," from the characteristic second mastication of the partly-digested food by the act called "rumination" or "chewing the cud," constitute at the present period a circumscribed group of Mammalia, which Cuvier believed to be "the most natural and best-defined order of the class."[2] He characterized it as having incisive teeth only in the lower jaw (fig. 107, *c*), which were replaced in the upper jaw by a callous gum. Between the incisors and molars is a diastema, in which, in certain genera only, may be found one or two canines. The molars (fig. 107, *h*), almost always six on each side of both jaws, have their crown marked by two double crescents, with the convexity turned inwards in the upper set, outwards in the lower.[3] The four legs are terminated by two toes and two hoofs, flattened at the contiguous sides, so as to look like a single hoof cloven; whence the name "cloven-footed," also given to these animals. The perfect circumscription and definition of this order, so desirable by the systematic zoologist, is indeed invaded, in the actual *Ruminantia*, by certain peculiarities of the camel tribe.

In entering upon the evidences of the first appearance in this planet of the order of animals, which now are the most valuable to man, it may be well to call to mind the characters of the *Anoplotherium*. The upper true molars have two double crescents, convex inwards, one of the inner ones being encroached on by a large tubercle, the reduced homologue of which may be seen in the internal interspace of the crescents in the ox and some other Ruminants. The lower true molars also, at one stage of attrition, form crescentic islands of enamel, with the convexity turned outwards, as in Ruminants, the last molar having the accessory crescent behind. The functional hoofs were two in number on each foot, but must have resembled those of the camel tribe in shape; the scaphoid and cuboid of the tarsus were distinct also, as in the *Camelidæ;* and the metacarpal and metatarsal bones were divided, as in the water musk-deer (*Moschus aquaticus*), and in the embryos of all Ruminants. The dentition of the extinct Dichodon[4] made a still nearer approach to that of the Ruminants. The chief distinction of this and other extinct Herbivores with double crescentic molars is the completion of the upper series of teeth by well-developed incisors. But the premaxillaries in the new-born camel contain each three incisors, one of which becomes fully developed. The *Camelidæ* are hornless, like the Anoplotherioids and Dichodonts, and with one exception—the giraffe—all Ruminants are born without horns.

Thus the *Anoplotherium*, in several important characters, resembled the embryo Ruminant, retaining throughout life those marks of adhesion to a more generalized mammalian type. The more modified or specialized form of hoofed animal, with cloven foot and ruminating stomach, appears at a later period.

Family I.—Bovidæ.

Fossil molars of the ruminant type and bovine character have hitherto been found, with unequivocal evidence, to the writer's knowledge, only in beds or breccias of pliocene and pleistocene age.

[1] 4to, 1793, pp. 130–132. [2] *Règne Animal*, tom. i., p. 254. [3] See art. Odontology, p. 466, figs. 120, 121.
[4] See art. Odontology, p. 465, fig. 118.

Mammalia.

At those periods in Britain there existed a very large species of bison (*Bison priscus*), and a larger species of ox (*Bos antiquus*), from pliocene fresh-water beds; whilst a somewhat smaller but still stupendous wild ox (*B. primigenius*) has left its remains in pleistocene marls of England and Scotland. With this was associated an aboriginal British ox of much smaller stature and with short horns (*B. longifrons*), which continued to exist until the historical period, and was probably the source of the domesticated cattle of the Celtic races before the Roman invasion. A buffalo, not distinguishable from the musk kind (*Bubalus moschatus*), now confined to the northern latitudes of North America, roamed over similar latitudes of Europe and Asia in company with the hair-clad elephants and rhinoceroses.

FAMILY II.—CERVIDÆ.

Cuvier[1] first made known the fact of teeth with the character of ruminant molars, and of portions of antlers, being associated with

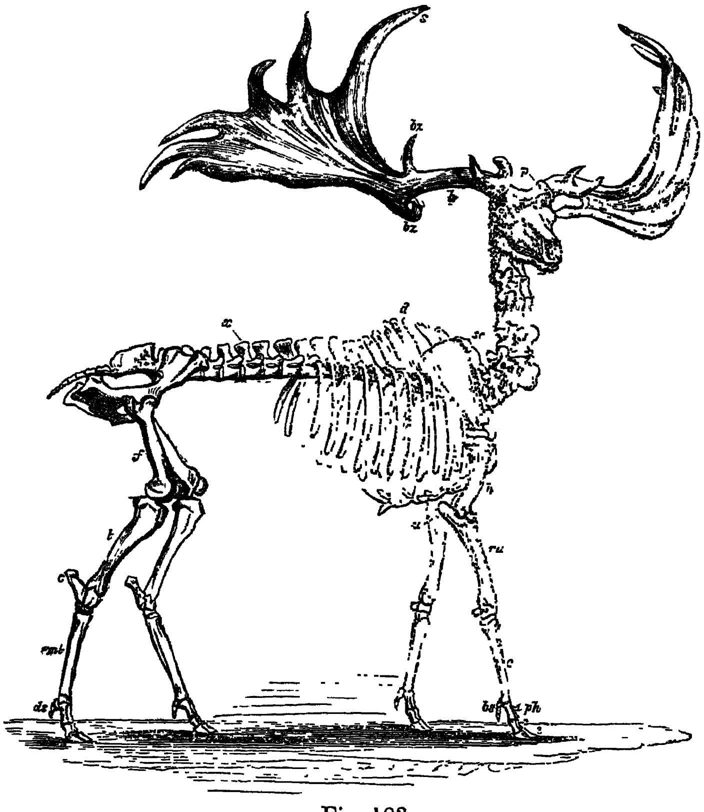

Fig. 103.

Megaceros Hibernicus (Pleistocene marl).

emains of *Lophiodon* and *Mastodon* in the fresh-water miocene beds of Montabusard, department of the Loiret. These early ruminant fossils agreed in size with the roebuck; but there were characters showing that they differed almost generically from all known deer. In 1834 Professor Kaup received from the miocene strata near Eppelsheim, Darmstadt, the entire cranium of a small Ruminant, the teeth of which were identical with those described and figured by Cuvier; but, the series being complete, showed that the animal had long procumbent canines, as in the *Moschus moschiferus*; in some secondary characters of the teeth, however, as in the proportions of the premolars, and especially the presence of the first of that series, at least in the lower jaw, it was generically distinct from *Moschus* or *Tragulus*. Moreover, the animal had possessed, like the males of the small deer of India called "Muntjac," antlers as well as long canine teeth. Both in the miocene beds of Ingré and Eppelsheim, antlers have been found which were supported on long pedicles, as in the muntjac, and simply bifurcate near their end. It is probable that these horns, which have been referred to the nominal species *Cervus anocerus*, may belong to the *Dorcatherium* of Kaup.

Other species of *Cervidæ* were, however, associated with that remarkable form in the miocene period. Dr Kaup ascribes some more or less mutilated antlers, which had been shed, to a species he calls *C. dicranocerus*. The beam rises from 1 to 2 inches without sending off any branch or brow-antler; it then sends off a branch so large and so oblique that the beam seems here to bifurcate; the anterior prong is, however, the smallest and shortest. The writer has received similar shed and mutilated antlers from the red crag of Sussex, which seems to contain a melange of broken-up beds of eocene, miocene, and pliocene age.[2]

The cervine Ruminants have been divided into groups according to the forms of the antlers. Of the group with antlers expanded and flattened at top, of which the fallow-deer (*Dama*) is the type, no fossil examples have been found in Britain. Cuvier has described and figured antlers of great size from the pliocene deposits of the valley of the Somme, near Abbeville, which, from the relative position and direction of the brow-snag and mid-snag, and from the terminal palm, he regards as a large extinct species of fallow-deer; the name *Cervus Somonensis* has since been attached to this species. But there once existed a group (*Megaceros*, fig. 103) characterized by a form of antler at present unknown amongst existing species of deer. With a beam (*b*) expanding and flattening towards the summit, and a brow-snag (*p*), as in the *Dama* tribe, this antler shows a back-snag (*bz*). Moreover, in antlers which, from their size and form, seem to have been developed by the deer at its prime, the brow-snag expands and sometimes bifurcates,—a variety never seen in the fallow-deer, but which becomes exaggerated in the reindeer group. The representative of the present *Megaceros* is one extinct species (*M. Hibernicus*, fig. 103), remarkable for its great size, and especially for the great relative magnitude and noble form of its antlers: it is the species commonly but erroneously called the "Irish elk;" because it is a true deer, intermediate between the fallow- and rein-deer; and because, though most abundant in, it is not peculiar to, Ireland. In that country it occurs in the shell-marl underlying the extensive turbaries. In England its remains have been found in lacustrine beds, brick-earth, red clay, and ossiferous caves.[3]

The reindeer (*Cervus Tarandus*) has peculiar antlers (fig. 104), and proportionably the largest of any of existing species. The beam is somewhat flattened throughout, but expands only and suddenly at its extremity, a similar expansion characterizing the brow-snag (*br*) and mid-snag (*bz*), two, three, or more points being developed from all these expansions in fully-developed antlers. The brow-snag is remarkable for its length. There is also frequently a short back-snag. It is plain, therefore, from the presence of this snag, from the great relative size of the antlers, from the complex brow-snag, and the terminal expansion of the beam, that we have in the reindeer the nearest of kin to the extinct *Megaceros*.

The existing species (*Tarandus*) is restricted to northern latitudes, ranging to extreme ones in Europe, and in America from the Arctic Circle southward to the latitude of Newfoundland, where the large variety called "Carabou" still exists. Reindeer of similar size ranged over continental Europe, appear to have been seen by Cæsar in Germany, and have left good evidence of their existence in many parts of England. The specimen figured (fig. 104) was found in pleistocene "till" at Bilney Moor, East Dereham.

A large deer, with subcompressed ramified antlers, slightly expanding at the base of the terminal divisions, but differing from the reindeer in the absence of the brow-snag, has left its remains in the pleistocene sands of Riège, near Pézenas, France. It is the *Cervus martialis* of Gervais; and seems to have been an intermediate form between the reindeer (*Tarandus*) and the elk (*Alces*). There is no existing representative of this interesting annectant form of deer.

In formations of corresponding age in France, called "alluvions volcaniques" by Gervais,[4] fossil antlers of two other extinct species of deer have been discovered, in which, as in *Alces*, the brow-antler is absent, but in which the beam does not expand into a palm.

In North America remains of a large deer (*Cervus americanus fossilis*, Harlan), much resembling the *Wapiti* (*Cervus canadensis*) have been found in pleistocene deposits on the banks of the Ohio. In South America Dr Lund discovered fossil antlers of two species in bone-caves in Brazil: they were associated with remains of an antelope (*Antilope maquinensis*, Lund) of which genus no living representative is now known in South America.

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1 *Ossemens Fossiles*, 4to, tom. iv., p. 104, pl. viii., figs. 5 and 6.

2 *Quarterly Jour. of the Geol. Soc.*, vol. xii., 1856, p. 217, figs. 14–16.

3 Owen, *Hist. of Brit. Fossil Mammals*, p. 444.

4 *Zoologie et Palæontologie Française*, 4to, p. 82.

Mammalia.

Of deer with antlers of the type of the existing red-deer (*C. elaphus*), a species is indicated in pleistocene beds and bone caves

Fig. 104.

Skull and Antlers of *Cervus Tarandus.*

which rivalled the *Megaceros* in bulk (*Strongyloceros spelæus*); and with this are found, in similar places of deposit, remains of a red-deer with antlers equalling or surpassing the finest that have been observed within the historical period.

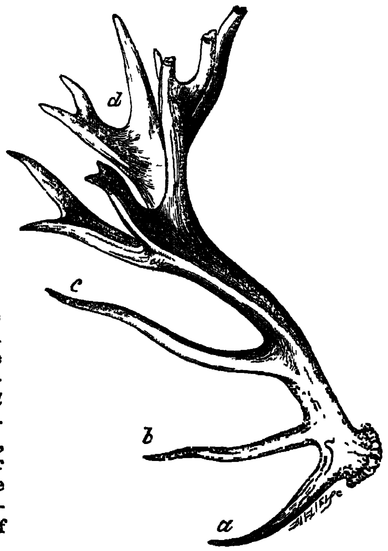

Fig. 105.

Antler of Red-deer, from alluvium, Ireland.

Fig. 105 represents one of a pair of antlers from the bed of the Boyne at Drogheda, now in the museum of Sir Philip Egerton, Bart., which measures 30 inches in length, and sends off not fewer than fifteen branches or "snags." *a* is the "brow-snag," which rises immediately above the "burr;" *b* the second, *c* the third, and *d* the "crown" or terminal cluster of snags, which gave to the deer developing them at the period of his full perfection the title of "crowned hart."

The little roebuck, like the red-deer, appears from its fossil remains to have continued to exist from the prehistorical pleistocene times to the present period.

ORDER CARNIVORA.

The quadrupeds which subsist by preying upon others co-existed under corresponding varieties of form, and in adequate numbers, with the numerous and various *Herbivora* of the newer tertiary periods. A brief description has already been made of some of the singular forms, the genera of which are extinct, that lived in eocene and miocene times.

Genus GALECYNUS, OW.—In 1829 the fossil skeleton of a Carnivore, of the size of a fox, was discovered by Sir Roderick I. Murchison in the pliocene schist of Œningen. On a close comparison of this specimen, the writer finds that the first premolar is smaller, and the third and fourth larger than in the fox, and all the teeth are more close-set and occupy a smaller space than in the genus *Canis;* the bones of the feet are more robust; and these, with other characters, indicate an extinct genus intermediate between *Canis* and *Viverra*.[1] The unique specimen is now in the British Museum.

Mammalia.

Genus FELIS, L.—As it is by this form of perfect Carnivore that Cuvier chiefly illustrated his principle of the correlation of animal structures, it will be exemplified more particularly in this place, and by the aid of the subjoined cut (fig. 106). The founder of palæontology thus enunciates the law which he believed to be so operative in his labours of re-constructing extinct species:—

"Every organized being forms a whole, a single circumscribed system, the parts of which mutually correspond and concur to the same definitive action by a reciprocal re-action. None of these parts can change without the others also changing, and consequently each part, taken separately, indicates and gives all the others."[2]

Cuvier did not predicate that law by an *à priori* method, by any of those supposed short cuts to knowledge, the fallacy of which Bacon so well exposes; he arrived at the law inductively, and after many dissections had revealed to him the facts—of the jaw of the Carnivore being strong by virtue of certain proportions; of its having a peculiarly shaped and articulated condyle, with a plate of bone of breadth and height adequate for the implantation of muscles, with power to inflict a deadly bite—a process grasped by muscles of such magnitude as necessitated a certain extent of surface for their origin from the cranium, with concomitant strength and curvature of the zygomatic arch; the facts of the modified occiput and dorsal spines in relation to vigorous uplifting and retraction of the head when the prey had been griped; the size and shape of the piercing, lacerating, and trenchant teeth; the mechanism of the retractile claws, and of the joints of the limb that wielded them:—it was not until after Cuvier had recognised these facts, and studied them and their correlations in a certain number of typical *Carnivora*, that he felt justified in asserting that "the form of the tooth gives that of the condyle, of the blade-bone (*s*), and of the claws, just as the equation of a curve evolves all its properties; and exactly as, in taking each property by itself as the base of a particular equation, one discovers both the ordinary equation and all its properties, so the claw, the blade-bone, the condyle, the femur, and all the other bones individually, give the teeth, or are given thereby reciprocally; and in commencing by any of these, whoever possesses rationally the laws of the organic economy will be able to re-construct the entire animal." The principle is so evident that the non-anatomical reader will have little difficulty in satisfactorily comprehending it by the aid of the subjoined diagram.

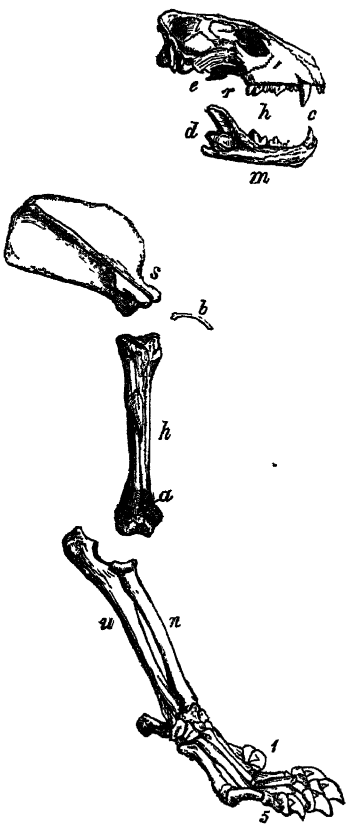

Fig. 106.

Palæontological characters of a Feline Carnivore.

In the jaws of the lion (fig. 106), there are large pointed teeth (laniaries or canines, *c*) which pierce, lacerate, and retain its prey. There are also compressed trenchant teeth (*h*), which play upon each other like scissor-blades in

[1] See *Quarterly Journal of the Geological Society*, vol. iii., 1647, p. 55.

[2] *Ossemens Fossiles*, 4to, tom. i. (1812), p. 58.

the movement of the lower upon the upper jaw. The lower jaw (*m*) is short and strong; it articulates to the skull by a transversely extended convexity or condyle (*d*), received into a corresponding concavity (*e*), forming a close-fitting joint, which gives a firm attachment to the jaw, but almost restricts its movements to one plane, as in opening and closing the mouth. The plate of bone, called coronoid process (*r*), which gives the surface of attachment to the chief biting muscle (crotaphyte or temporal) is broad and high; the surface on the side of the skull (temporal fossa, *t*) from which that muscle arises is correspondingly large and deep, and is augmented by the extension of ridges of bone from its upper and hinder periphery.

The bar or bridge of bone (zygomatic arch) which spans across the muscle, bends strongly outwards to augment the space for its passage; and as it gives origin to another powerful biting muscle (masseter), the arch is also bent upwards to form the stronger point of resistance during the gripe of that muscle. From almost all the periphery of the back surface of the skull there is a strong pitted ridge, affording extensive attachment to powerful muscles which raise the head, together with the animal's body, which the lion may have seized with his jaws; this beast of prey being able to drag along the carcase of a buffalo, and with ease to raise and bear off the body of a man. If we next examine the framework of the fore limb, which is associated with the above-defined structure of the skull, we find that the fore paw consists of five digits (1–5), the innermost and shortest (1) answering to our thumb, and having two bones; the other four digits having each three bones or "phalanges." All those digits enjoy a certain freedom of motion and power of reciprocal approximation for grasping; but their chief feature is the modification of the terminal phalanx, which is enlarged, compressed, subtriangular and more or less bent; with a plate of bone as it were, reflected forwards from that base, from which the pointed termination of the phalanx projects like a peg from a sheath. A powerful, compressed, incurved, sharp-pointed, hard, horny claw is fixed upon that peg, its base being firmly wedged into the interspace between the peg and the sheath. The toe-joint so armed is retractile. This complex, prehensile, and destructive paw is articulated to the two bones of the fore leg (radius, *n*, and ulna, *u*); they are both strong, are both distinct, are firmly articulated to the arm-bone (*h*) by a joint, which, although well built, allows great extent and freedom of motion in bending and extension; and, besides this, the two bones are reciprocally joined so as to rotate on each other, or rather the radius upon the ulna, carrying with it, by the greater expansion of its lower end, the whole paw, which can thus be turned "prone" or "supine;" whereby its application as an instrument for seizing and tearing is greatly advantaged. The humerus or arm-bone (*h*) is remarkable for the extension of strong ridges from the outer and inner sides, just above the elbow-joint. These ridges indicate the size and force of the supinator, pronator, flexor, and extensor muscles of the paw. To defend the main artery of the fore leg from compression during the action of these muscles, a bridge of bone (*a*) spans across it as it passes near their origin. The upper end of the arm-bone is equally well marked by powerful ridges for muscular implantation, especially for the deltoid; but these ridges do not project beyond the round "head" of the bone, so as to impede its movements in the socket.

The blade-bone (scapula, *s*) is of great breadth, with well-developed processes (spine, acromion, and coracoid) for muscular attachments; the size and shape of this bone relate closely to the volume of the muscles which operate upon the arm-bone and fore limb. A small clavicular bone (*b*) is interposed between a muscle of the head and one of the arm, giving additional force and determination of action reciprocally to both muscles.

Such are some of the modifications of the teeth and framework of a beast of prey, which concur, and were deemed by Cuvier to be correlated, in the organization of such animals

Let us compare them with those of the corresponding parts in an ox (fig. 107). The teeth answering to the great laniaries in the lion are absent; at most, one recognises the homologues of the lower canines, reduced in size and altered in shape, so as to form the outer teeth (*c*) of a bent row of incisors terminating the lower jaw. The back teeth (*h*), instead of being trenchant, have broad and flat crowns, roughened with hard ridges, opposing each other with a grinding action, like mill-stones. The lower jaw is long and slender; it articulates to the skull by a flat condyle (*d*), admitting of rotatory movements upon a flattened articular surface on the skull, and limiting the extent of opening and shutting the mouth. The coronoid process (*r*) is very slender, and the fossa which marks the size of the temporal muscle (*t*) is correspondingly small. The zygomatic arch (*o*) is short and feeble, and its span is narrow; it is almost straight, or with a slight bend downwards. The part of the skull (pterygoid plates), which afford attachment to the rotating muscles of the jaw, and the (angular) part (*f*) of the jaw into which they are inserted, are of great extent. The ox masticates grass with great efficiency; it inflicts no injury to other animals with its teeth. The horns are its weapons, and they are chiefly defensive.

The fore foot of the ox is reduced to two principal toes, with two rudimentary ones dangling behind. Each of these has its extremity enveloped by a thick horny case, or hoof, this modification is accompanied by a junction or coalescence of the radius (*n*) and ulna (*u*), preventing reciprocal rotation or movement of those bones on each other,—by a joint restricting the movement of the fore arm (antibrachium) upon the arm (brachium or humerus, *h*) to one plane,—by a long and narrow blade-bone (*s*), with a stunted coracoid and no clavicle; in short, by modifications adapting the limb to perform the movements required for locomotion, and almost restricting it to such. This type of fore limb is always associated with broad grinding teeth, and with the modifications of jaw and skull above defined. The due amount of observation assured Cuvier that these several modifications, like the contrasted ones in the Carnivora, were correlated, and he enumerates the physiological grounds of that correlation.

Fig. 107.

Palæontological characters of a Ruminant (*Bos*).

Those grounds may be traced to a certain degree in the secondary modifications of the ferine order. If the retractibility of the claw be suppressed, the carnassiality of the teeth is reciprocally modified. If the unguiculate foot is reduced from the digitigrade to the plantigrade type, the dentition is still more altered, and made more subservient to a mixed diet.

By the application of the correlative principle to the fossil mammalian remains of pliocene and later deposits, the Herbivora have been distinguished from the Carnivora; and out of the latter have been re-constructed extinct species of the feline, viverrine, ursine, and other families of the order. In England and continental Europe a peculiarly destructive feline quadruped existed, with the upper canines much elongated, trenchant, sharp-pointed, sabre-shaped; whence the name *Machairodus* proposed for this feline sub-genus. It was represented by species as large as a lion (*M. cultridens* and *M. latidens*); and by others of the size of a leopard (*M. palmidens* and *M. megantereon*). This form is first found in the miocene of Auvergne and of Eppelsheim; next in the pliocene of the Val d'Arno; and finally in cave breccia in Devonshire.

The finest examples of the large pleistocene lion (*Felis spelæa*) have been discovered in bone-caves,—*e.g.*, in those of Banwell, Somersetshire, and of Belgium. The production of the apex of the nasal process of the maxillary, as far back as that of the nasal bone, proves this species to have been a lion, not a tiger. It roamed over pliocene and pleistocene Europe, and has left its remains in many stratified deposits of the former period in Britain. Under similar circumstances have been found, more abundantly in Germany, the remains of the gigantic bear (*Ursus spelæus*), and more abundantly in England those of the great hyæna (*Hyæna spelæa*), probably a spotted one, like the fierce "Crocuta" of the Cape. Wolves, foxes, badgers, otters, wolverines, and martin-cats, foumarts and weasels, have left their remains in the newer tertiary deposits and bone-caves. Bats, moles and shrews were then, as now, the forms that preyed upon the insect world in Europe. The majority of these Carnivora, like the hares, rabbits, voles, and other Rodents, are not distinguishable from the species which still exist. These smaller unguiculate Mammals, like the smaller pleistocene

Mammalia.

Ruminants, seem to have survived those changes during which the larger species perished. It is probable that the horse and ass are descendants of a species of pleistocene antiquity. At the pliocene period there existed a species similar in size to a zebra. There is no certain character by which the present wild boar can be distinguished specifically from the *Sus*, which was contemporary with the mammoth.

Order Rodentia.

The small size of the great majority of the species of this order leads to the neglect or the oversight of their fossil remains by the labourers in quarries and other deposits of stone, to whom the palæontologist is usually indebted for his first acquaintance with characteristic fossils of such formations. No evidence has yet been obtained of any unequivocal remains of a rodent animal in strata more ancient than the eocene tertiary deposits. Cuvier detected remains of Rodents allied to the dormouse (*Myoxus*) and squirrel (*Sciurus*) in the building-stone of the Montmartre quarries near Paris. The lacustrine marls of the middle (miocene) tertiary period have yielded evidences of not fewer than eleven genera of Rodentia distinct from any now known to exist. The deposits at Eppelsheim, near Darmstadt, of the same miocene age have given evidence of Rodents akin to the marmot and the beaver. The more recent tertiary formations and the bone-caves in England have furnished fossil remains not distinguishable from the existing beaver, hare, and rabbit, water-vole and field-vole, as well as remains of a Pica, or tailless hare, belonging to the genus *Lagomys*, now confined, as an existing species, to Asia; and of a very large Rodent, akin to the beaver, called *Trogontherium* Similar fossil remains have been abundantly found in the pliocene and pleistocene formations of continental Europe; whilst the coeval deposits of America have yielded fossil remains of extinct species belonging to genera,—*e g.*, *Lagostomus*, *Echimys*, *Ctenomys*, *Cœlogenys*, and other Cavies,—now restricted to South America. In North America, fossil remains of a Rodent of comparatively gigantic size have recently been discovered. Some parts of the skeleton, and more especially the dentition of the rodent order, are highly characteristic,—the form of the articular surface for the lower jaw, which is a longitudinal groove, the molars, especially of the phytiphagous kinds, crossed by enamel plates more or less transverse,—these, with the long, curved, chisel-shaped incisors, two in each jaw, suffice to determine the ordinal relations of the fossil. The incisors alone would not be always so safe a guide, for the rodent modification of these teeth is repeated in the marsupial wombat and the lemurine aye-aye.[1]

With regard to the Rodentia, the great beaver (*Trogontherium*) seems to have become extinct in England and the Europæo-Asiatic continent before the historical period, whilst the smaller pliocene beaver continued to exist with us like the wolf, until hunted down by man. It still survives in a few of the great continental rivers. Of the little Lagomys of our ossiferous caves no living example remains in either England or Europe. The species, indeed, may be extinct: its genus is now limited to Central and Southern Asia.

Geographical Distribution of Pleistocene Mammals.

A most interesting generalization has been educed from the mass of facts relating to the fossil Mammals of the later tertiaries,—viz., their close correspondence between the fauna of those and present periods in the Europæo-Asiatic expanse of dry land. For here species continue to exist of nearly all those genera which are represented by pliocene and post-pliocene mammalian fossils of the same natural continent and of the immediately adjacent island of Great Britain.

The bear has its haunts in both Europe and Asia; the beaver of the Rhone and Danube represents the great Trogontherium; the Lagomys and the tiger exist on both sides of the Himalayan mountain chain; the hyæna ranges through Syria and Hindostan; the bactrian camel typifies the huge *Merycotherium* of the Siberian drift; the elephant and rhinoceros are still represented in Asia, though now confined to the south of the Himalayas. The true macacques are peculiar to Asia, and though most abundant in the southern parts of the continent and the Indian Archipelago, also exist in Japan; a closely-allied sub-genus (*Innus*) is naturalized on the rock of Gibraltar at the present day. A fossil species of Macacus was associated with the elephant and rhinoceros in England during the period of the deposition of the newer pliocene freshwater beds. The more extraordinary extinct forms of Mammalia, called *Elasmotherium* and *Sivatherium*, have their nearest existing pachydermal and ruminant analogues in the same continent to which those fossils are peculiar. Cuvier places the Elasmothere between the horse and rhinoceros: the existing four-horned antelopes, like their gigantic extinct analogues, the Sivathere and Bramathere, are peculiar to India. It may be regarded as part of the same general concordance of geographical distribution, that the genus *Hippopotamus*, extinct in England, in Europe, and in Asia, should continue to be represented in Africa, and in none of the remoter continents of the earth,—Africa also having its hyæna, its elephant, its rhinoceroses, and its great feline Carnivores. The discovery of extinct species of *Camelopardalis* in both Europe and Asia, of which genus the sole existing representative is now, like the hippopotamus, confined to Africa, adds to the propriety of regarding the three continuous continental divisions of the Old World as forming, in respect to the geographical distribution of pliocene, post-pliocene, and recent mammalian genera, one great natural province. The only large edentate animal (*Pangolin gigantesque*, Cuvier, *Macrotherium*, Lartet) hitherto found in the tertiary deposits of Europe, manifests its nearest affinities to the genus *Manis*, which is exclusively Asiatic and African.

Extending the comparison between the existing and the latest of the extinct series of Mammalia to the continent of South America, it may be first remarked that, with the exception of some carnivorous and cervine species, no representatives of the above-cited mammalian genera of the Old World of the geographer have yet been found in South America. Buffon[2] long since enunciated a similar generalization with regard to the existing species and genera of Mammalia; it is almost equally true in respect of the fossil. Not a relic of an elephant, a rhinoceros, a hippopotamus, a bison, a hyæna, or a lagomys, has yet been detected in the caves or the more recent tertiary deposits of South America. On the contrary, most of the fossil Mammalia from those formations are as distinct from the Europæo-Asiatic forms as they are closely allied to the peculiarly South American existing genera of Mammalia.

The genera *Equus*, *Tapirus* and the still more ubiquitous *Mastodon* form the chief, if not sole exceptions. The representation of *Elephas* during the pliocene period by distinct species in Asia (*E. primigenius*) and in South America (*E. curvidens*), is analogous to the geographical distribution of the species of *Tapirus* at the present day.

South America alone is now inhabited by species of sloth, of armadillo, of cavy, aguti, ctenomys, and platyrrhine monkey; but no fossil remains of a quadruped referable to any of these genera have yet been discovered in Europe, Asia, or Africa. The types of *Bradypus* and *Dasypus* were, however, richly represented by diversified and gigantic specific forms in South America during the geological periods immediately preceding the present. The skeleton of one of these forms of the sloth tribe is represented in fig. 108;

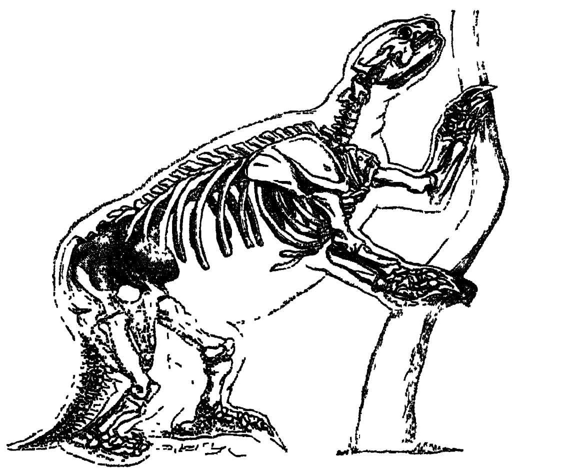

Fig. 108.

Extinct Terrestrial Sloth, *Mylodon robustus* (Pleistocene, S America).

it measures, from the fore part of the skull to the end of the tail, 11 feet. It was discovered buried 12 feet deep in the fluviatile deposits seven leagues north of the city of Buenos Ayres in the year 1841. It forms the subject of a work entitled *Description of the Skeleton of an Extinct Gigantic Sloth (Mylodon robustus)*,[3] in which are set forth in detail the grounds for regarding it as a member of the same natural family as the present small arboreal sloth, and as being modified to obtain its leafy food by uprooting and prostrating trees.

A still larger species of terrestrial sloth co-existed with the Mylodon in South America. Its skeleton, now complete in the British Museum, measures 18 feet; its dentition agrees as to number and kind of teeth with that of the sloths (*Bradypus*). But the

[1] See art. Odontology, pp 453–455.

[2] *Histoire Naturelle*, tom. ix., p. 13, 4to, 1758.

[3] 4to, 1842, Van Voorst.

molars (fig. 109) are longer, more deeply implanted, of more complex structure, and with grinding surfaces of the bilophodont type. The elephants, which subsist on similar food to that of the Megatherium, had their grinding machinery maintained by a numerous

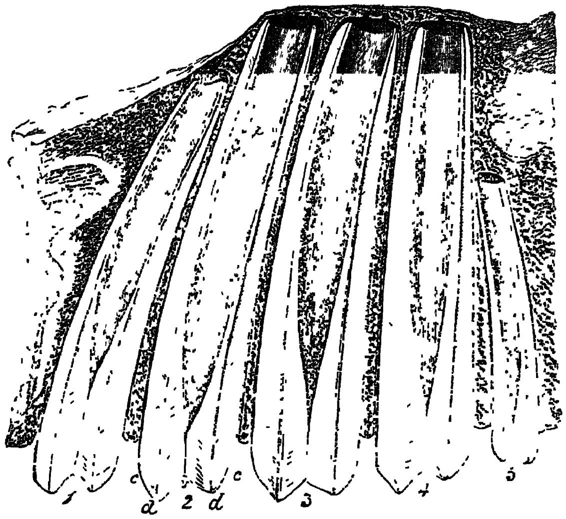

Fig. 109.

Section of Upper Molar Teeth, *Megatherium* (one-third nat. size), Pleistocene, South America.

succession of teeth. The same end was attained in the Megatherium, by a constant growth and renovation of the same teeth. The formative pulps were lodged in the deep basal cavities, exposed in the section figured (fig. 109). The molar teeth were five in number on each side of the upper jaw, and four in number on each side of the lower jaw (fig. 110). In this bone the fore part is much prolonged, and grooved above, to support a long, cylindrical, powerfully muscular tongue, by which, like the giraffe, the Megatherium stripped off the small branches of the trees its colossal strength enabled it to prostrate. The dentition of *Mylodon* differed only from that of *Megatherium* in the shape of the teeth. The same may be said of the allied genera called *Megalonyx* and *Scelidotherium*. They were contemporary and geographically associated genera of the same, now quite extinct, family of great terrestrial sloths.

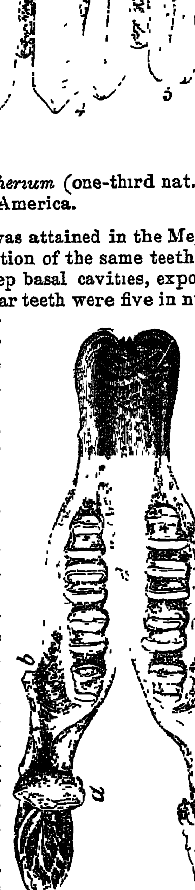

Fig. 110.

Lower Jaw and Teeth of *Megatherium* (Pleistocene, South America).

In like manner, the small loricated and banded quadrupeds of South America called armadillos were represented in pleistocene times in South America by as well-defended species, rivalling the Megatherioids in bulk. The specimen of the almost entire skeleton and bony armour (fig. 111) is one of the smaller species of these great extinct non-banded armadillos, yet it measures from the snout to the end of the tail, following the curve of the back, 9 feet; the tesselated trunk-armour being 5 feet in length and 7 feet across, following the curve at the middle of the back. These large extinct species differ from the modern armadillos, in having no bands or joints in their coat of mail, for the purpose of contracting to a ball. They also differ in the fluted form of the teeth (fig. 112); whence the generic name (*Glyptodon*) assigned to them. The species are distinguished, like their puny representatives (*Dasypus*), by peculiar patterns of the outer surface of the constituent ossicles of the tesselated mail. In the species figured (*G. clavipes*), a large raised central circular plate is surrounded by smaller portions. The species named *G. reticulatus*, *G. tuberculatus*, *G. ornatus*, &c., have their names from other modifications of the sculptured surface of their armour. Above the principal figure in cut 111 are shown the front and back margins of the body-armour; below it, opposite the left hand, are upper

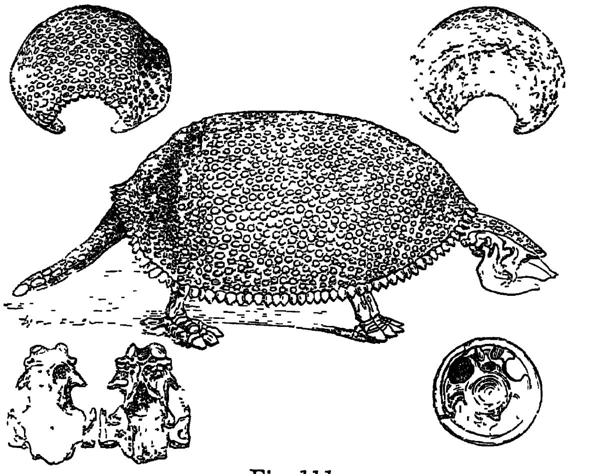

Fig. 111.

Extinct gigantic Armadillo.

and under views of the cranium, which was defended by a tesselated bony casque. The tail also had its independent osseous sheath, supported by the vertebræ within, as shown in the figure opposite the left hand.

Other evidences of extinct South American Mammals, matched only by species now peculiar to that continent, might be adduced if space permitted.

Fig. 112.

Teeth of great extinct Armadillo (*Glyptodon clavipes*), Pleistocene, South America.

Australia in like manner yields evidence of an analogous correspondence between its last extinct and its present aboriginal mammalian fauna, which is the more interesting on account of the very peculiar organization of most of the native quadrupeds of that division of the globe. That the Marsupialia form one great natural group, is now generally admitted by zoologists; the representatives in that group of many of the orders of the more extensive placental sub-class of the Mammalia of the larger continents have also been recognised in the existing genera and species: the dasyures, for example, play the parts of the *Carnivora*, the bandicoots (*Perameles*) of the *Insectivora*, the phalangers of the *Quadrumana*, the wombat of the *Rodentia*, and the kangaroos, in a remoter degree, that of the *Ruminantia*. The first collection of mammalian fossils from the ossiferous caves of Australia[1] brought to light the former existence on that continent of larger species of the same peculiar marsupial genera:—some, as the *Thylacine*, and the dasyurine sub-genus represented by the *D. ursinus*, are now extinct on the Australian continent, but one species of each still exists on the adjacent island of Tasmania; the rest were extinct wombats, phalangers, potoroos, and kangaroos,—some of the latter (*Macropus Atlas*, *M. Titan*) being of great stature. A single tooth, in the same collection of fossils, gave the first indication of the former existence of a type of the marsupial group, which represented the Pachyderms of the larger continents, and which seems now to have disappeared from the face of the Australian earth. Of the great quadruped so indicated under the name *Diprotodon* in 1838, successive subsequent acquisitions have established the true marsupial character and the near affinities of the genus to the kangaroo (*Macropus*), but with an osculant relationship with the herbivorous wombat. The entire skull of the *Diprotodon Australis* (fig. 113) has lately been acquired by the British Museum, showing *in situ* the tooth (*i*) on which the genus was founded. This skull measures 3 feet in length; that of a man

[1] Mitchell's (Sir Thos.) *Three Expeditions into the Interior of Australia*, 8vo, 1838, vol. ii., p. 359.

is inserted in the cut to exemplify the huge dimensions of the primeval kangaroo. Like the contemporary gigantic sloth in South America, the Diprotodon of Australia, while retaining the dental formula of its living homologue, shows great and remarkable modifications of its limbs. The hind pair were much shortened and strengthened, compared with those of the kangaroo; the fore pair were lengthened as well as strengthened; yet, as in the case of

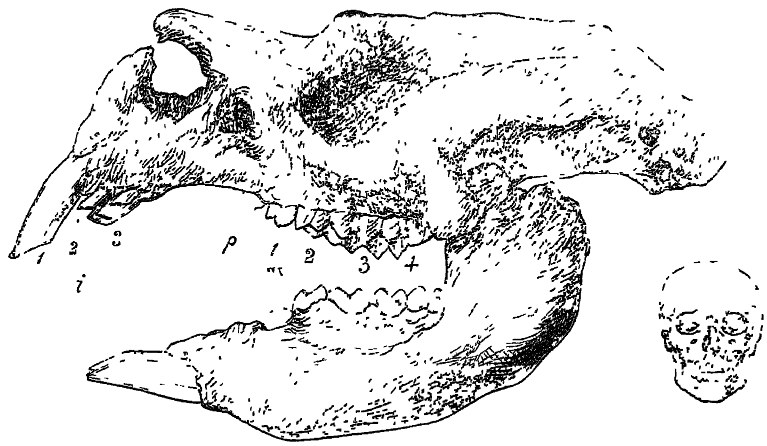

Fig. 113.

Skull, gigantic Pachydermoid Kangaroo (*Diprotodon Australis*) Pleistocene, Australia.

the Megatherium, the ulna and radius were maintained free, and so articulated as to give the fore paw the rotatory actions. These, in *Diprotodon*, would be needed, as in the herbivorous kangaroo, by the economy of the marsupial pouch. The dental formula of *Diprotodon* was $i\frac{3-3}{1-1}$, $c\frac{0}{0}$, $p\frac{1-1}{1-1}$, $m\frac{4-4}{4-4}=28$,[1] and, as in *Macropus major*, the first of the grinding series (p) was soon shed; but the other four two-ridged teeth were longer retained, and the front upper incisor (i, 1) was very large and scalpriform, as in the wombat. The zygomatic arch sent down a process for augmenting the origin of the masseter muscle, as in the kangaroo. The foregoing skull, with parts of the skeleton, of the *Diprotodon Australis*, were discovered in a lacustrine deposit, probably pleistocene, intersected by creeks, in the plains of Darling Downs, Australia.

The same formation has yielded evidence of a somewhat smaller extinct herbivorous genus (*Nototherium*), combining, with essential affinities to *Macropus*, some of the characters of the Koala (*Phascolarctus*).[2] The writer has recently communicated descriptions and figures of the entire skull of the *Nototherium Mitchelli* to the Geological Society of London.[3] The genus *Phascolomys* was at the same period represented by a wombat (*P. gigas*) of the magnitude of a tapir, one of the grinding teeth of which is represented, of the natural size, in fig. 114.

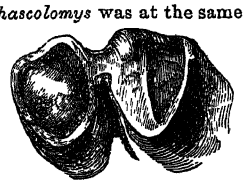

Fig. 114.
Grinding Surface of Molar of *Phascolomys gigas* (nat. size), Pleistocene, Australia.

The pleistocene marsupial *Carnivora* presented the usual relations of size and power to the *Herbivora*, whose undue increase they had to check. Fig. 115 represents an almost entire skull, with part of the lower jaw of an animal rivalling the lion in size, the marsupiality of which is demonstrated by the position of the lacrymal foramen (l) in front of the orbit; by the palatal vacuity (o), by the loose tympanic bone, the development of the tympanic bulla in the alisphenoid, by the very small relative size of the brain, and other characters detailed in a Memoir lately communicated by the writer to the Royal Society of London. The carnassial tooth (p) is 2 inches 3 lines in longitudinal extent, or nearly double the size of that in the lion. The upper tubercular tooth (m, 1) resembles in its smallness and position that in the placental Felines. But in the lower jaw the carnassial (p) is succeeded by two very small tubercular teeth (m, 1 and 2), as in *Plagiaulax* (fig. 88); and there is a socket close to the symphysis of the lower jaw of *Thylacoleo* which indicates that the canine may have terminated the dental series there, and have afforded an additional feature of resemblance to the *Plagiaulax*.

The foregoing are some of the more interesting illustrations of the law, that "with extinct as with existing Mammalia, particular forms were assigned to particular provinces, and that the same forms were restricted to the same provinces at a former geological period as they are at the present day."[4] That period, however, was the more recent tertiary one.

In carrying back the retrospective comparison of existing and extinct Mammals to those of the eocene and oolitic strata, in relation to their local distribution, we obtain indications of extensive changes in the relative position of sea and land during those epochs, in the degree of incongruity between the generic forms of the Mammalia which then existed in Europe and any that actually exist on the great natural continent of which Europe now forms part. It would seem, indeed, that the further we penetrate into time for the recovery of extinct Mammalia, the further we must go into space to find their existing analogues. To match the eocene Palæotheres and Lophiodons, we must bring Tapirs from Sumatra or South America, and we must travel to the antipodes for Myrmecobians, the nearest living analogue to the Amphitheres of our oolitic strata.

On the problem of the extinction of species little can be said; and of the more mysterious subject of their coming into being, nothing profitable or to the purpose at present. As a cause of extinction in times anterior to man, it is most reasonable to assign the chief weight to those gradual

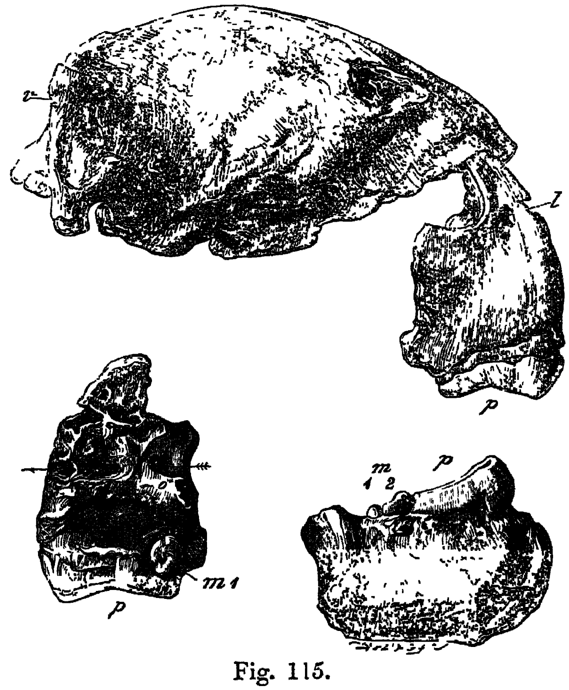

Fig. 115.

Skull of a large extinct Marsupial Carnivore (*Thylacoleo carnifex*), Pleistocene, Australia.

changes in the conditions affecting a due supply of sustenance to animals in a state of nature which must have accompanied the slow alternations of land and sea brought about in the æons of geological time. Yet this reasoning

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1 See that of *Macropus*, explained in art. ODONTOLOGY, p. 449.
2 "Report on the Extinct Mammals of Australia," *Trans. of Brit. Assoc.* 1844.
3 *Quarterly Journal of the Geol. Soc.*, pt. iv., 1858.
4 *Report on the Extinct Mammals of Australia*, 1844.

is applicable only to land-animals; for it is scarcely conceivable that such operations can have affected sea-fishes. There are characters in land-animals rendering them more obnoxious to extirpating influences, which may explain why so many of the larger species of particular groups have become extinct, whilst smaller species of equal antiquity have survived. In proportion to its bulk is the difficulty of the contest which, as a living organism, the individual of such species has to maintain against the surrounding agencies that are ever tending to dissolve the vital bond, and subjugate the living matter to the ordinary chemical and physical forces. Any changes, therefore, in such external agencies as a species may have been originally adapted to exist in, will militate against that existence in a degree proportionate to the bulk of the species. If a dry season be gradually prolonged, the large Mammal will suffer from the drought sooner than the small one; if such alteration of climate affect the quantity of vegetable food, the bulky Herbivore will first feel the effects of stinted nourishment; if new enemies be introduced, the large and conspicuous animal will fall a prey, while the smaller kinds conceal themselves and escape. Small quadrupeds are more prolific than large ones. Those of the bulk of the Mastodons, Megatheria, Glyptodons, and Diprotodons are uniparous. The actual presence, therefore, of small species of animals in countries where larger species of the same natural families formerly existed, is not the consequence of degeneration,—of any gradual diminution of the size of such species,—but is the result of circumstances which may be illustrated by the fable of the "oak and the reed;" the smaller and feebler animals have bent and accommodated themselves to changes to which the larger species have succumbed.

That species should become extinct, appears, from the abundant evidence of the fact of extinction, to be a law of their existence. Whether, however, it be inherent in their own nature, or be relative and dependent on inevitable changes in the conditions and theatre of their existence, is the main subject for consideration. But admitting extinction as a natural law, which has operated from the beginning of life, it might be expected that some evidence of it should occur in our own time, or within the historical period. Reference has been made to several instances of the extirpation of species, certainly, probably, or possibly, due to the direct agency of man. But this cause avails not in the question of the extinction of species at periods prior to any evidence of human existence: it does not help us in the explanation of the majority of extinctions, as of the races of aquatic Invertebrata and Vertebrata which have successively passed away. Within the last century, Academicians of Petersburg and good Naturalists described and gave figures of the bony and the perishable parts, including the alimentary canal, of a large and peculiar fucivorous Sirenian,—an amphibious animal like the Manatee, which Cuvier[1] classified with his herbivorous *Cetacea*, and called *Stelleria*, after its discoverer. It inhabited the Siberian shores and the mouths of the great rivers there disemboguing. It is now believed to be extinct, and this extinction has not been due to any special quest and persecution by man. We may discern in this fact the operation of changes in physical geography, which have at length so affected the conditions of existence of the *Stelleria* as to have caused its extinction. Such changes had operated, at an earlier period, to the extinction of the Siberian elephant and rhinoceros: a future generation of zoologists may have to record the final disappearance of the Arctic buffalo (*Ovibos moschatus*). Remains of *Ovibos* and *Stelleria* show that they were contemporaries of *Elephas primigenius* and *Rhinoceros tichorrhinus*. The great auk (*Alca impennis*, L.) existed in the last century: no specimen has been obtained within the present. Scandinavian naturalists believe it to be extinct. It has not been specially hunted down, like the dodo and dinornis; but by degrees has become more and more scarce. Physical changes, slowly operating, seem to have affected its sources of food and other circumstances favourable to its well-being. The numbers of its bones on the shores of Iceland, Greenland, and Norway, attest the abundance of the bird in former times. A consideration of such instances of modern extinctions may best throw light, and suggest the truest notions, of the causes of ancient extinctions.

As to the successions, or coming to be, of new species, one might speculate on the possibility of a variety of auk being occasionally hatched with a somewhat longer winglet and a dwarfed stature,—of such a variety better adapting itself to the changed climatal conditions than the old type, —of such an origin, for example, of *Alca torda*;—but to what purpose? Past experience of the chance aims of human fancy, unchecked and unguided by observed facts, shows how widely they have ever glanced away from the gold centre of truth. (R. O.)

PALÆSTRA (παλαίστρα, from πάλη, *wrestling*), signifies properly a wrestling-school, but seems to have been used among the Greeks as sometimes synonymous with gymnasium, generally as forming a part of the gymnasium (Herod. vi. 126, 128), and occasionally as distinct from it. The Romans used the terms as synonymous. (Vitruv. v. 11.) (See GYMNASIUM.)

PALAFOX-Y-MELZI, DON JOSÉ, a valiant Spanish patriot, was born of an old family in 1780, and was brought up at court. He was still a young man, living in retirement at his hereditary seat of Torre del Alfranca, when Napoleon's troops, in 1808, were threatening the neighbouring city of Saragossa. The citizens intrusted him with their defence, by electing him to be captain-general of the kingdom of Aragon. He assumed this office under circumstances very formidable and perplexing. His own experience in military affairs was very small; the town was almost destitute of soldiers, defences, and resources; and the adjacent provinces of Navarre and Catalonia were invested by French troops disciplined in many a campaign, and flushed with many a victory. Yet the great natural tact and commanding spirit of the young leader surmounted all these embarrassments, and promptly organized a regular system of resistance. Soldiers from all the surrounding districts were summoned into town, every street was barricaded, every house was made a point of defence, and the inhabitants were formed into one united band, unanimous in their determination either to protect the city or perish beneath its ruins. Scarcely had Palafox completed these preparations, when a French force under Lefebvre-Desnouettes approached and began the siege. Then ensued a series of the most determined attacks and repulses. Often did the besiegers, with cool veteran courage, force their way into the city: as often did the besieged, with wild and desperate recoil, drive them back to their intrenchments. The besiegers seconded their onsets with a demand for capitulation; the besieged rallied their courage with the cry of "War to the very knife." At length, after a bloody siege of sixty-one days, the bravery of the citizens proved invincible; and on the 14th August the French retired, baffled, towards Pamplona. Palafox and his army had not long enjoyed their hard-won renown, when fate interposed with relentless hand to snatch from them the fruits of their success. The French returned in greater force under

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[1] *Règne Animal*, tom. i., p. 284.

Marshals Moncey and Mortier, and applied their resistless resources to the siege of the obstinate city. In vain did men, women, and children, under a terrific bombardment, and amid tumbling houses, oppose their bodies to the assaulting foe. A wasting epidemic broke out, and reduced the defenders to a mere handful. The leader himself, falling ill, was obliged to resign the command, and his successor, St Marc, capitulated on the 21st February 1809. The events in the after part of Palafox's career are not very important. After suffering imprisonment in the dungeon of Vincennes, on account of his resistance to the French, he was liberated on the restoration of Ferdinand VII. in 1813. Although confirmed in the following year in the office of captain-general of Aragon, he soon ceased to take any part in politics. His death took place in 1847.

PALAIS, Le, a town of France, department of Morbihan, stands on the N. side of the island of Belle Isle. It is strongly fortified, and contains a citadel, which serves as a state prison. The harbour is good and safe; and there is a school of navigation. Some trade is carried on in fish. Pop. 4972.

PALAMAS, Gregorius, an eminent Greek ecclesiastic, was born about the beginning of the fourteenth century, and was brought up at the court of Constantinople. After imbibing for ten years the peculiar doctrines of the monks of Mount Athos, he shut himself up in a solitary cell near Berrhœa to practise these doctrines, and for the next ten years starved his body and mystified his brain by sitting in a dark corner, with his chin on his breast, and his eye fixed on his navel, in expectation of seeing a celestial light settle on that part of his frame. When Baarlam denounced these exercises, and ridiculed their observers with the nickname of *Omphalopsychi* ("navel-souls"), the zealous fanatic came forward as the champion of his sect. The controversy was referred to the ecclesiastical court of Constantinople, and Palamas retired from the post he had taken. At the councils which were severally held in 1341 and 1351, he pled the cause of his party, and so identified himself with the tenets he advocated that his fellow-sectarians were thenceforth called *Palamites*. The battle was now gained, and he retired to the see of Thessalonica. The time of his death is unknown. The published works of Palamas are *Prosopopœia*, or two judicial pleas of the body and soul against each other, published, with a Latin version by Combéfis, in his *Auctarium Novissimum*, folio, Paris, 1672; and a refutation of the statements of John Veccus, printed in the *Opuscula Aurea* of Petrus Arcudius, 4to, Rome, 1630.

PALAMOW, a district of British India, presidency of Bengal, lying between N. Lat. 23. 12. and 24. 22., and E. Long. 83. 18. and 84. 31.; and bounded on the N. by the districts of Behar and Ramgurh, E. by that of Ramgurh, S. by that of Chota Nagpore, S.W. by that of Sirgoojah, and W. by that of Mirzapoor. Length from S.E. to N.W., 88 miles; breadth, 70 miles; area, 3468 square miles. The country has never been thoroughly explored. The Koel is the only river in Palamow that is perennial in its flow. The hills and valleys of the district are densely covered with forests and jungles, which are the haunts of many wild animals. Most valuable sources of mineral wealth exist. There are numerous scattered villages throughout the country; and two places that may be called towns,—Palamow, near the centre; and Oontaree, on the northern boundary. Pop. (1855) of the districts of Palamow and Chota Nagpore, 482,900.

PALATINATE (Germ. *Pfalz*), an ancient division of Germany, consisting of two parts, the Upper and the Lower Palatinate. The former, having an area of 2756 square miles, lay to the N.E. of Bavaria, of which kingdom it now forms the circles of Upper Palatinate and Upper Franconia. The Lower Palatinate, which had an area of 1590 squares miles, lay on both sides of the Rhine, between Worms and Carlsruhe. It is now divided among Rhenish Prussia, Baden, and Bavaria. The portion included in the last of these countries forms the modern circle of Palatinate. (See Bavaria.)

PALAWAN, or Paragua, an island of the Eastern Archipelago, separating the Chinese from the Sooloo Sea. [illegible] N. Lat. 8. 27. and 11. 32., E. Long. 117. 18. and 119. 48., and extends from the Philippine Islands on the N.W. to the vicinity of the northern extremity of Borneo. Its length is about 275 miles, and its average breadth 32 miles. The eastern part, for about 10 or 20 miles from the sea, is low and flat; but near the western coast a chain of hills runs through the island. It is well watered, and has a fertile soil, which for the greater part is not cultivated. The natural products resemble those of Borneo, including rice, honey, wax, bulrushes of a white colour that are much valued, and many other articles. Gold and pearls are obtained here. Among the animals are leopards, porcupines, several kinds of squirrels, and many birds of rare and beautiful plumage. It is inhabited by people in a very savage state; [illegible] portion is possessed by the Sultan of Sooloo, and the Spaniards have long exercised dominion over the northern part, which belongs to the province of Calamianes. The hilly regions are held by the original natives, a people resembling the Papuans. The principal town is Babuyan, which is fortified, and has about 2000 inhabitants.

PALAZZUOLO, or Palazzolo, a town of Sicily, province of Syracuse, stands on a bleak hill, 19 miles W. of Syracuse. It occupies the site of the ancient Acræ, a colony founded by Syracuse, B.C. 663. Many interesting antiquities have been found here, especially remains of temples and of two theatres, statues, and other relics. Pop. 8600.

PALEMBANG, a Dutch province in the island of Sumatra, comprehending the former kingdom of that name, along with the district of Jambi, extends along the east coast of the island, and is bounded on the N.W. by the Battah country, N.E. and E. by the Banka Strait, S. by the province of Lampong, and W. by that of Bencoolen. Near the sea is a low, flat, and marshy tract of ground; but towards the interior the country is hilly, and contains several volcanoes, one of which, near the frontier of Bencoolen, did much injury by an eruption in 1833. The country is watered by several considerable rivers, such as the Mœsi, Komering, Lamatang, and others; and the soil is very fertile, producing pepper, bamboos, lacquer-wood, &c. European vegetables grow well; and live stock thrive better here than in Java. In the year 1811, the Dutch had merely a commercial factory at Palembang, when the sultan began hostilities against them; and in order to their entire destruction, under pretence of conveying them safely to Batavia, sunk during the night the ships in which they had embarked by means of holes previously made. But the hopes which had been entertained of gaining by this murderous deed the favour of the British, then in possession of Java, were disappointed, for an expedition sent by them dethroned the sultan, and placed his younger brother on the throne. The Dutch having, in 1816, regained their East Indian possessions, the sultan complained of his deposition; and having satisfied the government of Batavia of his innocence of the crime imputed to him, was reinstated in 1818. But soon he began fresh assaults on the Dutch; and suddenly one morning their factory was cannonaded by the guns of his fort. They made an unsuccessful expedition against Palembang; and the country remained in rebellion till 1821, when it was conquered by them. The sultan still retains his title, but the supreme power is exercised by a Dutch regent, who resides at Palembang, the capital. The internal administration, however, is in the hands of the native chiefs. This town stands on both sides of the Mœsi, about 50 miles above its mouth. It is built

chiefly of wood and bamboos, but the sultan's palace and the principal mosque are stone edifices. The river is here deep and navigable; and an active trade is carried on. Pop. about 25,000. The province of Palembang is but thinly peopled.

PALENCIA, a province in the interior of Spain, one of the eight into which Old Castile is divided. It has an area of 258 square leagues, and the following boundaries:—N., Santander; E., Burgos; S., Valladolid; W., Leon and Toro. The partidos into which it is divided are Astudillo, Baltanas, Carrion, Cervera de Rio Pisuerga, Frechillas, Palencia, and Saldaña. The surface is in general level, and almost devoid of trees; the northern part of the province, comprising the whole of the partido of Cervera, is mountainous. The climate is generally cold, especially in the north, but healthy, and would be much more so but for the almost entire want of trees. The numerous streams which traverse the province contribute to its remarkable fertility: the principal are the Pisuerga and the Carrion, which cross the province from N. to S., uniting near Dueñas, and passing into the province of Valladolid; the Camera, the Cieza, the Arlanza, the Abanades, &c. The canal of Castile crosses the province also from N. to S., with a branch through Tierra de Campos, and by facilitating the exportation of its grain, has done good service to the agriculture of the province. The whole partido of Cervera abounds in minerals, but the coal is the only mineral that is worked. There are mines at San Felices de Castilleria, 2 leagues N. of Cervera, and at Orbó, 3 leagues from Cervera, both furnishing coal of good quality, and plentiful; and several others in Villaverde de la Peña. In all the partidos, with the exception of Cervera, wheat and other cereals, legumes, hemp, and flax are produced in abundance; in Cervera the land is occupied with pastures and with wood. In the numerous gardens by the water-courses are grown all kinds of fruit, with the exception of the olive; but linseed oil is plentifully produced. Game is abundant in Cervera; and the Pisuerga and Carrion are good fishing streams. The principal industry is the manufacture of flour, and the principal commerce its exportation to Cataluña and the Havannah. The woollen manufactures of blankets, serges, and baize are tolerably extensive. There is a fair provision of elementary instruction in the province, which contains about 600 schools of this class; for secondary instruction there is only one, in the capital. Pop. 148,491.

PALENCIA, capital of the above province, is situated in a plain on the left bank of the Carrion, 2 leagues above its confluence with the Pisuerga. The environs of the town on the W. are delightful, presenting to the view gardens, trees on the banks of the Carrion, and numerous fountains. The climate is somewhat cold, but salubrious: most equal in autumn. The city is protected on the W. by the river, and on the other sides by a wall, dating from the re-conquest, of 36 feet in general height, and 9 in thickness, solidly built with stone, with some additional constructions in the recent war, and affording entrance by seven gates. The city is divided into two parts, the ciudad and the puebla: in the latter, occupied chiefly by the working classes, the streets are straight and commodious, the houses of a single storey; in the former the streets are narrow, the houses of two storeys, with courts and sometimes gardens. The principal buildings are,—the cathedral, of Gothic style, begun in the fourteenth century, and finished in the seventeenth; the episcopal palace, an unfinished building, with fine gardens; the palace of Don Sancho, King of Navarre, in the centre of the city; and the hospital, an immense building of stone. There are, besides, four churches and ten convents, not remarkable for their architecture. The school of secondary instruction has 11 professors; the *seminario conciliar*, in the ex-convent of the Jesuits, has 8. There are, besides, nine schools of primary instruction. The chief industry of the town consists in the fabrication of woollens, for which it is celebrated. Its mantas, serge, and baize supply Spain, Portugal, and America, and their manufacture occupies a third part of the population, besides that employed in the bleaching and dyeing works connected with it. Next to this in importance is the manufacture of flour. There are also manufactures of chocolate, brandy, &c., and of common earthenware. Palencia, under the name of *Pallantia*, was a wealthy and considerable city in the time of the Romans, and makes a considerable figure in Spanish history. Pop. 10,490.

PALERMO (anciently *Panormus*, Fr. *Palerme*), the second city of the kingdom of Naples, and the capital and chief seaport of Sicily, stands on the south-western shore of a large bay on the north side of the island, in a rich plain surrounded on three sides by hills, which, from its form and beauty, has received the name of *Conca d'Oro*, or "Golden Shell;" N. Lat. 38. 8., E. Long. 13. 22. The many cupolas, turrets, and spires that rise to the view of one looking at it from the sea, gives to Palermo a noble and striking aspect. In form it is nearly rectangular, its shortest side extending along the shore; and it is surrounded by old walls, which are entered by numerous gates. The other defences of the place consist of a citadel, bastions, and batteries, which render the town strong against an attack from the sea, though it is not well protected on the land side. The buildings of Palermo are distinguished by considerable regularity, and those that line the principal streets are very handsome. The principal streets, two in number, cross at right angles near the centre of the town, thus dividing it into four nearly equal parts. They are well paved with lava, and form at their intersection a public place of an octagonal form, four sides of which are occupied by these streets, and each of the others by a handsome three-storeyed building of Grecian architecture. Many statues stand and fountains play in this place, from which a fine view may be obtained of the four avenues of houses terminating in the gates of the town. The inferior streets are equally well paved with the principal ones, but they are frequently in a very dirty and disagreeable state. Palermo contains several other public places, some of them of considerable size. But the most frequented places of resort for amusement are the Marina and the Flora; the former of which is a public walk, about 80 yards broad, stretching for more than a mile along the sea-shore; and the latter a beautifully laid out and ornamented garden near the eastern corner of the town. Many of the private houses are remarkable for the splendour of their architecture, but they very frequently err in a want of simplicity, and in a profusion of ornament. They are generally lofty, and, like those of Naples, have flat, terraced roofs and projecting balconies. The most of them are divided into flats, each forming a distinct dwelling. Strange and lively is the scene that the streets of Palermo present to a stranger. Close to the most splendid palaces wretched booths often project into the street; workmen of all kinds pursue their trades on the pavement in front of their shops; while the sides of the streets are also occupied by crowds of beggars, and idlers of higher rank sit in front of the coffee-houses; so that all the passengers on foot, as well as in carriages or on horseback, have to proceed indiscriminately along the centre of the streets. The public buildings are numerous, and many of them sumptuous,—more so, indeed, generally, than is consistent with good taste. The cathedral, which was built in 1180, is a fine edifice in the Gothic style; but in recent times a dome has been added, and the interior has been re-modelled after the Grecian style. It contains many tombs in red porphyry, among which are those of King Roger the Norman, and the Emperor Frederick II. The church of St Joseph is remarkable for its crypt and gray marble columns. There are, besides those

already mentioned, many other churches, all rich in paintings, sculptures, and mosaics, and all very similar in their general appearance and style. Palermo has also seven abbeys and about seventy convents. The palace in which the viceroy resides occupies a beautiful situation in the midst of gardens at the S.W. end of the town. It is an ancient irregular building, in various styles of architecture, and contains a hall, many other fine buildings, a picture gallery, a beautiful chapel built by Roger the Norman in 1129, and an observatory, from which, on the 1st of January 1801, the planet Ceres, the first known of the asteroids, was discovered by Piazzi. In front of the palace is a public square, containing, among other statues, one in bronze of Philip IV. of Spain. The university of Palermo was founded in 1447, or, according to other accounts, as early as 1394; but it is now in a declining state. It has a library of 40,000 volumes, and a valuable collection of antiquities. The interests of education are provided for at Palermo by several other institutions for different branches of instruction. The account of the public buildings of Palermo would not be complete without taking notice of the archbishop's palace, court-house, custom-house, mint, *monte di pietà*, prison, barracks, arsenal, and several theatres. It is the seat of an archbishop, and of the lieutenant-general of Sicily. The public charities consist of several hospitals, a poor-house, a foundling institution, lunatic asylum, and other establishments. In the neighbourhood of the town are many fine country houses of the Sicilian nobility, and, among the rest, a royal residence in the Chinese style. There are also two fine specimens of Moorish architecture,—the grotto of St Rosalia on the Monte Pellegrino, which is a great object of veneration to the Sicilians; and a Capuchin convent, with curious catacombs. As a manufacturing town, Palermo is not very important. The chief branch carried on is the making of silken stuffs, which was begun here in the eleventh century; cotton, oil-cloth, gold and silver articles, hardware, &c., are also produced; and the tunny fisheries on the coast give employment to 3000 or 4000 of the inhabitants, and yield ample returns. The situation of the town, and its excellent harbour and anchorage, afford great facilities for foreign commerce; but the intercourse with the interior of Sicily is greatly hindered by the want of sufficient means of conveyance in the island. The harbour, which lies outside of the walls, is formed by a mole, constructed at a cost of L.1,000,000, extending southwards for a quarter of a mile into the sea. The principal articles exported from Palermo are shumac, oranges and other fruits, oil, wines, spirits, manna, brimstone, liquorice, raisins, and grain; and there are imported silken, cotton, and woollen stuffs; hides, timber, tobacco, sugar, hardware, &c. The total value of the exports in 1852 was L.698,744, of which L.294,989 were to the United Kingdom and its colonies, and L.448,755 to other countries. The whole imports in the same year amounted in value to L.606,083, of which L.253,089 were from the British empire, and L.352,994 from other countries. Communication is kept up between Palermo and Naples, both directly by sea and through Messina and Reggio; but the means of conveyance are barely sufficient for the necessities of commerce. Since 1850 the port has been frequently visited by British steamers engaged in commerce. In 1854 the number of these that entered was 27, and their average tonnage 543. Some traces of an ancient amphitheatre have been found near the palace, and many fragments of marble and other remains have been obtained; but these are all that have come down to us of the ancient Panormus. Although this name, by which it was generally known in ancient times (being derived from the excellence of the harbour), was of Greek origin, there is no doubt that it was not by that nation, but by the Phœnicians, that the town was founded. It was at one time among their principal places in Sicily; but at the earliest historical period at which Panormus is brought into notice, it was no longer subject to its mother country. This was in 480 B.C., when the Carthaginians under Hamilcar made it their head-quarters against Himera. How it came into their hands we have no means of knowing; but it continued for a long time to be their principal naval station in Sicily, and the capital of their possessions in that island. It was taken by Pyrrhus in 276 B.C., but was soon after recovered by Carthage. During the first Punic war, in 254 B.C., Panormus was taken by that people, and four years after, a decisive victory was gained by them under the walls. Before the close of this war the Monte Pellegrino, then called *Ercta*, was occupied by Hamilcar Barca; and such was the strength of the position, that for three years he held out against the utmost efforts of the Romans. After the conquest of Sicily by that people, Panormus enjoyed the privileges of a free town, and became the chief place of commerce and navigation in the island. It afterwards lost its freedom, and received a Roman colony; but throughout the time of the empire it continued in a flourishing condition, though it never reached that importance which it now possesses. When Sicily was conquered by the Goths, Palermo, along with the rest of the island, fell into their hands; but it was recovered by Belisarius, and the Byzantine Empire retained possession of it till 855 A.D., when it was taken by the Saracens, and made the capital of their Sicilian possessions. Since that period Palermo has been, with few intervals, the capital of Sicily, and has followed the fortunes of that island. It has suffered at various times from earthquakes; and during the Sicilian insurrection in 1848 it was bombarded by the royal troops, and partially destroyed. Pop. (1856) 200,000.

Palermo, the province of which the above town is the capital, is bounded on the N. by the Mediterranean, E. by the provinces of Messina and Catania, S. by that of Trapani, and W. by those of Girgenti and Caltanisetta; length from N.W. to S E., 66 miles; breadth, 48 miles; area, 1985 square miles. The coast is irregular; and the surface consists of barren hills and rich valleys, having a general slope towards the north. Numerous small streams flow through the province into the Mediterranean. The country produces corn, oil, fruits, almonds, manna, shumac, liquorice, silk, &c. It is the largest and the best peopled of the Sicilian provinces. Pop. (1856) 541,326.

PALES, a Roman divinity of flocks and shepherds, represented by some writers as a female, and by others as a male, but embodying the same idea as Pan among the Greeks. A festival, termed *Palilia*, and sometimes *Parilia*, as if *a pariendo*, was celebrated annually at Rome, in honour of this tutelary deity, on the 21st of April, the anniversary, according to early tradition, of the foundation of Rome by Romulus. (Varro, *De Ling. Lat.*, vi. 15; Cicero, *De Div.* ii. 27.) From the *Fasti* of Ovid (iv. 731, &c.), we learn that the solemnities of this festival began by a public purification by fire and smoke. Towards the evening, when the shepherds had fed their flocks, the stables were adorned with laurel boughs, and the smoke of burnt sulphur, rosemary, fir-wood, and incense, was made to pass through the stalls to purify them. The flocks themselves were also purified by this smoke, and were made to pass through bonfires made of heaps of hay and straw. After the offerings were over, which consisted of cakes, millet, milk, &c., the shepherds engaged in prayer to Pales. and thus terminated the solemn part of the proceedings. This was followed up by the most festive joviality, the shepherds bounding over the *flamma Palilis*, or bonfire, with great spirit, to the sound of cymbals and flutes. They next ranged themselves on benches of turf, ate plentifully, and drank without stint, till the Palilian constellation (Hyades) had vanished in the evening twilight.

PALESTINE.

Palestine. THE land of God's chosen people, and the scene of the earthly labours and sufferings of our Lord, has commanded, and ever must command, a greater share of attention than any other. No ancient country has been so much visited by travellers in all ages and from all parts of Christendom, and of none have so many books been written. Greece, Rome, and the other seats of early civilization, each present to us features of interest; but those of Palestine are greater, and of a kind peculiarly its own. Its physical features and productions, the history and manners of its people, their language with its idioms and proverbs, are all more or less interwoven with the expressions of our religion, and have been familiar to us from our earliest years.

The Holy Scriptures were primarily committed to a people living at a particular time, surrounded by certain scenes, and familiar with certain objects, to which frequent allusions are made which are apt to be unintelligible or misunderstood by those who are ignorant of the time and circumstances. A knowledge of the country and people of Palestine farther gives a peculiar beauty and force to numerous passages in the sacred writings, and will hence ever commend itself to the careful study of the intelligent Christian. Changes may no doubt have taken place in the climate, productions, and general aspect of the country since the times of the Old and New Testaments, but still the great characteristics remain. These are witnesses to the events that have occurred in their presence. "They can be cross-examined with the great facts and narratives. If they cannot tell the whole truth, at any rate, so far as they have any voice at all, they tell nothing but the truth." (Stanley's *Sinai and Palestine.*)

From another point of view, it is important to notice how admirably adapted, above every other, was this country for the abode of that people to whose keeping were committed the principles of a religion destined to be universal. It was more varied in its characteristics than probably any other district on the face of the earth, containing within its range more or less of the natural features of almost every other. Had it been less varied or more eastern in its character, it is not unreasonable to suppose that the sacred writings would have contained less with which the European mind could sympathize. It was farther eminently fitted for preserving that religion in its purity. It presented no grand natural features which in other countries elicited from the human heart divine honours;[1] its coasts were singularly deficient in harbours to tempt to commerce and commercial alliances; huge natural barriers were interposed between it and the two great centres of civilization in the eastern world, Egypt and Babylon, the corrupters of all the nations of the earth; the wild grandeur of Sinai was, like the body of Moses, hid from the people lest they might worship it; and the lofty Lebanon, though visible in the distance, formed no part of their allotted territory. The inhabitants, too, partook of the exclusive nature of their country, and kept aloof from every other nation or people whom they looked upon as barbarians. They were not suffered to remain in Egypt nor in Babylon; and, to our mind, there is no stronger evidence that their mission is not yet fulfilled than is to be found in the fact that, though 1800 years have elapsed since they were driven out of their own country, and ceased to have any fixed abiding-place, they are yet as a people as distinct as when dwelling in their own land. They, too, were as varied in their character and circumstances as was the country in its physical aspects. They belonged to every rank and condition of life; and hence the Scriptures, though coming to men in a particular time and in particular circumstances, are yet preeminently adapted for men in all time and in all circumstances.

Palestine. Notwithstanding the great number of travellers that have visited Palestine, to no one more than to Dr Robinson are we indebted for what is now known of the geography of that country. With the publication of his *Biblical Researches* in 1841 a new era may be said to have commenced in biblical geography. Up to his time travellers in Palestine were guided almost entirely by the traditions of the monasteries—traditions originally established, for the most part, by persons ignorant of the topography of the country and of the language of the people, long after the events for which they were celebrated took place. All these Dr Robinson, in the outset, resolved to set at defiance; and accordingly he proceeded on the principle that "all ecclesiastical tradition respecting ancient places in and around Jerusalem, and throughout Palestine, is of no value except so far as it is supported by circumstances known to us from the Scriptures, or from other contemporary testimony." The traditions and the evidence from names and associations surviving among the native Arabs he held to be much more reliable; and unquestionably the common Arabic population, aside from the ordinary routes of travel, untainted with ecclesiastical traditions and superstitions, unbiassed by any motive to err or to deceive, are a better authority for the names of places in Palestine than are the monks of Nazareth or Bethlehem. His companion, Dr Eli Smith, was admirably qualified for carrying out this branch of investigation, having by long residence acquired a thorough knowledge of the Arabic people and a complete mastery of their language. Dr Robinson, too, had prepared himself for his researches by a course of study extending over a period of nearly twenty years. The two great principles by which they were guided in their investigations were, first, "to avoid, as far as possible, all contact with the convents and the authority of the monks; to examine everywhere for ourselves, with the Scriptures in our hands, and to apply for information solely to the Arab population;" and secondly, "to leave as much as possible the beaten track, and direct our journeys and researches to those portions of the country which had been least visited." After an interval of fourteen years, Dr Robinson again visited Palestine, and again his companion during the more important part of his journey was Dr Smith. The results of this second visit were published in his *Later Researches*, which appeared in 1856. In his two journeys, Dr Robinson has identified, or been the first Frank traveller to visit, about 150 ancient places; and though in some cases his positions have been contested, his works are universally acknowledged to be the most valuable and reliable that have yet appeared. We trust that he may still be spared to complete the work for which his long course of study and laborious investigations have so

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[1] "Whilst the great seats of Greek and Roman religion at Delphi and Lebadea, by the lakes of Alba and of Aricia, strike even the indifferent traveller as deeply impressive, Shiloh and Bethel, on the other hand, so long the sanctuaries and oracles of God, almost escape the notice even of the zealous antiquarian, in the maze of undistinguished hills which encompass them. The first view of Olivet impresses us chiefly by its bare matter-of-fact appearance; the first approach to the hills of Judea reminds the English traveller not of the most but of the least striking portions of the mountains of his own country." (Stanley.)

eminently qualified him. To quote his own words in the preface to his later work, "The great object of all these travels and labours has been, as formerly announced, to collect materials for the preparation of a systematic work on the physical and historical geography of the Holy Land."

Of a different and more popular character is Mr Stanley's *Sinai and Palestine*, 1856,—a work which will perhaps be more appreciated by the general public. Mr Stanley visited Palestine, not so much with a view to discovery, or for minute investigation, as to connect and illustrate the historical events of the Old and New Testaments with the existing topography of the country. It is in thus grouping together the physical features and the historical incidents of the region, that the main feature of Mr Stanley's work consists. He clothes with the reality of place the events of sacred history, and gives to the records of the past the actual life of the present. His descriptions of physical scenery are graphic and impressive, and his collocation of historical events is frequently striking—always apt and beautiful. Professor Carl Ritter has, with his usual ability, systematized and digested the voluminous records of centuries in his volumes on Palestine in his *Erdkunde*. Our limits prohibit us from noticing more of the numerous writers on Palestine; and this is the less necessary, as ample lists of them are to be found in the works of Robinson, Kitto, Ritter, and others.

Name. The name Palestine, by which this country is now commonly known, occurs nowhere in the Hebrew Scriptures. The word from which it is derived, and which is sometimes translated *Palestina* in our English version, is *Philistia* (Heb. פלשת; Gr. παλαιστίνη), the name proper of the country of the Philistines, which comprised the southern portion of the coast plain of Canaan. This being the part of the country with which the Greeks were first and chiefly acquainted, they came to apply the name generally to the whole country; and Herodotus, who travelled there, terms the Hebrews, Syrians of Palestine. We find Josephus, too, occasionally using the word Palestine (παλαιστίνη) for the whole country, though he more frequently uses it in its more restricted sense, as applied to that part which was inhabited by the Philistines. The name by which this country is first designated in Scripture is the *Land of Canaan*, from its earliest inhabitants being descendants of Canaan, the fourth son of Ham. This, however, only comprised the territory lying between the Jordan and the Mediterranean, the region to the east of that river being called the *Land of Gilead*. Referring to the period before it actually came into the possession of the children of Israel, it is called the *Land of Promise*—*i.e.*, the land which God had promised to Abraham to bestow upon his seed. The *Land of Jehovah* and the *Holy Land* are terms used as indicating God to be the sovereign proprietor of the soil, though in the present day the latter term is probably used more in regard to its having been the scene of the life and sufferings of Christ. The *Land of Israel* frequently occurs, first in reference to the whole country, but afterwards only to the territory of the ten tribes, which formed the separate kingdom of Israel as distinct from that of Judah. *Judea* and the *Land of Judah*, though originally applied to the territory of the tribe of Judah alone, and afterwards to the kingdom of Judah, came, after the captivity, to be sometimes applied in a loose way to the whole country.

Extent. One is at first naturally struck with the small extent of territory occupied by the children of Israel. The limits varied much at different times; but even in its more extended acceptation Palestine was not more than one-half the extent of Scotland, or one-fourth that of England and Wales. Its length from north to south was only about 180 miles, and its average breadth 65; its extreme breadth being only about 100 miles. This includes a considerable portion of territory beyond the Jordan, not comprised in Palestine proper or the Land of Canaan. The land beyond Jordan was not, it would seem, originally designed to form part of the land of Israel, which was to have been bounded by the River Jordan and its inland lakes. This is the land which, at their request, was given to the tribes of Reuben and Gad and the half tribe of Manasseh; and it is somewhat remarkable that these never emerged from their original nomadic state of life.

Situation and boundaries. Palestine is situated about midway between the equator and the polar circle, between 30. 40. and 33. 32. N. Lat., and 33. 45. and 35. 48. E. Long. It is bounded on the W. by the Mediterranean, E. by the Great Desert (now called the *Hauran*), S. by the desert which separates it from Egypt, and N. by the Lebanon Mountains. The boundaries are minutely laid down by Moses, in Numbers xxxiv. 3–12; but our present knowledge of the country is not sufficient to enable us to identify with certainty the limits there specified. The line of coast from north to south trends westwards, which causes the country between the coast and the valley of the Jordan to be much wider in the south than in the north. But where the country was narrowest there were possessions on the east of the river, and where widest there were none; and hence the actual breadth of territory was in some measure equalized throughout.

Physical character. Palestine is extremely varied in its physical characteristics,—"a land of hills and valleys." It is described in Deuteronomy (viii. 7–9) as "a land of brooks of water, of fountains, and depths, that spring out of valleys and hills; a land of wheat, and barley, and vines, and fig-trees, and pomegranates; a land of oil-olive and honey; a land wherein thou shalt eat bread without scarceness; thou shalt not lack anything in it; a land whose stones are iron, and out of whose hills thou mayest dig brass." The surface is generally mountainous, or, more properly, it is one mountain mass rising from a level sea-coast on the W. and from a level desert on the E. In the N. the roots of Lebanon form the high lands of Galilee, and are succeeded southward by the great plain of Esdraelon, stretching from the shores of the Mediterranean to the valley of the Jordan. Farther S. are the hills of Central Palestine, rising gradually into the mountains of Judah and Benjamin. The valley of the Jordan extends from N. to S. through the entire territory, and separates Palestine proper from the mountainous districts of Bashan, Gilead, and Moab.

Coast plains. The level country of the coast, lying between the sea and the high land of the interior, varies very considerably in breadth, in some parts expanding into wide plains, in others contracted into narrow passes; while occasionally the mountain offshoots stretch out into the sea, and form promontories along the coast. **Philistia.** The most southern portion of this coast country was the great plain occupied by the ancient Philistines, and termed in the Old Testament the Plain or Low Country. It extended from Joppa to Gaza, having on the W. the sea, and on the E. the hill country of Ephraim and Judah. The Philistines were not an indigenous race, though settled in Palestine as early as the time of the patriarchs, but were, as the name implies, "strangers," the general opinion being, that they were immigrants from the island of Crete. They became a great commercial people, and were a frequent source of annoyance to the children of Israel long after they had established themselves in Canaan. The fertility of their land must have contributed greatly to their power—rich corn-fields stretching without interruption from the low sandy tract on the shore to the base of the hills of Judah. "Two parallel tracts," says Stanley, "divide the flat plain; the sandy tract (Ramleh), on which stand the maritime cities, and the cultivated tract, which presents for the most part an unbroken mass of corn, out of which rise here and there slight

Palestine. eminences in the midst of gardens and orchards, the seats of the more inland cities. Gath has entirely disappeared; but Ekron, Ashdod, Gaza, and Ascalon retain their names, and the three last have sites sufficiently commanding to justify their ancient fame." "The most striking and characteristic feature of Philistia is its immense plain of corn-fields, stretching from the edge of the sandy tract right up to the very wall of the hills of Judah, which look down its whole length from N. to S. These rich fields must have been the great source at once of the power and the value of Philistia, the cause of its frequent aggressions on Israel, and of the increasing efforts of Israel to master the territory." The towns here are remarkable for the beauty of their situations and the profusion of gardens that surround them. They rise above the plain on their respective hills,—Ascalon and Jaffa on the sea-coast, and Gaza, Ashdod, and Ekron, at some distance from it.

Sharon. "The corn-fields of Philistia, as we advance farther N., melt into a plain less level and less fertile, though still strongly marked off from the mountain wall of Ephraim as that of Philistia was from that of Judah and Dan." (Stanley.) This is "Sharon;" and, like Philistia, it is divided into the *ramleh* or sandy tract along the sea-shore, and the cultivated tract farther inland, here called *khassab* ("the reedy"), apparently from the high reeds which grow along the banks of some of the streams. It is interspersed with corn-fields, and thinly studded with trees, the remnants apparently of a great forest which existed here down to the second century. Sharon, however, is chiefly noted for its rich pasture lands, and is, says Mr Monro, "clothed with fresh verdure as far as the eye can reach." The "rose of Sharon" he thinks to be the *Cistus roseus* of Linnæus, which is very abundant here. No historical name or event is attached to this district in the Old Testament; but then, as now, it was noted for the richness of its pastures. Under the Roman empire, however, it became of great note, and contained Cæsarea the Roman capital of Palestine. No human being now lives within many miles of this once rich and busy city, and the waves of the Mediterranean dash over its prostrate columns and huge masses of masonry. Beyond Cæsarea the plain becomes more contracted and irregular in its character, until the long ridge of Mount Carmel closes up its northern frontier.

Acre. Immediately N. of Mount Carmel, and between it and the ridge which forms the promontory of Râs Nakhora, is the plain of Acre, about 15 miles in length from N. to S., and about 5 in general breadth from the sea-shore to the hills which bound it on the E. It forms, so to speak, the embouchure of the great plain of Esdraelon, and, like the other plains, presents a sandy tract along the coast and a fertile tract inland. The soil of this last, though naturally rich, is now almost entirely uncultivated, but in the season presents a most exuberant natural vegetation. The town of Acre, or Accho, though of great antiquity, being one of the places from which the Israelites were unable to expel the ancient Canaanites, only became of importance in modern times. It is noted for the number of sieges it has sustained, and was called by Napoleon the "key of Palestine."

Phœnicia. The plain of Phœnicia lay N. of that of Acre, or more properly included it, extending S. to Mount Carmel. It is separated both geographically and historically from Palestine, though forming a natural continuation of the coast plain. Here were the great towns of Tyre and Sidon, at one time the great centres of commerce in the ancient world.

Carmel. Carmel is a mountain ridge 6 or 8 miles long, stretching N. by W. from the plain of Esdraelon into the sea, where it forms a high promontory, which incloses on the S. the Bay of Acre. It is about 1500 feet in height, and consists rather of several connected hills than of one ridge. No mountain in or around Palestine is said to retain its ancient beauty so much as Carmel;—its "excellency" is still to be seen. It is covered with rich verdure, and plentifully watered by numerous crystal streams. On its summits are pines and oaks, and farther down olives and laurel trees; while everywhere are to be seen fruits and flowers growing wild in great profusion. During the middle ages, the grottos of Carmel were the abodes of numerous monks, who thence took the name of *Carmelites*.

Lebanon. The Lebanon Mountains consist of two ranges, which come down parallel to each other from the N., and extend their southern branches into Palestine. The outer or western ridge, fronting the sea, into which it projects several promontories, was called *Libanus* by ancient writers; while to the inner or eastern range, fronting the plains of Damascus, they gave the name of *Anti-Libanus*. In the Bible the name Lebanon is applied to both ridges. On the loftiest summits, rising to the height of about 9300 feet, and in the fissures facing the north, snow may be seen all the year round. Inclosed between the two ridges of Lebanon is an extensive valley, called in Scripture "the valley of Lebanon," and by the ancients *Cœlesyria* ("the inclosed or hollow Syria"). Though it can scarcely be said to form any part of Palestine proper, yet its geographical and historical connection with that country renders some notice of it necessary. It is about 90 miles in length from N. to S., and about 11 in breadth throughout, except at the two ends, being somewhat wider at the northern, and narrower at the southern extremity. This plain is one of the most beautiful and fertile districts of Syria. It is abundantly watered by numerous mountain springs; but owing to the concentration of the sun's rays, the heat in summer is excessive. Only a small portion of it is cultivated, being chiefly used for pasture.

Galilee. Immediately S. of Lebanon is the high table-land of Galilee, extending to the plain of Esdraelon on the S., and sloping on the E. to the Jordan and its upper lakes, and on the W. to the plain of Acre. This table-land, which is estimated to have a general elevation above the level of the sea of from 900 to 1000 feet, is not without its eminences. The chief of these is Jebel Safet, 2770 feet above the level of the Mediterranean. The summit of this steep and lofty mountain is crowned by a castle; and a little below the summit is a city supposed by some to be that which our Saviour had in view in his Sermon on the Mount, as "a city set on a hill." The mountains of Galilee are as distinct in form as they are separate in fact from those of Samaria and Judea. "Those hills are the western roots which Hermon thrusts out towards the sea, as it thrusts out the mountains of Bashan towards the desert; and as such they partake of the jagged outline of the varied vegetation, and of the high upland hollows which characterize in a greater or less degree the whole mass of the Lebanon range, in contrast to the monotonous aspect of the more southern scenery." "It is one peculiarity of the Galilean hills, as distinct from those of Ephraim and Judah, that they contain or sustain green basins of table-land just below their topmost ridges." (Stanley.) In such a position stands Nazareth, inclosed by an amphitheatre of rounded hills.

Esdraelon. The high lands of Galilee are separated from the rest of Palestine on the S. by the plain of Esdraelon, extending from the shores of the Mediterranean Sea on the W. to the valley of the Jordan on the E. Its central and widest portion reaches straight across, without interruption, from the hills of Samaria to those of Galilee, and may be said to be in the form of a triangle, measuring about 14 miles on the N. side, 18 on the E., and 20 on the S.W. On the W. it is narrowed into a pass, through which flows its only stream, the Kishon; and beyond this the plain opens out again round the Bay of Acre. In the E. the surface is somewhat undulated by offshoots from the mountains; and here three great valleys go off to the

Palestine. valley of the Jordan. These valleys are separated from each other by the ridges of Gilboa and Little Hermon, the central one being that which is properly known as the Valley of Jezreel; a name, however, which is sometimes given to the whole plain. It is a deep plain, about three miles across, and has a rapid descent to the Jordan. The northernmost branch, between Little Hermon and Tabor, in its descent to the Jordan, opens to the N.E. into a side plain, as it were, distinguished by the mountain called the "Horns of Hattin," inclosed between the hills of Galilee, and those which immediately skirt the sea of Tiberias. The *Khurun Hattin*, or "Horns of Hattin," is a ridge about a quarter of a mile in length, and 30 or 40 feet high, terminated at each end by an elevated peak 20 or 30 feet higher. It is known to pilgrims as the Mount of the Beatitudes, the supposed scene of the Sermon on the Mount, though this is at least doubtful. The plain of Esdraelon is often mentioned in sacred history as the great battlefield of Jewish and other nations, under its various names of Megiddo, Jezreel, &c. Its adaptation for military contests has caused its surface to be frequently moistened with blood from the earliest periods of history down to our own time. It is noted for its great fertility, and is covered with the richest pasture, having here and there patches of cultivated land. It is sparsely inhabited, being almost without villages, which, however, occur on the slopes of the surrounding hills.

Tabor. Mount Tabor, in many respects the most remarkable mountain in Palestine, stands apart and alone on the N.E. border of the plain of Esdraelon. It is only about 1800 feet in height, but it commands an extensive and beautiful view of the surrounding country. As seen from the N.W., it towers like a dome; while from the E. it has the appearance of a long arched mound. The sides are mostly covered with bushes and oak and other trees; but the latter stand too far apart from each other for it to be what could properly be called a wooded hill. The top is an oval plain about a quarter of a mile in extent, containing ruins of ancient buildings. From the names of Tabor and

ermon. Hermon occurring together, it was taken for granted that they must lie near each other; and hence the latter name was identified with the hilly ridge about six miles south of Mount Tabor. There is no reason to suppose, however, that this mountain is ever referred to in Scripture as Hermon; and all the passages where that name occurs are applicable with greater strength and beauty to Hermon, the loftiest peak of the Lebanon Mountains. This one is therefore now commonly called the Little Hermon (*Dûhy* by the Arabs), and is a desert shapeless mass, with neither beauty nor fertility to excite the attention of the traveller. It is about 1860 feet in height, and sinks gradually down on the E. to a low ridge of table-land along the eastern part of the valley of Jezreel. Farther S. are the moun-

Gilboa. tains of Gilboa, constituting an elevated tract, with several ridges; in all about a league in breadth, and rising to the height of about 1300 feet. "The mountains of Gilboa seem yet to lie under the curse uttered by David in his lamentations, for the north side, the side on which 'the shield of the mighty was vilely cast away,' and where 'the beauty of Israel was slain,' presents a more barren appearance than is almost to be found in the land." (Van de Velde.)

South of the plain of Esdraelon, throughout to the borders of the southern desert, is an almost unbroken ridge of mountains or mountain tract, stretching from north to south, and nowhere less than from 25 to 30 miles in breadth. Towards the east it forms the precipitous western wall of the great valley of the Jordan and the Dead Sea; while towards the west it sinks down by an offset into a ridge of lower hills, which lie between it and the great plain along the coast of the Mediterranean. This mountainous country rises gradually from the plain of Esdraelon towards the south, until, in the vicinity of Hebron, it attains an elevation of nearly 3000 feet above the level of the Mediterranean. It comprises the districts of Judah and Samaria, between which, however, there is no distinct natural boundary, although they differ considerably in their general characteristics. Palestine.

The hills of Samaria are often beautifully wooded, and this region is more populous and better cultivated than any other part of Palestine. Towns and villages are scattered here and there in every direction among olive woods and vineyards. The principal mountains are those of Ebal and Gerizim, from which the solemn blessings and curses of the law were declared to the assembled hosts of Israel. They are separated from each other by a narrow valley, on each side of which they rise in rocky precipices to the height of about 800 feet, but from the general elevation of the country, they are 2500 feet above the level of the Mediterranean. In this narrow valley, in some parts only a few hundred feet in width, stood Shechem, whose site is now occupied by the modern Nablous—"a valley green with grass; gray with olives, gardens sloping down in all directions; at the end a white town embosomed in all this verdure, lodged between the two mountains which extend on either side of the valley—that on the south Gerizim, that on the north Ebal;—this is the aspect of Nablous, the most beautiful, perhaps it might be said the only very beautiful, spot in Central Palestine." (Stanley.) Shechem was the capital of the northern kingdom of Palestine after the separation, and Gerizim is the mountain to which the woman of Samaria referred when she said—"Our fathers worshipped in this mountain." The well here is almost the only special spot absolutely undisputed of all the localities associated with our Lord's life in Palestine. It is remarkable, that in the evangelic narratives we find so very little that serves to indicate the precise spots hallowed by the life of our Saviour. It seems as if an angelic tongue were still saying, "He is not here, but is risen"—"Why seek ye the living among the dead?" Samaria.

The mountains of Judea, although of greater historical celebrity, are less attractive in appearance than those of Samaria. They are rugged and generally uninteresting in their character, but eminently fitted for the abode of that tribe which was aptly described as a lion couching, and not to be roused up. "The tribes of the east and of the north were swept away by the Assyrian kings; Galilee and Samaria fell before the Roman conquerors; whilst Judah still remained erect, the last because the most impregnable of the tribes of Israel." (Stanley.) The hills of Judea are generally separated from one another by valleys and torrents, and are for the most part of moderate height, uneven, and seldom of any regular figure. The rock of which they are composed is easily converted into mould, which, being arrested by terraces, when washed down by the rains, renders the hills cultivable in a series of long narrow gardens formed by these terraces from the base upwards. Thus the hills were in former times clad most luxuriantly; but when the inhabitants were dispersed, and cultivation was abandoned, the terraces fell to decay, and the soil which had been collected on them was washed down into the valleys, leaving only the arid rock bare and desolate. This is the general character of the hills of Judea; but in some parts they are still wooded, and in others the ancient mode of culture is still retained, by which the traveller may now judge how productive the country must have once been. The features of desolation which have just been noticed are especially true of the northern part of Judea, forming the ancient territory of Benjamin. Its most favourably-situated mountains are wholly uncultivated, and perhaps in no other country is such a mass of rock exhibited without an atom of soil. In the east, towards the plain of Jericho, it takes a naturally stern and grand character, such as Judea

Palestine

no other part of Palestine offers. It is through this wild and melancholy region that the roads from Jerusalem to Jericho, and (by way of Wady Saba) to the Dead Sea, lie. It has hence by the former route often been traversed by travellers in their pilgrimages to the Jordan; and they unite in depicting it in the most gloomy hues. "The road," says Dr Olin, "runs along the edge of steep precipices and yawning gulfs, and in a few places is overhung with the crags of the mountain. The aspect of the whole region is peculiarly savage and dreary, vieing in these respects, though not in overpowering grandeur, with the wilds of Sinai. The mountains seem to have been loosened from their foundations, and rent in pieces by some terrible convulsion, and there left to be scathed by the burning rays of the sun, which scorches the land with consuming heat." These characteristics become more manifest on approaching the Jordan; and the wild region extending north of the road is believed, with sufficient probability, to form the "wilderness" where, after his baptism, Jesus "was led up" of the Spirit to be tempted of the devil, and where "he fasted forty days and forty nights." The lofty ridge which extends north of the road, and fronts the plain of Jericho, is called Quarantana, with reference to this event: and the particular summit from which Satan is supposed to have displayed to the Saviour "the kingdoms of the world and the glory of them," is crowned by a chapel still occasionally resorted to by the devouter pilgrims; while the eastern face which overhangs the plain is much occupied with cells and grottos, once the favourite abodes of pious anchorites. The Quarantana forms apparently the highest summit of the whole immense pile, and is distinguished for its sere and desolate aspect even in this gloomy region of savage and dreary sights. It is estimated to have an almost perpendicular height of 1200 or 1500 feet.

In the southern region, usually called in Scripture "the hill country of Judah," there are few mountains of a marked character, the peaks of the general ridge being of little apparent elevation, although actually much elevated above the sea-level. The most desolate part of the whole of this wild region seems to have been distinguished as "the wilderness of Judah," while "the mountains of Judah," or "the hill country of Judea," applies to the mountainous region south of Jerusalem, towards Hebron. To this district belongs the wilderness of Tekoa, and beyond it, eastward, "the wilderness of Engedi," Maon, and Ziph,—names made familiar to us by the history of David. To obtain a clear notion of this tract, we should view it from the great Arabah, beyond the southern extremity of the Dead Sea, whence it was surveyed by the Israelites when they contemplated entering the Promised Land from the south-east. The two terraces which, towards the south end of the Dead Sea on the east side, form the descent to its deep basin from the high lands of Judea, stretch off to the south-west; and the ascents from the plain to the first, and from the plateau of the first to the top of the second, which forms the general level of Judea, present to him who approaches from the lower region of the Arabah high mountain barriers, which he has to ascend by gorges or passes of more or less difficult ascent. After ascending from the great valley, the traveller passes over a wild district covered with rocky hills, till he comes to the frontier-wall of the first terrace or step, which was probably pre-eminently "*the* mountain of the Amorites." There are in this three principal passes, the southernmost being that of Nubeh-es-Sufah, the Zephath of Scripture, called also Hormah, which we know to have been the pass by which the Israelites attempted to enter Palestine from Kadesh when they were driven back. The top of this pass is said to be 1434 feet above the level of the sea. On reaching the top, a journey of three hours among hills of chalky limestone brings the traveller to the second great ascent to the general level of the hill country of Eastern Judea. This second ascent is similar to the first, but not more than half as high. This statement will convey some idea of that difficulty of military access to the country in this direction which eventually induced the invading Hebrews to take another and more circuitous route. In the direct south of Judah the approach is marked by an ascent more gradual, over a succession of less elevated plateaus, from the desert regions of sand and rock to the hills of Judah. Recent discoveries in that quarter have shown that much of the south border country, which was formerly regarded as desert, is in fact a variegated region, affording good pastures, into which the sheep-masters of Judah doubtless sent their flocks of old.

Jordan.

To the east of this mountain tract lies the valley of the Jordan, the most remarkable of all the known depressions of the earth, as well on account of its great length as of its almost incredible depth. It is around and along this deep fissure that the hills of Western and Eastern Palestine spring up, presenting on the one side a mass of green pastures and forests melting away on the east into the red plains of Haurân, and on the other a mass of gray rock rising above the yellow desert on the south, and bounded on the west by the long green strip of the maritime plain.

The source of the Jordan has given rise to so much uncertainty and doubt that we consider it necessary to go into the subject at some length. It is usual to refer the origin of a river to the remotest of its sources; but we occasionally find, particularly with respect to ancient rivers, that this is not the case—various accidental circumstances operating to give this distinction to some one of the less remote springs. This was doubtless the case here, for we can easily suppose that the Jews would be unwilling to seek for or to acknowledge that the sources of the Jordan lay beyond their own territory. Accordingly we find that Josephus and others place the source of this river at or in the vicinity of Bâniâs (the ancient *Paneas*). It there issues from a spacious cavern under a wall of rock at the base of the Heish Mountain. Directly over the cavern, and in other parts in the face of the perpendicular rock, niches have been cut, apparently to receive statues. Here Herod built a temple in honour of Augustus; and somewhat below there was a town, traces of which still remain. In one place Josephus carries its source still higher, stating that the waters which came out at the Paneas cavern issued from Lake Phiala, which lay 15 miles eastward, and which was the true source of the river. He relates that the tetrarch Philip cast some chaff into this lake, and that it came out at the Paneas cavern. Irby and Mangles, in travelling by a direct route from Damascus to Bâniâs in February 1818, came upon "a very picturesque lake, apparently perfectly circular, of little more than a mile in circumference." According to Dr Robinson's account, which differs in several respects from that of Irby and Mangles, it lies at the bottom of a deep bowl, apparently an ancient crater, about 150 or 200 feet below the level of the surrounding country. The water is stagnant and impure, with a slimy look. The singularity of this lake is, that it has no apparent supply or discharge, and its waters appeared perfectly still. The locality and appearance of this lake leave little doubt that it is the Phiala of Josephus—a deep round lake, like a bowl or cup, whence its name; but it is impossible to suppose that it can have any subterranean communication with the stream at Panias, for in order to that it must pass under a rivulet which lies apparently lower than the lake itself. The bright, limpid, sparkling waters of the former can have no connection with the dark, stagnant, slimy matter of the latter; and, indeed, to supply such a fountain would exhaust the lake in one day.

A second source of the Jordan, also described by ancient writers, is at a place called Tell el-Kâdy, about 2½ miles W. by N. from Bâniâs. The *Tell*, or hill, is a small oblong

Palestine. eminence on the plain, extending from E. to W. The western end appears as if built up with large trap boulders, and through these the water gushes out several feet above the base. It forms a little lake at the bottom, and then rushes down a steep channel to the next lower plateau. In the surface of the hill directly above is a cavity of some extent, into which the water also rises, and runs off as a considerable stream through a break in the edge of the Tell, tumbling down its south-western side, and afterwards joining the other stream. These streams form together the middle and largest arm of the Jordan, called Leddân; equal, indeed, in the volume of its water to both the other branches. The fountain at Tell el-Kâdy exactly corresponds to the source which Josephus speaks of as "the other source" of the Jordan, called also Dan, where stood the city of Dan, anciently *Laish*, belonging originally to the territory of Sidon, but captured by the Danites, and named after the founder of their tribe. The same city Dan is placed by Eusebius and Jerome at four Roman miles from Paneas. towards Tyre, corresponding well with the present distance of the sources. The river issuing from this source, Josephus says, was called "the Lesser Jordan," obviously in distinction to the somewhat longer stream from Paneas, into which it flows.

We find, however, that there is a source more remote than either of these, and one of which the ancients make no mention whatever. This is the stream coming from Wady et-Teim, called Nahr Hasbâny, which flows about a mile to the W. of Tell el-Kâdy. It rises 6 or 8 miles farther N., near the large village of Hasbeiya, and is afterwards joined in its course by a stream from Mount Hermon. The first who minutely described this source of the Jordan was Mr Thomson the missionary, whose account is to be found in the number of the *Bibliotheca Sacra* for February 1846. He says:—"*Sept. 20th*, 1843.—We left the palace of the emirs of Hasbeiya about sunrise, and in half an hour reached the fountain of Hasbâny. Our path led us across the bed of a winter torrent, which comes down from the mountains on the E. of Hasbeiya, and over a rocky hill covered with lava boulders. The fountain lies nearly N.W. from the town, and boils up from the bottom of a shallow pool some eight or ten rods in circumference. The water is immediately turned by a strong stone dam into a wide mill-race. This is undoubtedly the most distant fountain, and therefore the true source of the Jordan. . . . . . It meanders for the first 3 miles through a narrow but very lovely and highly-cultivated valley. Its margin is protected and adorned with the green fringe and dense shade of the sycamore, button, and willow trees; while innumerable fish sport in its cool and crystal bosom. It then sinks rapidly down a constantly deepening gorge of black basalt for about 6 miles, when it reaches the level of the great volcanic plain, extending to the marsh above the Lake Hûleh. Thus far the direction is nearly S., but it now bears a little westward, and in 8 or 10 miles it enters the Hûleh not far from its N.W. corner, having been immensely enlarged by the waters from the great fountains of Bâniâs, Tell el-Kâdy, el-Mellâhah, Derakit or Belât, and innumerable other springs. The distance from the fountain of Hasbâny to the lake cannot be less than 25 miles, and nearly in a straight direction. . . . . Although the channel immediately above the fountain of the Hasbâny is during most of the year dry and dusty, yet during the rainy season a great volume of water rushes down from the heights of Jebel esh-Sheikh, above Rasheiya, a distance of 20 miles, and unites with the water of this fountain. The stream is there so formidable as to require a good stone bridge, which is thrown across it a few rods below the fountain." A similar account of this source is given by Van de Velde and others who have since visited it. The former, who was there in 1852, says—"A little higher up the water is turned off by a large stone dam, and part of it is carried away in a small stream, which works a mill lower down. A few yards above is the basin or source where the water comes bubbling up from under steep projecting rocks. It is of a transparent dark colour, and appears to be of immense depth. But there was still something I did not understand: it appeared to me that the main stream of water came down from a point farther up; this made me doubt whether I really had before me the right source, until it was explained to me that this stream which I saw coming down from the N.E., above the source, was only a winter torrent, which, rising at Râsheiya, swells into a brook of no inconsiderable appearance, containing even more water than the Hasbâny source itself, but which, nevertheless, dries up entirely in summer, and then leaves the true source visible." The question as to the source of the Jordan is, whether we are to adopt that which has now been found to have the most remote origin, or to keep to that which the usage of all antiquity has sanctioned? Dr Robinson seems to be almost the only supporter of the latter view. "The attempt," he says, "to introduce a change at this late hour would be alike presumptuous and futile. As well might we require the majestic floods of the Mississippi and Missouri to exchange these names above their junction, inasmuch as the latter is, of the two, by far the longer and the mightier stream." It seems to us, however, that the sanction of ancient usage is not in this case so strong, nor has it been in modern times in so general use, as to lead us to depart from what is an all but universal rule. It was the general opinion till very recently, that the different sources did not commingle their waters until they met in the small lake now called Bahr el-Hûleh, the Merom of Scripture; but it has been found that they unite at some distance from the lake, and enter it in one stream.

Merom

The first of the three great lakes of the Jordan is the Bahr el-Hûleh, the Waters of Merom of the Old Testament, and the Lake Samochonitis of Josephus. Its dimensions are very variously stated, and they doubtless vary much at different times of the year. Dr Robinson estimates it to be about 4 or 5 miles in length, and not less than 4 in breadth at the northern end. Besides this, however, the lake was skirted on the N. by a marshy tract of equal or greater extent, covered with tall reeds and flags, but which in the rainy season is doubtless covered with water, and may therefore be properly regarded as forming part of the area of the lake. The basin of the lake is bounded on the W. by a high ridge of hills, and on the E. by a much lower ridge. The lake does not occupy the centre of the valley, but is much nearer to the eastern than to the western side. There is a space of about 5 miles between its shore and the western hills, but on the opposite side its border extends almost to the hills. The length of the basin is about 15 miles. The lake abounds in fish, and is the resort of numerous wild fowl. On quitting this lake the Jordan passes rapidly along the narrow valley, and between well-shaded banks, to the Lake of Gennesareth, called also the Lake of Tiberias or the Sea of Galilee, a distance of about 10 miles. In this part of its course it has a fall of nearly 400 feet, and is described as a continuous torrent rushing down in a narrow rocky channel between almost precipitous mountains. About 2 miles below Lake Hûleh is a bridge called Jacob's Bridge, and here the river is about 80 feet wide and 4 feet deep.

Sea of Galilee.

The Sea of Galilee, called in the Old Testament the Sea of Chinnereth, is the second of the three great lakes of the Jordan. It is situated in a deep basin, more than 1000 feet below the level of the surrounding country, and 328 feet below the level of the Mediterranean. It is about 13 miles in length by 6 in breadth, and is surrounded by lofty and precipitous hills. Though thus sheltered, it is yet liable to sudden and dangerous storms; the wind, when violent, coming down almost perpendicularly upon its sur-

face, and ploughing it up into huge waves. It was in one of these storms that the disciples were overtaken, and in danger of perishing, when Jesus came to them walking on the sea. The barrenness of the surrounding mountains, and the total absence of wood, give an aspect of dulness to the scenery; and this impression is heightened by the dead calm and the silence which reigns over the wide expanse of its surface. Its waters are very clear and sweet, and contain various species of excellent fish in great abundance. The borders of the lake were in the time of Christ well peopled, being covered with numerous towns and villages, but now they are almost desolate, and the fish and water-fowl are but little disturbed. When visited by the American expedition in 1848, there was only one small frame-boat on the lake, used merely to bring wood across from the opposite side. On the shore of this lake stood Capernaum, where Jesus dwelt; Bethsaida and Chorazin, where many of his mighty works were done; Magdala, the residence of Mary Magdalene; and Tiberias, which had only just then been built by Herod Antipas, and was beginning to rise into importance. Along its banks the depth of its situation produces a tropical vegetation unknown in the hills above. Fertility is everywhere more or less apparent in the thin strip of land which intervenes between the mountains and the lake. On its western side the mountains recede suddenly inland, leaving an open level plain, now called el-Ghuweir, and anciently "the land of Gennesareth." Josephus speaks of this plain as a place of wonderful fertility, abounding with fig-trees, walnuts, olives, and palms, and producing the principal fruits all the year round, and grapes and figs during ten months of the year. Though this description is evidently exaggerated, Dr Wilson says that "the valley has every appearance of the greatest fertility; and when kept in order and properly laid out, would be truly beautiful and delightful. At present it has some rich pasturage and cultivated fields, bearing luxuriant crops of corn, rice, and vegetables. Wild figs and quantities of the nakb tree are still found growing in it in several places. Various lines of oleanders, particularly along the streams which run through it, add to its beauty. The soil is of a dark alluvial loam, and contains the *debris* of the basaltic rock in the neighbourhood." This tract is definitely bounded by the hills which run down to the lake on the S. and N. of it, at Mejdel and at Khân Minyeh. It is about 3 English geographical miles in length, by 2 in breadth. "No less than four springs pour forth their almost full-grown rivers through the plain." (Stanley.)

From the Sea of Galilee to the Dead Sea the direct distance is only about 60 miles, but by reason of its many windings the Jordan has here a length of more than 200 miles. In this distance it has a fall of nearly 1000 feet. This portion of the river was explored by Lieut. Molyneux, of H.M.S. Spartan, in 1847, and an account of the expedition is given in the *Royal Geographical Society's Journal* for 1848. On leaving the Sea of Tiberias they found the river to be upwards of 100 feet in breadth, and 4 or 5 feet deep. In many parts it was split up into a number of small streams, with little water in any of them, and occasionally the boat had to be carried upwards of 100 yards over rocks and through thorny bushes. In other places it had to be carried on the backs of the camels for some distance, the stream being quite impracticable. At its upper end the *ghor*, or great valley of the Jordan, is about 8 or 9 miles broad, and this space is anything but flat—nothing but a continuation of bare hills, with yellow dried-up weeds, which look at a distance like corn-stubbles. These hills, however, sink into insignificance when compared to the ranges of mountains which inclose the ghor, and it is therefore only by comparison that this part of it is entitled to be called a valley. Within this broader valley is a smaller one on a lower level, through which the river flows. After passing el-Buk'ah, the Jordan forms two branches, which inclose an oval-shaped island about 5 or 6 miles in circumference. Here its winding course is marked by luxuriant vegetation, and the ghor or valley now begins to assume a much better and more fertile aspect. It appears to be composed of two different platforms; the upper one on either side projects from the foot of the hills which form the great valley, and is tolerably level, but barren and uncultivated. It then falls away in the form of rounded sand-hills or whitish perpendicular cliffs, varying from 150 to 200 feet in height, to the lower plain, which is properly the valley of the Jordan. The river here and there washes the foot of the cliffs which inclose this smaller valley, but generally it winds in the most tortuous manner between them. In many places these cliffs are like walls. About this part the lower plain is about a mile and a half or two miles broad, and full of the most rank and luxuriant vegetation, like a jungle. At Attah the lower valley breaks out into a magnificent plain, extending from the foot of the hills on either side across the ghor, but with a steep western side, where the large Arab village of Beisan stands. On reaching the top of this high western ridge, the country southward, as far as the eye could see, was fertile, well watered, and thickly inhabited. Hundreds of small sheds might be seen studded on the plain, with men watching the crops (chiefly Indian corn), and slinging stones to keep off the birds. "I think," says Lieutenant Molyneux, "the view from this point over the valley of the Jordan was one of the finest things I had seen; an abundant vegetation extending up the slopes of the eastern hills, which are crowned with trees up to the summit, and everything growing in the wildest luxuriance; while on the western side the higher steppe breaks down into steep sand-hills or whitish perpendicular cliffs, with only here and there the means of ascent. The river as usual winds very much, with banks about 20 feet in height, of brown clayey soil, somewhat resembling those of the Thames, and for some distance on either side a thick and almost impenetrable jungle." Such is the general character of the Jordan valley to the Dead Sea,—sometimes lofty perpendicular cliffs or sand-hills inclose the river on each side, at other times they recede to a considerable distance, and leave an extent of jungle or fertile plain. The valley seemed to contain a considerable population. Next year (1848) an American expedition, under the command of Lieutenant Lynch, U.S.N., likewise explored this portion of the valley of the Jordan. The account given by this expedition does not differ materially from that furnished by Lieutenant Molyneux, except that the river in the former case was greater, being in April, whereas in the latter case it was in August. "The great secret," says Lieutenant Lynch, "of the depression between Lake Tiberias and the Dead Sea is solved by the tortuous course of the Jordan. In a space of 60 miles of latitude, and 4 or 5 miles of longitude, the Jordan traverses at least 200 miles. The river is in the latter stage of a freshet; a few weeks earlier or later, and the passage would have been impracticable. As it is, we have plunged down twenty-seven threatening rapids, besides a great many of lesser magnitude."

Plain of Jericho.

The valley of the Jordan is generally not more than about 8 miles in width, but immediately above the Dead Sea the hills on either side recede, leaving a plain about 12 miles in breadth. This is the plain of Jericho, now partly desert, but, from the abundance of water and the heat of the climate, susceptible for the most part of being rendered in the highest degree productive. Indeed, its fertility has been celebrated in every age. Josephus, whenever he has occasion to mention Jericho, rarely fails to break forth into praises of the richness and productiveness of its environs. He calls it the most fertile tract of Judea; pronounces it a divine region; and, in speaking of the fountain, says it watered a tract 70 stadia long by 20 broad, covered with

Palestine. beautiful gardens and groves of palms of various species. The Scriptures call Jericho the "city of palm trees;" and Josephus describes these graceful trees as here abundant and very large, and growing even along the banks of the Jordan. This region also produced honey, opobalsam, the cypress tree (or *el-henna*), the sycamore, and myrobalanum, as well as the common fruits of the earth, in great abundance. Of all these productions few are now to be seen. The groves of palm trees have disappeared; even the one solitary remnant noticed by recent travellers has, within the last few years, taken its departure. The sycamore, too, has retired from the plain, and the opobalsam is no longer known in the country. Honey, if found at all, is now comparatively rare, and the cypress tree has entirely disappeared. The myrobalanum alone appears to thrive, being probably the thorny shrub growing wild in the plain to which the name of *zŭkkûm* is given by the Arabs. It produces a green nut, from the kernel of which is extracted the oil known in the present day as the "balsam of Jericho."

Dead Sea. The Dead Sea (called in Scripture the Salt Sea, the Sea of the Plain or the Arabah, and the Eastern Sea; by Josephus, the Asphaltic Lake, λίμνη Ἀσφαλτίτης; and by the Arabs, *Birket Lut*, "Sea of Lot"), is the largest as well as the most remarkable of the lakes of Palestine. It is about 39 or 40 geographical miles in length from north to south, and 9 or 10 wide from east to west. It lies deeply embedded between, on the western side, lofty cliffs rising to the height of about 1500 feet, and on the eastern, high mountains, the loftiest ridges of which are estimated to be from 2000 to 2500 feet above the sea. The northern shore of the lake, as described by Lynch, is an extensive mud flat, with a sandy plain beyond; and the north-western an unmixed bed of gravel coming in a gradual slope from the mountains to the sea. The eastern coast is a rugged line of mountains, bare of all vegetation,—a continuation of the Haurân range coming from the north, and extending south beyond the scope of vision, throwing out three marked and seemingly equidistant promontories from its south-eastern extremity. At the south-western extremity of the lake is the isolated ridge called the Mountain of Usdom, containing fossil salt. The bottom consists of two submerged plains, an elevated and a depressed one,—the southern averaging about thirteen, and the northern about thirteen hundred feet below the surface. The well-defined promontory on its eastern side marks the extent of each of these plains. The old stories about the pestiferous qualities of the Dead Sea are mere fables. Birds are observed flying over the sea, and even resting upon its waters, without being injured; and Dr Robinson was five days in the vicinity without perceiving any noisome smell or noxious vapour arising from the lake. The uncommon saltness of the water, however, renders it speedily destructive to any fish that may be brought down by the streams; but it is asserted that there is one small species of fish peculiar to it. The quantity of salt, too, that is constantly given off in small particles is equally destructive to vegetation on its shores. Everything along the shore is covered with a white incrustation of salt. "Strewn along its desolate margin lie the most striking memorials of this last conflict of life and death; trunks and branches of trees, torn down from the thickets of the river-jungle by the violence of the Jordan, thrust out into the sea, and thrown up again by its waves, dead and barren as itself." (Stanley.) (See ASPHALTITES.)

The deep depression of the Dead Sea below the level of the Mediterranean appears never to have been suspected till the time of its actual discovery in 1837, when Messrs Moore and Beek, then engaged in surveying it, were led to examine the question of its comparative elevation. Since that time various barometrical observations have been made, but they differ considerably from each other. The trigonometrical observations of Lieutenant Symonds of the British Royal Engineers are the most reliable that we yet possess, and they give its depression at 1312·2 feet below the level of the Mediterranean, which corresponds very closely with that obtained by Mr Henry Poole in 1855 with the *anéroid métallique*,—namely, 1313·5 feet.

It was long believed that this lake did not exist before the destruction of Sodom and the other "cities of the plain," and that before that time the Jordan continued its course through the great valley of Arabah, which extends from the Dead to the Red Sea. The fact, however, of the former being above 1300 feet lower than the latter, and the discovery of a ridge of high land, about 400 feet above the level of the sea, stretching directly across this valley, render this hypothesis extremely improbable. Even supposing that this ridge may be of recent formation, and that the depression of the Jordan valley has taken place since that time, we have yet, from Lake Hûleh where the depression commences, to the Red Sea, a direct distance of nearly 300 miles, with a fall of only about 50 feet. It seems more likely that the fertile and well-watered district in which stood the "cities of the plain," was that southern portion of the lake which is at present submerged under some 13 feet of water. It seems, too, to be the salt rocks around this portion that give to the waters their present deadly qualities.

Though there is every reason to believe that the Dead Sea has existed here from the earliest times that we have any account of the country, it is impossible to suppose that it was in its present depressed state at the time when "Lot lifted up his eyes, and beheld all the plain of Jordan, that it was well watered everywhere, before the Lord destroyed Sodom and Gomorrah, even as the garden of the Lord." The appearance of the district itself, with its numerous evidences of active volcanic agency,—its bitumen, sulphur, nitre, lava, &c.,—render this view extremely likely. "The bituminous and sulphureous sources of the Dead Sea," says Volney, "the lava, the pumice-stones thrown upon its banks, ... demonstrate that the seat of a subterraneous fire is not yet extinguished. Clouds of smoke are often discovered to rise from the lake, and new crevices to be formed on its shore." Lieutenant Lynch unexpectedly found between the Jabbok and the Dead Sea a sudden break-down in the bed of the Jordan. He says, that "if there be a similar break in the water-courses to the south of the sea, accompanied with like volcanic characters, there can scarce be a doubt that the whole ghor has sunk from some extraordinary convulsion, preceded most probably by an eruption of fire and a general conflagration of the bitumen which abounded in the plain. Whether this great depression took place at once on the destruction of the cities of the plain, or has been going on gradually since that time, is very doubtful. The latter hypothesis, however, seems the more probable. The accounts given by modern travellers of the River Jordan differ in many respects from the character that we form of it from the notices that occur in Scripture. In the latter case, we figure to ourselves a considerable river moving majestically along its course, having few fords, and periodically overflowing its banks. On the other hand, we have an impetuous torrent, with no proof of its overflowing its banks, and in many places without sufficient water to float a boat of light draught. Molyneux, in speaking of the upper part of its course, says,—"I am within the mark when I say that there are many hundreds of places where we might have walked across without wetting our feet, on the large rocks and stones." These accounts can easily be reconciled if we suppose that formerly the depression of the Dead Sea and the lower course of the Jordan was much less than at present, and that consequently it had a slower course, and a considerably larger volume of water.

It is now generally believed to be most probable that,

Palestine. anterior to the historical period, the whole valley, from the base of Hermon to the Red Sea, was once an arm of the Indian Ocean, which has gradually subsided, leaving the three lakes in its bed, with their connecting river. According to Captain Newbold, in the *Journal of the Royal Asiatic Society*, vol. xvi., "The valley of the ghor, which is a vast longitudinal crevasse in calcareous and volcanic rocks, extending from the southern roots of Libanus and Anti-Libanus, to the Gulf of Akaba, from 1000 to 2000 feet deep, and from 1 to 8 miles broad (this is understated), appears to have been caused by the forcible rending and falling in of the aqueous strata resulting from the eruption of the basalt, which bases it almost from its commencement to the Dead Sea. . . . . Watery corrosion or abrasion can have had little influence in its formation. The great alterations in its surface commenced prior to the historic period, and terminated probably in the catastrophe of Sodom." See also an article on this subject in the *Royal Geographical Society's Journal*, vol. xxiii. (1853), by Captain W. Allen, R.N., who, from indications of alluvial deposit on the sides of the mountains around the Dead Sea and lower portion of the Jordan, apparently marking the gradual subsidence of the waters in this district, came to the same conclusion. As, however, these indications seem to be entirely confined, as regards the Dead Sea, to its northern portion, and as their appearance would seem to indicate a time more recent than that claimed for that state of the country, we are inclined to consider it rather as an indication of the gradual sinking of the basin of the Dead Sea subsequently to the destruction of the cities of the plain.

Minor streams. Besides the Jordan, Palestine possesses scarcely another river of any size. Most of those that are laid down in the maps, or whose names figure in history, are merely torrents or water-courses, which carry off the waters in the rainy season, or, if they have their origin in springs, are spent in the season of drought soon after they quit their sources. There are, however, numerous springs, which in a country like this are of the greatest importance to cultivation. The Kishon, the river on whose banks the army of Sisera was overthrown, is in winter and spring a large and rapid river, flowing from Mount Tabor, and collecting the waters of a large part of the plain of Esdraelon and its bordering hills; but in summer all the part which passes over the plain is quite dried up, and only water from perennial springs in Carmel is then found in the last seven miles of its bed. It enters the Bay of Acre near the foot of Mount Carmel. The Kishon, says Van de Velde, "is considered, on account of its quicksands, the most dangerous river in the land;" and hence Deborah and Barak, in their song of victory, sang—"The River Kishon swept them away; that ancient river, the River Kishon." They that fled had to cross the bed of the torrent; but the Lord sent a heavy rain; the waters rose; the warriors stumbled, and fell into the quicksands, and the waves which came rushing on washed them away into the sea. The Belus, now called *Nahr Kardanus*, falls into the Bay of Acre higher up than the Kishon. It is a small stream, fordable even at its mouth in summer. It is not mentioned in the Bible, and is chiefly celebrated for the tradition, that the accidental vitrefaction of its sands taught men the art of making glass. The chief of the other streams that fall into the Mediterranean are,—the Zerka, about 3 miles N. of the ruins of Cæsarea, and supposed to be identical with the Crocodile River of Pliny; the Nahr el-Kasab, about 12 miles S. of Cæsarea, supposed to be the River Kanah of Scripture; the Nahr el-Arsouf, about 10 miles S. of this last, and about the same distance N. of Joppa, chiefly noted for a celebrated castle of the same name which stood near its mouth in the time of the Crusades; the Nahr-Abi-Petros, a little to the N. of Joppa, and the Nahr el-Rubin, 12 miles S. of that town; a brook about a mile and a half S. of Ashdod, which appears to be the Sorek of Scripture, and between Askelon and Gaza, two small streams, whose names are unknown; the Wady Gaza, 2 or 3 miles S. of the town of that name, which seems to be the Bezor of Scripture; and the brook el-Arish, which is supposed to be the river of Egypt which formed the southern boundary of the coast of Palestine. The most important tributaries of the Jordan and the Dead Sea are the Jarmuk, the Jabbok, and the Arnon. The first of these, called also Mandhur (the *Hieromax* of ancient geography), joins the Jordan about 5 miles below the Lake of Gennesareth. Its source is ascribed to a small lake, about a mile in circumference, lying 30 miles E. of the Jordan. It is a beautiful stream, and brings down a considerable body of water. The Jabbok, now called the Zerka, is a narrow, but deep and rapid stream, which joins the Jordan about half-way between Gennesareth and the Dead Sea. The Arnon, now the Wady Modjeb, is an affluent of the Dead Sea, and often mentioned in Scripture. The brook Kedron flows through the valley of Jehoshaphat, on the E. side of Jerusalem, to the Dead Sea. It is at present nothing more than the dry bed of a winter torrent, and even in that season there is no constant flow of water. The resident missionaries assured Dr Robinson that they had not during several years seen a stream running through the valley. It, however, bears marks of being occasionally swept over by a considerable volume of water.

Eastern Palestine. Of the region beyond the Jordan we know very little, as it has been seldom visited by travellers, partly on account of the insecure nature of the country, and partly also from the slight historical interest that attaches to it in comparison with Western Palestine. "The mountains rise from the valley of the Jordan to the height, it is believed, of 2000 or 3000 feet, and this gives them, when seen from the western side, the appearance of a much greater actual elevation than they really possess, as though they rose high above the mountains of Judea on which the spectator stands. As they are approached from the ghor, the horizontal outline which they always wear when seen from a distance is broken; and it is described, that when their summits are attained, a wholly new scene bursts upon the view, unlike anything which could be expected from below—unlike anything in Western Palestine. A wide table-land appears, tossed about in wild confusion of undulating downs, clothed with rich grass throughout, and in the northern parts with magnificent forests of sycamore, beech, terebinth, ilex, and enormous fig trees. . . . . The vast herds of wild cattle, now seemingly extinct, but which then wandered through those woods,—as those of Scotland through its ancient forests,—were in like manner at once the terror and pride of the Israelite—'the fat bulls of Bashan.' Flocks, too, there were of every kind—'rams, and lambs, and goats, and bullocks, all of them fatlings of Bashan.'" (Stanley.) Mr Buckingham describes with equal delight and admiration the varied beauties of this romantic region, the Decapolis of the Romans, the seat of ten renowned cities, famed for wealth and refinement, but now a scene of desolation, over which the wild Arab ranges with his flocks in quest of pasture or of prey. The country, according to the account of this traveller, is of extraordinary richness, abounding in the most beautiful prospects of thick forests, verdant slopes, and extensive plains. The landscape alone varied at every turn, and gave new beauties from every different point of view. "The general face of this region," he adds, "improved as we advanced farther into it; and every new direction of our path opened upon us views which surprised and charmed us by their grandeur and their beauty. Lofty mountains gave an outline of the most magnificent character; flowing beds of secondary hills softened the romantic wildness of the picture; gentle slopes, clothed with wood, gave a rich variety of tints hardly to be imitated by the pencil; deep valleys, filled with murmuring

streams and verdant meadows, offered all the luxuriance of cultivation; and herds and flocks gave life and animation to scenes as grand, as beautiful, and as highly picturesque, as the genius or taste of a Claude could either invent or desire." To the south, on the eastern shore of the Dead Sea, is found the bleak, barren, and mountainous district of Carac, where are the ruins of Rabboth-Moab, the ancient capital, and formerly a populous and an important place. Farther to the north is a vast plain of table-land, stretching southward from Damascus, not watered by any great river, yet rendered fertile by the industry of the inhabitants, who collect the rain-water into ponds for the purpose of irrigation, and thus contrive to raise large crops of grain. Of these countries, Haurân is the most celebrated for its luxuriant harvests of wheat; and the undulations of the ripened grain on its extensive fields have been compared to the rolling waves of the ocean. Many hummocks are seen scattered over the plain, the sites generally of deserted villages. All these hummocks, and every stone found in the field,—all the building stones, and the whole mountains of Haurân,—consist of basalt; and the houses being entirely built of this stone, even to the door-posts, present rather a sombre appearance. The beauty and fertility of this region is said to far exceed that of Western Palestine. It was pre-eminently "a place for cattle;" and on this account it was coveted by Reuben and Gad and the half tribe of Manasseh.

Scenery.

The high terms of admiration in which most travellers speak of the scenery of Palestine are evidently beyond the truth. "As a general rule," says Mr Stanley, "not only is it without the two main elements of beauty—variety of outline, and variety of colour—but the features rarely so group together as to form any distinct or impressive combination. The tangled and featureless hills of the lowlands of Scotland and North Wales, are perhaps the nearest likeness accessible to Englishmen of the general landscape of Palestine south of the plain of Esdraelon. Rounded hills, chiefly of a gray colour,—gray partly from the limestone of which they are all formed, partly from the tufts of gray shrub with which their sides are thinly clothed, and from the prevalence of the olive,—their sides formed into concentric rings of rock, which must have served in ancient times as supports to the terraces, of which there are still traces, to their very summits; valleys, or rather the meetings of these gray slopes, with the beds of dry water-courses at their feet—long sheets of bare rock laid, like flagstones, side by side along the soil; these are the chief features of the greater part of the scenery of the historical parts of Palestine. In such a landscape the contrast of every exception is doubly felt. . . . . The eye rests with peculiar eagerness on the few instances in which the gentle depressions become deep ravines, as in those about Jerusalem, or those leading down to the valley of the Jordan; or in which the mountains assume a bold and peculiar form, as Lebanon and Hermon, at the head of the whole country, or Tabor, 'Nebi-Samuel,' and the 'Frank Mountain,' in the centre of the hills themselves." On entering Palestine, he was struck with "the western, almost the English, character of the scenery. Those wild uplands of Carmel and Ziph are hardly distinguishable (except by their ruined cities and red anemones) from the lowlands of Scotland or of Wales; the cultivated valleys of Hebron (except by their olives) from the general features of a rich valley in Yorkshire or Derbyshire."

Ruins.

"Above all other countries in the world, it is a *land of ruins*. It is not that the particular ruins are on a scale equal to those of Greece or Italy, still less to those of Egypt. But there is no country in which they are so numerous, none in which they bear so large a proportion to the villages and towns still in existence. In Judea it is hardly an exaggeration to say that, whilst for miles and miles there is no appearance of present life or habitation, except the occasional goat-herd on the hill-side, or gathering of women at the wells, there is hardly a hill-top of the many within sight which is not covered by the vestiges of some fortress or city of former ages." "The ruins we now see are of the most diverse ages; Saracenic, crusading Roman, Grecian, Jewish, extending perhaps even to the old Canaanitish remains before the arrival of Joshua." "In the rich local vocabulary of the Hebrew language, the words for sites of ruined cities occupy a remarkable place. Four separate designations are used for the several stages of decay or of destruction which were to be seen even during the first vigour of the Israelite conquest and monarchy." (Stanley.) On this subject we cannot refrain from adducing the testimony of the Rev. J. L. Porter regarding the existing ruins in Eastern Palestine. "I had often read," he says, "how God had delivered into the hands of the children of Manasseh, Og, King of Bashan, and all his people; and I had observed the statement, that a portion of his territory, even the region of Argob, contained *threescore* cities fenced with high walls, gates, and bars, besides unwalled towns a great many. I had sometimes turned to my atlas, where I found the *whole of Bashan* delineated, and not larger than an ordinary English county. . . . . That *sixty walled cities*, besides unwalled towns a great many, should be found at such a remote age, far from the sea, with no rivers and little commerce, appeared quite inexplicable. Inexplicable and mysterious though it appeared, it was strictly true. On the spot, with my own eyes, I had now verified it. *Lists of more than a hundred* ruined cities and villages in these mountains alone I had tested and found correct, though not complete. More than thirty of these I had myself either visited or observed so as to fix their positions on the map." (*Five Years in Damascus*, 1855.)

Geology.

The mountains of Palestine are chiefly composed of an oolitic limestone, of a whitish or light gray colour, and abounding in caverns, to which frequent allusion is made in Scripture. In many places the limestone is covered with chalk rocks, containing layers and detached masses of flint, as well as corals, shells, &c. Masses of black basalt occasionally occur in the N. of Galilee, but are more common on the eastern side of the Jordan, and about the Dead Sea. In the valley of the Jordan, and especially about the Dead Sea, we have unmistakeable indications of volcanic action; and even in the northern portion of the valley, and about the sources of the river, these are much more numerous than was formerly supposed. Such indications, however, do not seem to have been discovered in other parts of the country, but earthquakes are not unfrequent. At Tiberias, the Dead Sea, and other parts of the valley, hot springs occur, many of which have a sulphureous taste or odour. Lava is found about the Dead Sea, the Sea of Tiberias, and other parts of the Jordan valley. At Béisan, Dr Robertson writes, "the whole region here is volcanic, like that around and above the Lake of Tiberias;" and Mr Buckingham, while crossing the River Hieromax, in his journey to Nazareth, observed that the dark masses of rock over which it took its course resembled a stream of cooled lava.

Minerals.

Of the mineral resources of the country little is known. Iron is abundant in several parts, but it is almost the only metal that is known to exist. Some traces of silver have been found. Near the sources of the Jordan there are rich mines of asphaltum, and large portions of this mineral are occasionally washed up by the Dead Sea. Salt is very abundant in the neighbourhood of the Dead Sea; and sulphur, nitre, and pumice are found there.

Climate.

The climate of Palestine is temperate, and much less changeable than ours. The variations of sunshine and rain, which with us extend throughout the year, are there unknown, the year being divided into a rainy season, com-

prising the latter part of autumn and the winter, and a dry season, comprising the rest of the year, when the sky is almost uninterruptedly cloudless, and rain very rarely falls. The rainy season usually commences about the end of October or beginning of November, not suddenly, but by degrees, and with occasional intervals of two or three days of fine weather. During the months of November and December the rains continue to fall heavily, and afterwards less so, and at longer intervals, till the end of March or beginning of April, when they entirely cease. The early and the latter rains mentioned in Scripture seem to have been the first showers of autumn and the later showers of spring. In summer the absence of rain soon destroys the verdure of the fields, and gives to the general landscape the aspect of drought and barrenness. In autumn the whole land becomes dry and parched, the cisterns are nearly empty, and all nature, animate and inanimate, looks forward with longing for the return of the rainy season. Snow falls more or less in winter, but the cold is not severe, and the ground is never frozen. In the higher parts, as at Jerusalem, it often falls to the depth of a foot or more, but it never lies long upon the ground. Thunder and lightning are frequent in winter. In the plains and valleys the heat of summer is very oppressive, but not in the more elevated tracts, as at Jerusalem, except when the south wind (sirocco) blows.

Fertility. The question as to the fertility of Palestine, so long agitated, has been satisfactorily set at rest by the investigations of recent travellers. In the scarped rocks and ruined terrace-walls that are everywhere seen in the hilly parts of the country, and in the remains of aqueducts and other means of artificial irrigation, we have ample evidence that the country was formerly in the highest state of cultivation; and we find that even now, with the present rude appliances of husbandry, the land, where cultivated, produces abundant crops. All travellers testify to the magnificence of the crops that are raised in the country. In Dr Robinson's works frequent notice is taken of this subject. In one place he speaks of the heavy crops of wheat and barley reminding him of the rich harvest he had seen a year before in Lincolnshire; and in another place he says that he passed through, in the north of Galilee, "fields of wheat of the most luxuriant growth, finer than which I had not before seen in this or any other country." (*Later Researches.*) "No soil," says Schubert, "could be naturally more fruitful and fit for cultivation than that of Palestine, if man had not destroyed the source of fertility by annihilating the former green covering of the hills and slopes, and thereby destroying the regular circulation of sweet water, which ascends as vapour from the sea to be cooled in the higher regions, and then descends to form the springs and rivers; for it is well known that the vegetable kingdom performs in this circulation the function of capillary tubes. But although the natives, from exasperation against their foreign conquerors and rulers (Pliny, *Hist. Nat.* xii. 54), and the invaders who have so often over-ruled this scene of ancient blessings, have greatly reduced its prosperity, still I cannot comprehend how, not only scoffers like Voltaire, but early travellers, who doubtless intended to declare the truth, represent Palestine as a natural desert, whose soil never could have been fit for profitable cultivation. Whoever has seen the exhaustless abundance of plants on Carmel and the border of the desert, the grassy carpet of Esdraelon, the lawns adjoining the Jordan, and the rich foliage of the forests of Mount Tabor—whoever has seen the borders of the lakes of Merom and Gennesareth, wanting only the cultivator to entrust to the soil his seed and plants,—may state what other country on earth, devastated by two thousand years of warfare and spoliation, could be more fit for being again taken into cultivation."

The vegetable productions of Palestine, owing to the diversified nature of the surface and climate, are considerably varied in their character. The trees, however, are almost all of small size, and extensive forests are unknown. **Productions.** The stately cedars of Lebanon, so often mentioned in Scripture, were not, properly speaking, trees of Palestine. They were always confined to the Lebanon range, and at present they are only to be found in one small hollow on its north-western slope. They are from 60 to 80 feet in height, with wide-spreading branches, and a trunk sometimes nearly 40 feet in circumference. The olive, the fig, and the pomegranate are the common trees of the country; but they are all so small as scarcely to attract the eye of the spectator till he is in the midst of them. The olive, which was, and still continues to be, the principal tree of Palestine, rarely rises to the height of more than 20 or 30 feet, but its branches are numerous and widely extended. It was an object of special culture by the Jews, on account of the valuable oil obtained from it. The fig tree was also extensively cultivated, and plantations of it still sometimes cover large tracts of country. The pomegranate was largely cultivated in the gardens and orchards of Palestine, and is frequently referred to in Scripture. It is a thick bushy tree, with thorny twigs, and rises to the height of about 20 feet. The palm tree, which in Scripture times was so common in Palestine, is now rarely to be seen. "Two or three in the garden of Jerusalem, some few perhaps at Nablous, one or two in the plain of Esdraelon, comprise nearly all the instances of the palm in Central Palestine." (Stanley.) It is still, however, not uncommon on the maritime plains. The terebinth, or turpentine tree, is one of the most common of the forest trees, though the name does not occur in our English Bibles. It is supposed to be that indicated by the Hebrew word אֵלָה, which is variously rendered in our version, oak, plain, teil tree, &c. The oak, indeed, is found in Palestine, but the name occurs more frequently in our version than in the original, and suggests the idea, that it was much more common and conspicuous in Palestine than it really was. There are several species of this tree to be found, but they are all of small size. It is still abundant in Bashan, remarkable for its size among the trees of Palestine. Among the other trees of Palestine may be mentioned the sycamore, mulberry, pine, pistachio, laurel, cypress, myrtle, almond, apricot, walnut, apple, pear, orange, lemon, &c.

The vine appears to have been cultivated in all parts of Palestine, probably with the exception of the low and hot valley of the Jordan. The hilly country of the north, and the elevated region of Judea, were, however, its chief seats. Hebron, according to the Jewish tradition, was the primeval seat of the vine; and at present the grapes of Hebron are the finest in Palestine. The region around this town abounds with vineyards, which frequently rise in successive terraces on the hill-sides. Each has still its round or square watch-tower of stone, from 10 to 15 or 20 feet high, in which keepers are stationed to protect the fruit from injury or pillage during the season of the vine. Grapes may always be had after June, but the regular vintage does not begin until the middle of September, and is not over everywhere until the middle of November.

Though deficient in trees, Palestine abounds with shrubs and wild flowers; indeed, the number of aromatic shrubs and fragrant flowers that are everywhere to be met with has been a subject of general remark among travellers. "My report," says Schubert, "would become a volume were I to enumerate the plants and flowers which the season exhibited to our view, for whoever follows the comparatively short course of the Jordan from the Dead Sea northward along the borders of Gennesareth and Merom, and onward to the utmost springs in Anti-Libanus, traverses in a few days climates, zones, and observes varieties of plants,

Palestine. which are in other countries separated by hundreds of miles. . . . . . . Whoever desires views, really extensive and beautiful, of lilies, tulips, hyacinths, and narcissuses, must, in the spring season, visit the districts through which we passed, where even the garlic assumes a size and beauty which might render it worthy of becoming an ornamental plant in our gardens." Among this profusion of wild flowers there is a peculiar blaze of scarlet imparted to the landscape by the prevalence of red flowers, chiefly anemones, wild tulips, and poppies. "Of all the ordinary aspects of the country, this blaze of scarlet colour is perhaps the most peculiar; and to those who first enter the Holy Land it is no wonder that it has suggested the touching and significant name of 'the Saviour's blood-drops.'" (Stanley.)

In the time of the patriarchs, and when first occupied by the children of Israel, Palestine was a pastoral country. As the people became settled and increased in numbers, agriculture came in for a share of attention, and the flocks and herds were sent to the wildernesses and other places not suited for cultivation; but throughout at least Old Testament times we have abundant evidence that pasturage continued to be a favourite and a principal pursuit with the Jewish people. Hence the frequent allusions that occur in Scripture to pastoral life. The plains and valleys everywhere abound with the most luxuriant pastures, and even the hilly portions, where vegetation is more scant, are well adapted for the numerous flocks of sheep and goats which still constitute the chief wealth of the people. Most of the present inhabitants, like the early settlers, are nomadic, wandering about from place to place with their flocks as the season or the state of the herbage demand. In summer, when the plains are parched with drought and every green herb is dried up, they proceed to the mountains or banks of the rivers; and in winter and spring, when the rains have re-clothed the plains with verdure and filled the water-courses, they return.

The chief of the agricultural productions are wheat and barley, of which the country, as already mentioned, yields most abundant crops. Maize and rye are also common, and rice is produced on the marshy borders of Lake Hûleh and upper parts of the Jordan. Pease and beans of several species are grown, and in some parts the potato has been introduced. Hemp is more commonly grown than flax; and in favourable localities cotton is largely cultivated. Among the other productions are madder, indigo, and tobacco; and in some places the sugar-cane is cultivated to a small extent. In the hill country the season of harvest is later than in the plains of the Jordan and of the sea-coast. In the plain of the Jordan, the wheat harvest is early in May; in the plains of the coast and of Esdraelon, it is towards the latter end of that month; and in the hills, not until June. The barley harvest is about a fortnight earlier than that of wheat.

Animals. Palestine in ancient times was distinguished for the abundance of its cattle, including sheep, goats, camels, and asses; and these, though now much diminished in numbers, still constitute a principal part of the wealth of the inhabitants. Herds of black cattle are now rarely to be seen, though they would seem to have been common in ancient times. This no doubt arises from the heavy and unscrupulous exactions of the government, from whose notice wealth, in the shape of animals so large, could not easily be concealed or withdrawn. The ox in the neighbourhood of Jerusalem is small and unsightly, but on the Upper Jordan, especially to the east of that river, and in the vicinity of Tabor and Nazareth, it thrives better and is more common. The bulls of Bashan are frequently alluded to in Scripture as being particularly strong and ferocious. The buffalo is met with in various parts,—on the coast it is equal in size and strength to those of Egypt. Sheep and goats are still to be seen in great numbers in all parts of the country. Their flesh and milk serve for daily food, and their wool and hair for clothing. Mutton is, and always has been, the principal animal food used in the East; beef or veal is now but rarely eaten, though it seems to have been made use of by the ancient Israelites to a considerable extent. The sheep of Palestine are all of that species which is characterized by an enormously large tail, chiefly composed of fat. They are horned, and commonly white,—black ones are very rare. There are two species or varieties of the goat; one differing little from the common species, the other considerably larger in size, with long, hanging ears, and in the head and horns very much resembling a ram. The latter is furnished with hair of considerable fineness, but seemingly not so fine as that of the same species in Asia Minor. The "wild goats" mentioned in Scripture were probably the ibex and the kebsch, both of which are still found in the mountains of Palestine. The latter is also called the wild sheep, though it bears little resemblance to that animal, and is chiefly distinguished by a long pendant mane about its throat and the upper part of its fore-legs. The milk of goats was by the Jews more esteemed than that of any other animal, and the flesh was in high favour, especially that of kids. Camels are still, as they were in Scripture times, the principal beasts of burden in Palestine, the roads being few and not suited for carts or carriages.[1] It is an animal that is invaluable to the wandering Arab tribes, and is used both for carrying burdens and for riding. The flesh was forbidden to the ancient Jews, but is eaten by the Arabs, and the milk is much used. The horse was not much made use of by the ancient Israelites, and the rearing of it was discouraged by law. It was chiefly employed in warlike enterprises and for state purposes. The horses of Egypt are the earliest mentioned, and that country was always famous for them. The horse at present is not a common animal in Palestine, although some fine animals of the high Arabian breed are not unfrequently seen. The ass was more commonly used by the Jews than the horse, and frequently persons of the first consequence rode on it. It was also employed to carry burdens and in labours of the field, but was prohibited from ploughing in the same field with the ox. The ass in the East, when properly trained and cared for, is an active and docile animal; and hence the term is used in Scripture in a laudatory sense. Wild asses are often named in Scripture, but they are not now to be found in Palestine, though they are still to be seen in Mesopotamia and farther east. They are of an elegant figure, and of great swiftness, roaming in herds in desert places far from the abodes of men. Mules are first mentioned in the time of David, but were probably known much earlier. They do not seem to have become very common. Asses and mules are at present much used for riding, as they afford a means of locomotion well suited to the difficult mountain paths of the country.

Among the wild animals, the lion, though not uncommon in ancient times, seems to be now extinct in the country. Bears, however, are still to be met with among the mountains. Boars are often observed upon Mount Tabor and the woody slopes of Mount Carmel, and from thence they

[1] "Roads for wheeled vehicles are now unknown in any part of Palestine; and in the earlier history they are very rarely mentioned. As a general means of communication, the 'chariots' of Jehu and of Ahab are only described as driven along the plain of Esdraelon. Under the Romans, indeed, the same astonishing genius for road-making which carried the Via Flaminia through the Apennines, and has left traces of itself in the narrow passes of the Scironian rocks, may have increased the facilities of communication in Palestine; and hence, perhaps, the mention of the chariot road through the pass from Jerusalem to Gaza, where the Ethiopian met Philip. But under ordinary circumstances, they must have always been more or less impracticable in the mountain ranges." (Stanley.)

Palestine. frequently descend into the plains of Acre and Esdraelon. Jackals are common, and are very destructive to the flocks. The hyæna is found chiefly in the valley of the Jordan, and in the mountains around the Lake of Tiberias, but it is also occasionally seen in other districts of Palestine. The panther is found among the mountains of Central Palestine. Wolves and foxes are common. The gazelle or antelope is often seen in flocks bounding over the grassy plains, and is hunted by the Arabs. Among the rest may be mentioned porcupines, hedgehogs, hares, conies, jerboas hares, rats, mice, and moles. The conies, "a feeble folk" who "make their houses in the rocks," have been identified with the *wubar*, an animal characterized by the liveliness of its motions and the quickness of its retreat within the rocks when danger is apprehended. Except in the head, it very much resembles a rabbit, but is of a stronger build and of duskier colour, being of a dark brown. "It is entirely destitute of a tail, and has some bristles at its mouth, over its head, and down its back, along the course of which there are traces of light and dark shade. In its short ears, small, black, and naked feet, and pointed snout, it resembles the hedgehog." (Wilson.)

The birds of Palestine are not numerous. "In no region," says Dr Wilson, "in which we had before travelled had we seen so few of the feathered race as in the Holy Land." The number of distinct species, however, is considerable. Among the more important or better known may be noticed,—the vulture, eagle, osprey, roller, ostrich, kite, hawk, crow, owl, golden oriole, cuckoo, bee-eater, kingfisher, woodpecker, woodcock, partridge, spoonbill, stork, heron, pelican, swan, goose, duck, and quail. The katta, a bird much more common than this last, and about the size of a partridge, is supposed to be the quail of Scripture. There are no serpents of large size, and it seems to be doubtful if there be any of a venomous nature found in Palestine. Scorpions hold a principal place among the noxious animals; and mosquitoes are common. Bees are extremely common in this "land of honey," and deposit their honey in trees and crevices of the rocks. Occasionally the country is visited by immense swarms of locusts, which consume grass, foliage, and every species of vegetation. Beetles are abundant, and of various species; and mosquitoes are rather common.

The principal towns of Palestine will be found noticed under their respective names in other parts of this work; and an account of the present inhabitants will be given under SYRIA, of which country Palestine is now only a division.

Divisions. The earliest inhabitants of Palestine were known by the general name of Canaanites, being descended from Canaan, the youngest son of Ham. By them the country was thinly peopled in the time of Abraham; and they were divided into several distinct nations. These nations were,—the Kenites, the Kenizzites, the Kadmonites, and the Gergashites, who dwelt to the E. of the Jordan and the Lake of Gennesareth; the Hittites, the Perizzites, the Jebusites, and the Amorites, who occupied the hilly region in the S.; the Canaanites, properly so called, who dwelt in the middle of the country; and the Hivites, who inhabited the extreme N., among the southern branches of Lebanon; while the Phœnicians occupied the northern, and the Philistines the southern part of the coast. In the time of Moses the nations W. of the Jordan seem to have occupied the same positions as before; but the eastern region was divided into three large territories,—Bashan in the N., Gilead in the centre, and in the S. the land called the Plains of Moab, a part of the territory of the Moabites which had been conquered from them by the Amorites. After the conquest of Palestine by the Israelites under Joshua, the country was divided among the twelve tribes, by whose names the various portions were subsequently known,—Judah, Benjamin, Simeon, and Dan inhabiting the southern portion; Ephraim, the half tribe of Manasseh, and Issachar, the central; Zebulon, Naphtali, and Asher, the northern; and Reuben, Gad, and the remaining half of Manasseh, the country E. of the Jordan. Palestine was afterwards divided into the two kingdoms of Israel and Judah; the latter including the tribes of Judah and Benjamin, and the former the other ten. In the time of our Saviour, Palestine was divided into the following provinces:—Galilee, in the N., consisting of Upper or Northern, and Lower or Southern Galilee; Samaria in the centre; and Judea in the S. of Palestine proper; while, on the E. of the Jordan, Peræa was subdivided into eight smaller districts.

History. The earliest event in connection with Palestine recorded in sacred history is the arrival in the country of Abraham, who, along with Lot, his nephew, migrated hither at the Divine command from Mesopotamia in the year 1921 B C. The following year a famine in Canaan compelled Abraham to remove into Egypt, but he soon after returned; and finding the pastures insufficient for the large flocks and herds of himself and Lot, he separated from his nephew, who settled in Sodom, while Abraham himself took up his abode in the valley of Mamre, near Hebron. Previous to the arrival of Abraham in Canaan, Chedorlaomer, who is called in the Bible, King of Elam or Elymais, a part of Persia, and who is said by Josephus to have been a vassal of the Assyrian empire, extended his conquests beyond the Euphrates, and reduced into subjection five of the petty kings or chiefs who lived in the valley S. of the Dead Sea. After twelve years of submission, and about eight years after the coming of Abraham, these five chieftains rebelled against Chedorlaomer, who in the next year (1912 B C.) invaded the country with three other monarchs, and after defeating the rebels in a pitched battle, retired, carrying with him from Sodom and Gomorrah large quantities of booty and many captives, among whom was Lot. Abraham, hearing of this disaster, armed all his followers, to the number of 318, and pursued the retreating army. He overtook them near the source of the Jordan, fell upon them by night, and totally defeated them, rescuing his nephew and the rest of the captives along with their goods.

The destruction of Sodom and Gomorrah took place in the year 1897 B C., when, on account of the wickedness of these cities, God rained brimstone and fire from heaven upon them, by which they were entirely destroyed. The only persons who escaped from this catastrophe were Lot and his two daughters After Abraham's death, Isaac became the head of the patriarchal family, and he seems to have resided all his life in the Promised Land. The only event of historical importance that is recorded in his days is the covenant he made with Abimelech, King of the Philistines, a successor of the monarch of the same name with whom his father had entered into a similar alliance. In 1759 B.C., Jacob, Isaac's younger son, obliged to leave the country on account of the resentment of his brother Esau, took refuge in Mesopotamia with his uncle Laban. There he remained for twenty years in the capacity of servant, receiving in marriage Laban's two daughters, Leah and Rachel, as the price of the first fourteen years, and large flocks of sheep and goats, which constituted the principal riches of those days, for the remaining period of his service. At last, in the year 1739 B C., Jacob returned to Canaan with his wives, the eleven sons that had been born to him in his exile, and his flocks. On his way to that country, Jacob was reconciled to his brother Esau, who had established himself as a powerful prince in the mountains of Seir, the country afterwards occupied by the Edomites, his descendants. In 1728 B C., Joseph, the favourite son of Jacob, was by his brethren sold to a company of Ishmaelites and Midianites, and carried down to Egypt, where he was re-sold to Potiphar, one of the chief officers of the king. On account of a false accusation by his mistress, he was thrown into prison, where he remained for some time. Having, however, interpreted two dreams of the king, and thereby foretold seven years of plenty and seven years of famine, he was raised by the king to the highest authority. During the seven plentiful years he stored up the corn in granaries, so that when the famine came there was still corn in Egypt. Jacob sent down his sons to Egypt for corn, but they knew not their brother Joseph. On their second visit, he made himself known to them, and invited Jacob his father, and all his household, to come into Egypt. This invitation was complied with; and in 1706 B C. the whole patriarchal family, to the number of 76, removed to Egypt, and settled in the land of Goshen. The people while in Egypt rapidly increased in numbers, and continued unmolested until the rise of a new dynasty in that country. The monarch, alarmed at the rapid growth of an alien people in his dominions, took measures to prevent, if possible, their increase, by

reducing them to the condition of slaves, and destroying all their male children. A deliverer was, however, at length raised up for the people in the person of Moses, who, when he could be no longer concealed by his mother, was committed to the river in a basket of bulrushes, and being discovered by the king's daughter, was adopted by her, and brought up at the Egyptian court. But in the year 1531 B.C. Moses, then forty years old, espoused the cause of his oppressed countrymen, and was compelled to leave Egypt. He took refuge among the Midianites, near the eastern arm of the Red Sea, and remained there as a shepherd for 40 years. At the end of that time, he, along with his brother Aaron, was divinely commissioned to deliver the Israelites out of Egypt. This deliverance was effected in the year 1491 B.C. by means of the ten plagues with which the Egyptians were afflicted, and which compelled them at last to let the Israelites go.

When they took their departure from Egypt, Moses was their ruler and their guide. He led them through the wilderness, where they were fed by the miraculous interposition of heaven; and through him their Divine Legislator gave them laws and statutes. But the burden of his office being too great for him, the judicial duties were divided; all lesser causes being, by the advice of his father-in-law, referred to the rulers of thousands, of hundreds, of fifties, and of tens, while those only of greater moment were submitted to the chief judge. Moses was succeeded in his office by Joshua, under whom the Israelites obtained possession of the land of Canaan, which was partitioned by lot among the different tribes, and again subdivided among the families of the same tribe. The land was declared inalienable, and the perpetual inheritance of the families to whom it was originally assigned; and accordingly, every fiftieth year, which was proclaimed to be a year of jubilee, all debts and mortgages on land were declared to be cancelled, and every man was to return into his own land. Other laws were passed for enforcing the purity of divine worship and of moral conduct; for equity in the transactions between man and man; and also for the punishment of idolatry and other iniquities; for it was the peculiar distinction of this community, that the law took cognisance not only of offences against society, but of every breach of the Divine commands. The order of the priesthood was also instituted in the family of Levi, gifts and sacrifices were offered by them in expiation of sin, and various acts were enumerated by which the children of Israel became unclean, and which, though innocent in themselves, were yet employed to point out the great defilement of sin, and for which, therefore, certain modes of purification were appointed. The distinction was also laid down between clean and unclean animals, from the latter of which the people were commanded to abstain. An enumeration was made in the plains of Moab of all the males of the children of Israel above twenty years of age, and the sum of them is given at 601,730; the Levites, who were not mentioned among the rest, amounted to 23,000; which makes the sum of 624,700 males above twenty years of age. The total population must therefore at that time have been about 2,500,000. The Israelites, after their settlement in the land of Canaan, were involved in wars with the surrounding states, and were often given into their hands on account of disobedience. The land was in this manner frequently wasted, and the happiness of the people interrupted, by the inroads of their neighbours. From these enemies they were saved by deliverers called judges, raised up to them, under whose peaceful sway the land enjoyed long intervals of rest. But during the old age of Samuel, the last of the judges, in consequence of the misconduct of his sons and the unsettled state of the country, the people were dissatisfied, and entreated, against the solemn protest of this aged prophet, that they might have a king, like the nations around them; and Samuel was desired to hearken to their request. Saul was accordingly (1095) chosen king; but, on account of his disobedience, the kingdom was rent from him, and given to David; and he terminated his fatal course in a disastrous defeat on the mountains of Gilboa, in which he and his son Jonathan were slain. David ascended the throne of Judah in 1055, but Ishbosheth, a son of Saul, reigned for seven years over the other tribes. The latter being murdered in 1048, David became king of the whole country without dispute, and commenced a prosperous reign, in the course of which he subdued all his enemies. Although the peace of the country was disturbed by the domestic treason of Absalom, yet David left a flourishing kingdom to his successor Solomon, under whose reign (1015–975) the kingdom was enlarged on every side, and became one of the most flourishing empires of Asia, extending on the east as far as the Euphrates, and possessing ports both on the Mediterranean and on the Red Sea. David was a man of war, but Solomon was devoted to peace; and accordingly, during his reign was constructed that magnificent temple at Jerusalem which was the wonder of future ages.

After the death of Solomon, the kingdom was divided into two sovereignties. The tyrannical conduct of Rehoboam, in which he persisted, against the advice of his aged councillors, gave rise to the revolt of the ten tribes, who chose Jeroboam for their king; and thus began that division of the empire which paved the way for its downfall under the successive attacks of its enemies. The kingdoms of Israel and Judah were hereafter ruled by different monarchs, who no longer joined against their common enemies, but waged war against each other; and, in place of the union that might have been expected in the descendants from a common stock, they regarded each other with all the aversion of aliens. In the meantime, the powerful empires of Assyria and Babylon in the E., and of Egypt in the S., were contending with each other for the dominion of the world; their vast armies frequently threatened the destruction of the comparatively petty states of Judea; and at length, in the reign of Hoshea, 721 years before the Christian era, Samaria, the capital of the kingdom of Israel, was taken by the King of Assyria, the land conquered, and the whole nation carried into captivity.

We subjoin a list of the kings who reigned in Samaria, with the length of their several reigns, and the period when they reigned:—

		B.C.			B.C.
1. Jeroboam I.	21 yrs.	975	13. Jeroboam II.	41 yrs.	823
2. Nabab	14 „	954	1st *Interregnum*	11 „	782
3. Baasha	23 „	953	14. Zachariah	6 mos.	771
4. Elah	1 „	930	15. Shallum	1 „	771
5. Zimri	7 days	929	16 Menahem.	10 yrs.	770
6. Omri	11 yrs.	929	17. Pekahiah	2 „	760
7. Ahab	21 „	918	18. Pekah	20 „	758
8. Ahaziah	1 „	897	2d *Interregnum*	10 „	738
9. Jehoram	12 „	896	19. Hoshea	7 „	728
10. Jehu.	28 „	884			
11. Jehoahaz	17 „	856	Samaria taken	254 „	721
12. Jehoash	16 „	839			

The kingdom of Judah, weakened by the loss of the ten tribes, was afterwards assailed by the King of Babylon; and was at length brought to an end by Nebuchadnezzar in 588 B.C. Jerusalem was taken and destroyed along with the temple, and the king, the princes, and most of the people of Judah were carried away to Babylon.

The following is the line of kings who reigned in Jerusalem from the death of Solomon to the destruction of the first temple:—

		B.C.			B.C.
1. Rehoboam	17 yrs.	975	13. Hezekiah	27 yrs	725
2. Abijah	3 „	958	14. Manasseh.	55 „	698
3. Asa.	41 „	955	15. Amon	2 „	643
4. Jehoshaphat	25 „	914	16. Josiah	31 „	641
5. Jehoram or Joram	4 „	889	17. Jehoahaz	3 mos.	
6. Ahaziah	1 „	885	18. Jehoiakim	11 yrs.	610
7. Queen Athaliah	6 „	884	19. Coniah or Jehoiachin	3 mos.	
8. Joash or Jehoash	40 „	878	20. Zedekiah	11 yrs.	598
9. Amaziah	29 „	838			
10. Uzziah or Azariah	52 „	809	Jerusalem taken	387 „	588
11. Jotham	16 „	757			
12. Ahaz	16 „	741			

Seventy years were appointed as the term of the Jewish captivity, in the course of which the empire of Babylon was overthrown by Cyrus the king of Persia, in whose reign the Jews were encouraged to rebuild their city, and to return to their own land. Zerubbabel, Ezra, and Nehemiah, were the successive leaders that presided over the restoration of the Jewish kingdom. After many interruptions from the jealousy of their powerful enemies, the second temple was at length reared. But it was so inferior in magnificence and splendour to that of Solomon, that the aged men wept when they contrasted this modern structure with the glory of the first house. The Jews were now ruled by the Persian king and his lieutenants in civil though not in sacred things, which were regulated by the law of Moses as administered by their own high priests; and they enjoyed for a period of nearly two centuries the blessings of a settled government. After the conquest of Persia by Alexander, and the division of his kingdom among his successors, Asia was distracted by new wars among those rivals for the supreme dominion, and the Jews often embarrassed by these contentions, owed their independence rather to the forbearance of their enemies than to their own strength. At length, however, Antiochus Epiphanes, who ascended the throne of Syria in 175 B.C., having heard of insurrections among them, invaded their territory with a powerful army, and besieged and took Jerusalem while it was yet unprepared for defence. He wreaked his vengeance on the unhappy Jews, 4000 of whom were put to death, and an equal number reduced to slavery. The temple was plundered of all its treasures and sacred utensils, and an unclean animal, a sow, was offered by his orders on the altar of burnt-offerings. The Jewish nation was at the same time cruelly persecuted; an edict was issued for the extermination of the whole race; and in furtherance of this barbarous policy, Apollonius, the commander of the troops, when the people had assembled in Jerusalem on the Sabbath, made a furious

attack with his troops on the peaceful multitude, whom he slaughtered without mercy, or carried into a hopeless captivity. The city was plundered, and set on fire in many places; the walls were broken down, and a strong fortress built on Mount Zion, which commanded the temple and the adjacent parts. Having made these preparations, he proceeded to farther persecutions against the religion of the Jews. They were watched in their visits to the holy sanctuary, and harassed by the troops; the rite of circumcision was prohibited; and a compliance with the heathen idolatries was enforced at the point of the sword. They were compelled to profane the Sabbath and to eat swine's flesh. The holy temple was violated by the worship of Jupiter, whose statue was erected on the altar of burnt-offerings, and the licentious revels of the Bacchanalia were substituted for the pure festivals of the Jewish church. The rage of persecution spared neither age nor sex; and all over the country torture and death were inflicted on the unhappy persons who, remaining stedfast in their faith, refused to participate in these heathenish rites.

Such unheard-of cruelties excited the deepest indignation, and at length roused the nation to resistance. The heroic family of the Maccabees, consisting of five brethren, the sons of Mattathias, a priest of the race of Asmoneus, were the champions of the patriotic cause. They were all of renowned valour; and Judas having headed the insurgents, a determined band only 6000 in number, defeated the oppressors of his country in many great battles, and restored its independence (165 B C.) But he had to contend against domestic treason as well as foreign war. Alcimus, who was in the interest of the Syrians, assuming the title of high priest, claimed the allegiance of the Jews, and Judas was compelled in self-defence to seek the alliance of the Romans, who eagerly sought a pretence for interference in the affairs of their neighbours. In the meantime, the Maccabee chief was slain in the field of battle (161 B.C.), and was succeeded by his brother Jonathan, who, employing his power in aiding Alexander Balas to obtain the crown of Syria, was allowed by him in return to unite the spiritual authority of the high priest with the temporal sway (153 B.C.); and under this dynasty of the Asmonean princes Palestine was governed for more than a hundred years. Jonathan was succeeded by his son Simon (143 B C.), who secured the tranquillity of the country by cultivating the friendship of Rome. He was cut off, the victim of domestic treason; and John Hyrcanus, his younger son, ascended the throne (136 B.C.) His reign was prosperous and successful. He not only threw off the Syrian yoke, but extended his territories eastward and northward. He besieged and utterly destroyed Samaria; and thus gratified the vindictive spirit of the Jews against the Samaritans. The short reign of Aristobulus, his son, followed in 106 B.C.; in the next year that of Alexander Jannæus, whose oppressions excited a civil war in the country. The insurgents, calling in the aid of the Syrians, became unpopular; and Alexander, after many reverses, at last succeeded in collecting a powerful army, with which he completely re-established his power, and took vengeance on his enemies. He was succeeded in 78 B.C. by his son Hyrcanus the Second. His brother Aristobulus, after secretly opposing him for some time, at length threw off the mask, and openly aspired to the supreme power. The two competitors were preparing to appeal to arms, when the Romans under Pompey, having subdued the greater part of Syria, were now called into Palestine as peaceful arbiters in this dispute. Aristobulus, however, being impatient, had recourse to arms, and shut himself up in Jerusalem, which was invested in the year 63 B.C. by the Roman general Gabinius, the lieutenant of Pompey, and carried by assault with great slaughter. The authority of Hyrcanus was reestablished, and Aristobulus was carried prisoner to Rome, whence afterwards making his escape, he raised the standard of revolt in Judea. But he had no force that could oppose the Roman armies under Mark Antony, who speedily re-established the authority of Rome in every part of the country. The rule of Judea was in 47 B.C. delegated to Antipater, the minister of Hyrcanus, who appointed his two sons, Phasael and Herod, to be governors, the one of Jerusalem, and the other of Galilee. But a new competitor appeared for the supreme authority in Judea, namely, a son of Aristobulus, who, having taken refuge among the Parthians, invaded the country with a powerful army, and succeeded in obtaining the kingdom. Phasael committed suicide, and Hyrcanus was deprived of his ears and sent to Babylonia; but Herod, the younger son of Antipater, escaped to Rome, where, through the influence of Antony, he was made king of Judea (B.C. 40). Two years afterwards he established himself on the throne, and thus put an end to the Asmonean dynasty. He employed himself in works of architecture, particularly in the repair of the temple, by which he hoped to obtain favour among the Jews. It was in his reign that the Messiah was born, and it was from his cruelty that he fled into Egypt. On his death, in the year 4 A.D., he bequeathed his dominions to his three sons: to Archelaus the government of Idumea, Samaria, and Judea; to Antipas that of Peræa and Galilee; and to Philip that of Trachonitis, Gaulanitis, Batanea, and Paneas, lying partly beyond the limits of Palestine. Archelaus was soon after deprived of his great office, on account of maladministration, and banished into Gaul. Judea was now reduced to the condition of a Roman province, under a governor who resided at Cæsarea, but who was subordinate to the prefect of Syria. One of these governors was Pontius Pilate, under whose authority the Saviour was crucified. The Jews were far from being a contented or happy people under the Roman yoke. They were exposed to the severe exactions of their delegated rulers, and to outrages and plunder by the Roman soldiers stationed in the province to overawe the people. Disturbances, provoked by these oppressions, and quelled by the legionary troops, became the pretext for fresh cruelties; and misery, disorder, and violence thus reigned throughout the once happy land. The only portion of the country that enjoyed comparative quiet was Galilee and the country beyond Jordan, which was ruled by Antipas and Philip. In 38 A.D. Herod Agrippa was appointed, by Caligula, king of Galilee and the country beyond Jordan; and in 41 B C. he obtained from Claudius the rest of the dominions of his grandfather, Herod the Great. His policy was conciliatory towards the Jews; he respected their worship, repaired and adorned the temple, and joined with them in their persecution of the new sect of Christians, having put to death the apostle James. His miserable end, being eaten of worms, is related in the Acts of the Apostles. His son Agrippa succeeded him, but after his death Judea was again governed by Roman procurators. The discontent of the Jews, their impatience of the Roman yoke, their proneness to insurrection under the vain predictions of their soothsayers, that a conquering Messiah was to arise, who should restore the independence and glory of their country, afforded too fair a pretence for the severities of their rulers. The country abounded in scenes of rapine and anarchy; the national faith and the holiest rites were despised and trampled upon; and at length, under the administration of Florus, the people flew to arms, and entered on their last and desperate conflict with the Roman power. The insurrection broke out (in the year 65 A.D.) at Cæsarea, the inhabitants of which, galled by cruel insults, declared their determination to resist to the last extremity. The Jews in Jerusalem shared in this heroic determination, and made preparations for defence. Cestus, the prefect of Syria, advanced to the gates and demanded an entrance for the Roman troops. The Romans were, however, on this occasion defeated with great slaughter, and lost all their artillery.

The intelligence of these disasters excited the indignation of Nero, who sent Vespasian, a man of tried valour and experience, to assume the government of Syria, and to calm the troubles of that distracted province. He entered Judea about the year 67, along with his son, the renowned Titus, to whom was committed the conduct of the war. Many sanguinary battles were now fought between the contending armies, in which the tumultuary levies of the Jews were broken and dispersed by the veteran legions of Rome; towns and fortresses were successively taken; and the Jews, no longer able to face the enemy in the field, were driven within the walls of their capital, to which Titus at length laid siege. The defence was obstinate, and the besiegers were brave and numerous, employing all the resources of the military art in their attack on the devoted city. In the course of this protracted siege partial successes were obtained by the Jews, who fought bravely, and harassed the besiegers by frequent and successful sallies. But the defences of the city, strong both by nature and art, gradually gave way before the perseverance and skill of the Roman troops; and as Titus proceeded partly by blockade, he shut in the whole city with a wall, and the horrors of famine were added to all the other miseries which the inhabitants suffered. It would be endless to detail all the horrors of this protracted siege; famine raged within the walls; every inch of ground was fiercely disputed; and prodigious numbers of men fell on both sides. But the Romans made a steady progress. The city was not completely in their hands till four months after the beginning of the siege; and notwithstanding the wishes of Titus to save it, the temple was consumed by fire. The inhabitants were everywhere put to the sword, or made captives and sold for slaves. The number of Jews who perished in the siege is estimated at 1,100,000, a far greater population than the city usually contained; but the annual feast of unleavened bread, which took place at this time, had crowded it with a vast concourse of strangers from all quarters, who, by the sudden approach of the hostile army, were shut up within the walls. The destruction of the city took place in the year 70 A.D.

After the Roman armies were withdrawn from Jerusalem, many of the Jews returned to dwell in the ruined city, though the Roman emperor, indignant at the late rebellion, had placed a garrison of 800 troops on Mount Zion, in order to prevent any attempt to rebuild the sacred capital. The Jews, however, were still discon-

tented and rebellious; they still fondly believed that an earthly Messiah was shortly to arise, to free them from bondage, and to give them the dominion of the whole earth They accordingly listened to the tales of every impostor, and were easily seduced into rebellion by vain hopes of national glory that were never realized. In the course of these commotions great cruelties were committed; but in the end the Jews were everywhere borne down by the discipline of the Roman legions, and paid the penalty of their rebellion with their lives. By acts of mutual cruelty the animosity of both parties was inflamed; the sword of persecution was let loose against the Jewish religion by their conquerors; the rite of circumcision, the reading of the law, and the observance of the Jewish Sabbath, and all the other memorials of the national faith, were forbidden. In the city of Jerusalem, which was to a certain extent repaired, a colony of Greeks and Latins was established, in order to preclude the return of the Jews, and all further hopes of the restoration of their kingdom. But the policy of the Romans was of no avail against the deep-rooted prejudices of this infatuated people; and no sooner had a new impostor arisen in 131, of the name of Barcochab, "the son of a star," than the deluded Israelites hailed him as the light that was to dawn in the latter days, and usher in the day of their long-expected rest. They accordingly crowded to his standard; and in a short time he had mustered a powerful army of 200,000 devoted followers. Owing to the absence of the Roman legions, engaged at that time in distant service, important advantages were gained, and Jerusalem was again occupied by the insurgent Jews, besides about fifty castles, and numbers of open towns. But this career of success was speedily terminated by the arrival of Severus, afterwards emperor, with a large and well-appointed body of legionary troops; the Jews were overwhelmed by numbers, discipline, and military skill; their cities were taken and destroyed; and Bither, where the leader of the rebellion, Barcochab, had made his last stand, was stormed with great slaughter, and himself slain. Of the Jews it is estimated that 580,000 died on the field; and the remnant who escaped mostly perished by famine and disease, or amid the flames of their ruined cities. Under these ruthless devastations the country was at last converted into a desert; the inhabitants were either slain or driven into exile; and the Divine denunciations were now literally fulfilled against this misguided people, that they should be scattered among all the nations of the earth.

The victors having thus satiated their vengeance, began in due time to relax their stern and intolerant policy. Under the mild rule of Antoninus Pius, the Jews were restored to their ancient privileges, to the freedom of worship, and to all their other national rites. They were now mingled with the nations, and were found dwelling in all parts of the Roman empire; and their general condition at this time, as described by Gibbon, was not unfavourable. "The numerous remains," says this eloquent historian, "of that people, though they were excluded from the precincts of Jerusalem, were permitted to form and to maintain considerable establishments both in Italy and in the provinces, to acquire the freedom of Rome, to enjoy municipal honours, and to obtain at the same time an exemption from the burdensome and expensive offices of society. The moderation or contempt of the Romans gave a legal sanction to the form of ecclesiastical police which was instituted by the vanquished sect. The patriarch, who had fixed his residence at Tiberias, was empowered to appoint his subordinate ministers and apostles to exercise a domestic jurisdiction, and to receive from his dispersed brethren an annual contribution. New synagogues were frequently erected in the principal cities of the empire; and the sabbaths, the fasts, and the festivals, which were either commanded by the Mosaic law, or enjoined by the traditions of the rabbis, were celebrated in the most solemn and public manner. Such gentle treatment insensibly assuaged the stern temper of the Jews. Awakened from their dream of prophecy and conquest, they assumed the behaviour of peaceable and industrious subjects. Their irreconciled hatred of mankind, instead of flowing out in acts of blood and violence, evaporated in less dangerous gratifications. They embraced every opportunity of overreaching the idolaters in trade; and they pronounced secret and ambiguous imprecations against the haughty kingdom of Edom." (*Decline and Fall*, vol. ii., chap. xvi.) This statement, though it has received a colouring from the deep-rooted prejudices of the author against the Jewish religion, is nevertheless substantially true, and contains a just view of the condition of the Jews throughout the Roman empire. No great change appears to have taken place in the condition of Palestine until Constantine ascended the imperial throne in the year 306. He was, as is well known, the first Christian emperor; and under his powerful patronage, and that of his mother the Empress Helena, splendid structures were everywhere erected in the Holy Land in honour of the Christian faith. The land was gradually overspread with memorials of Christianity; and chapels, altars, and houses of prayer marked every spot said to be memorable for any of the sayings or doings of the Saviour. The Jews beheld with indignation the rise of these Christian monuments within the precincts of the holy city, since they were as much opposed to the Christian worship as to the heathen idolatry. But [illegible] was now at an end. Scattered in distant parts, they could no longer act with consistency or vigour; yet so attached were they to their own ancient rites, that, however faint the chance of success, they were ready in crowds to rally round the standard of their ancient faith wherever it was displayed, and to follow any daring leader into the field. But the time was past. Jerusalem was now filled with the emblems of a new faith, and crowds of pilgrims were attracted from the most distant countries by the eager desire of contemplating the place of the Redeemer's passion, and of the previous incidents of his life. These visits were encouraged from various motives. They evinced, no doubt, the zeal of the new converts; and being at once a proof of piety and a source of profit, they were encouraged by the clergy of Jerusalem.

The reign of Julian (361-363) was a new era in the history of Palestine; and the Jews anticipated, from his declared enmity to Christianity, his favour for their own faith. The policy of this heathen emperor countenanced them in this belief, when he endeavoured, by rebuilding the temple of Jerusalem in its former splendour, to discredit the truth of those prophecies which denounced perpetual desolation on the devoted city. He chose the commanding eminence of Mount Moriah for the site of a new structure, which was to eclipse the splendour of the Christian church on the adjacent hill of Calvary; and he resolved to establish a Jewish order of priests, who might revive the observance of the Mosaic rites, together with as numerous a colony of Jews as could be collected, in the holy city. Such was still the ardour of the national faith that the Jews crowded from all parts, and exasperated by their insolent triumph the hostility of the Christian inhabitants. All now joined with unwearied zeal in the sacred work of rebuilding the temple. Liberal contributions poured in from all quarters; men and women joined in the labour; and the authority of the monarch was seconded by the enthusiasm of the people. But this last effort of expiring zeal was unsuccessful; no temple ever arose on the ruins of the heathen edifices; and the progress of the work, according to a story generally believed at the time, was stopped by the interposition of heaven, by flames of fire bursting out from the foundations with loud explosions, by which the workmen were so terrified that they refused to continue their labour. The attempt, from whatever cause, was abandoned; and as it was only undertaken during the last six months of Julian's reign, the fact seems sufficiently explained, without the aid of a miracle, by the absence and death of the emperor, and by the new maxims that were adopted during the Christian reign that succeeded.

After the death of Julian it was the policy of the Christian emperors to depress the Jews in Palestine, though they were not ill treated throughout the provinces, and were even granted considerable privileges and immunities. But it is astonishing how carefully the fathers instilled into the minds of their children, along with their ancient faith, the fondly-cherished delusion, that some new and happier era of freedom and independence was yet to dawn on Judea; and how eagerly the children, imbibing this idea, became the prey of every impostor, and, under the blind impulse of enthusiasm, rashly entered into new conflicts with their enemies in the field, where they perished, the willing victims of a hopeless cause. About the beginning of the seventh century the peace of Judea was seriously disturbed by the Persian invasion of Chosroes. The Greeks and the Persians were for a long period rivals for the dominion of the East; and Chosroes, the grandson of Nushirvan, now invading the Roman empire, successively stormed and sacked the cities of Antioch and Cæsarea in Cappadocia. From Syria the flood of invasion rolled southward on Palestine, and the Persian army was joined by the Jews to the number of 26,000, still burning with the love of independence. Jerusalem was stormed by the combined armies in 614, the city was sacked, and the magnificent monuments of the Christian faith were mostly consumed by fire. But this, like all the other triumphs of the Jews, was short-lived. Heraclius, roused from inglorious sloth by the triumphs of the Persian arms, and by the approach of the victorious force to the walls of his own capital, quickly assembled his veteran armies, by whose aid he defeated the troops of Chosroes in 622; and in the course of a few successful campaigns he recovered all the provinces that had been overrun. He visited Jerusalem after his victories, in the lowly guise of a pilgrim, and prepared new triumphs for the Christians in the restoration of the magnificent churches which had been destroyed, in the persecution of the Jews, and in their banishment, as before, from the Holy City, which they were now forbidden to approach within a distance of 3 miles.

Palestine continued to own the sway of the Greek emperor till the rise of the Saracen power in the East. The followers of Mo-

hammed, extending their doctrines and their dominion by fire and sword, rapidly subdued Arabia, Syria, and Egypt, and in the year 637 turned their arms against Jerusalem. After a siege of four months, during which the Arabs suffered extremely from the inclemency of the winter, a capitulation was proposed and agreed to, when the Caliph Omar entered the city seated on a red camel, without guards, or any other precaution, and began to discourse in the most courteous manner with the patriarch on its religious antiquities. Omar was assassinated in Jerusalem in the year 643, after which the East was for 200 years distracted by the bloody wars that ensued among the Ommiade, the Abbasside, and the Fatimite caliphs; and Palestine having become an object of contest between them, was for a like period a scene of devastation and trouble. After the division of the Saracen dominions among these three factions in the middle of the eighth century, Palestine remained under the power of the Abbasside caliphs of Bagdad until 969 A.D., when it was transferred to the Fatimite line in Egypt. In 1076 Jerusalem was taken by the Turks, and held by them for twenty years; but in 1096 the Egyptian caliphs regained their power.

Jerusalem, though it was in the possession of infidel chiefs, was still revered as a holy city both by Christian and Jew, and was visited by pilgrims from every quarter; among others, by Peter the Hermit, a native of Amiens. The pathetic tale which he brought to Europe of the injuries and insults which the Christian pilgrims suffered from the infidels who possessed and profaned the Holy City, excited the deepest sympathy among the people and princes of Christendom. Councils were summoned, and were attended by ecclesiastics and laity. The mixed multitude were harangued by the zealous enthusiasts of this sacred cause; their pity and indignation were alternately roused by the sufferings of their brethren in the Holy Land; the flame of enthusiasm was propagated by sympathy and example; and the eager champions of the Cross, the flower of the European chivalry, assembled in martial array to march against the enemies of their common faith. To defray the necessary expenses of the expedition, princes alienated their provinces, the nobles their lands and castles, peasants their cattle and the instruments of husbandry; and vast armies were transported to Palestine, in order to accomplish the deliverance of the Holy Sepulchre. These rude and undisciplined bands died in great numbers on reaching the shores of Asia, from disease, famine, and fatigue; and of the first Crusaders it is estimated that 300,000 had perished before a single city was rescued from the infidels. Of the leaders in the Christian host, the first rank is due to Godfrey, Duke of Brabant and Bouillon, who was accompanied by his two brothers, Eustace the elder, who had succeeded to the county of Boulogne, and Baldwin the younger. The other chiefs were Robert of France, the brother of King Philip, and Robert, Duke of Normandy, the son of William the Conqueror; Bohemond, the son of Robert Guiscard, distinguished by his cool policy and ambition, with a small addition of religious zeal; Tancred, his cousin, who had imbibed the true spirit of chivalry, and all the virtues of a perfect knight; and Raymond of Toulouse, the Duke of Narbonne and Marquis of Provence, a veteran warrior of mature age and experience. The vast armies that were collected under the guidance of these leaders arrived by various routes at Constantinople; and after some time spent in the capital of the East, they crossed to the opposite shore of Asia. Having taken the towns of Nice and Antioch in the year 1097, they laid siege to Jerusalem about two years after, and took it by assault, with a prodigious slaughter of the garrison and inhabitants, that was continued for three days, without respect to age or sex.

Eight days after the capture of Jerusalem, the Latin chiefs proceeded to the election of a king, who should preside over their conquests in Palestine, and Godfrey of Bouillon was unanimously raised to this high position. But if it was an honourable office, it was also one of danger: he was not chosen to sway a peaceful sceptre; and he was summoned to the field in the first fortnight of his reign to defend his capital against the Sultan of Egypt, who approached with a powerful army. His signal victory in the battle of Ascalon confirmed the stability of his throne, and enabled him to extend on every side his kingdom, which consisted then only of Jerusalem and Jaffa, with about twenty villages and towns of the adjacent districts. The fortified castles into which the Mohammedans had taken refuge, and from which they made incursions into the open country, were reduced; the maritime cities of Laodicea, Tripoli, Tyre, and Ascalon, were besieged and taken, and the Christian kingdom thus included a range of sea-coast from Scanderoon to the borders of Egypt. The feudal institutions of Europe were introduced into this kingdom in all their purity; and a code of laws, called the Assize of Jerusalem, was drawn up, which was attested by the seals of the king, the patriarch, and the viscount of Jerusalem, and deposited in the sepulchre of the Saviour, as an unerring guide in all doubtful questions that might be brought before the tribunals of Palestine.

Godfrey was succeeded in 1100 by his brother Baldwin, who ruled with vigour and success. In 1118 his cousin, Baldwin II., ascended the throne, and still maintained the interests of the kingdom. Melisandra, his daughter, married Foulques of Anjou, who in right of his wife acquired the kingdom of Jerusalem. He lost his life by a fall from his horse, after having reigned ten or twelve years. His son, Baldwin III., ruled in Jerusalem twenty years; and his reign was remarkable as the era of the Second Crusade, and of the rise of the various orders of knighthood,—the Hospitallers, Templars, and Cavaliers.

The military force of the first Crusaders, wasted by fatigue and by losses in the field, was no longer able to oppose the hosts of Turks and Saracens by which it was surrounded. The first victories of the Europeans, and their rapid success, extended far and wide the terror of their arms. But this alarm having subsided, the Mohammedan chiefs collected their armies, and commenced a vigorous attack on the European posts scattered over a wide extent of country, and gained some important advantages. The accounts of these disasters that were circulated in Europe excited the liveliest sympathy of all Christians for their suffering brethren in the Holy Land, for the defence of which the European princes now entered into a new coalition. A second crusade was the consequence. It was undertaken in the year 1147, by the Emperor of Germany, Conrad III., and Louis VII., King of France, and was even more unfortunate than the first expedition. In the course of a tedious march through an unhealthy and hostile country, more than half the army of Conrad was wasted by famine and the sword, and not above a tenth part ever reached the Syrian shore. The subsequent battles with the Saracens reduced them to a miserable remnant; and the emperor, on his return with his shattered forces from this unfortunate campaign, was met by Louis and the French troops, who arrived in better condition at the scene of action. The French army, rashly advancing into the heart of the country, was assaulted and overwhelmed by an innumerable host of Turks; and the king, effecting his escape with great difficulty, finally took shipping with his knights and nobles, leaving his plebeian infantry to the sword of the victorious enemy. The two princes afterwards proceeded to Jerusalem, united the poor remains of their once mighty armies to the Latin troops in Syria, and laid a fruitless siege to Damascus, which was the termination of the Second Crusade.

The defeat and dispersion of these armies tended greatly to weaken the Christian cause in the Holy Land, and shake the foundations of the Latin throne at Jerusalem. Disputes also arose about the succession to the throne, which exposed the kingdom still more to the assaults of its enemies, with whom some of the discontented barons entered into traitorous correspondence. In the midst of these internal dissensions the kingdom of the Latins was assailed by a new enemy, namely, the Sultan Saladin, who, to valour, policy, and military skill, joined all the refined humanity of a Christian knight. He had risen from a private station to the sovereignty of Egypt, and had been for years extending his influence and his dominions. Reginald of Chatillon, a soldier of fortune, had seized a fortress, from which he issued with his followers to pillage the caravans and to insult the Mohammedans, and he even threatened the holy cities of Medina and Mecca. Saladin complained of these injuries; and being refused any satisfaction, invaded the Holy Land in 1187 with an army of 80,000 horse and foot. He advanced against Tiberias, to which he laid siege; and a decisive battle was hazarded by the King of Jerusalem in defence of this important place. In the contest which ensued the Christians were totally defeated, their king and many of the nobles taken prisoners, and 30,000 soldiers slain or captured. This great victory placed the whole country at the mercy of the conqueror. The fate of the kingdom had been set on a single cast, and its whole military force concentrated on this fatal field. The towns and castles, deprived of their governors, fell successively before Saladin's victorious force; and scarcely had three months elapsed when he appeared in arms before the gates of Jerusalem.

This city was in no condition to sustain a protracted siege, being crowded with fugitives from every quarter, who here sought an asylum from the destroying sword. A disorderly throng of 100,000 persons were confined within the walls, with but few soldiers. A defence was, however, maintained for fourteen days, after which the capture of the city was averted by a capitulation, by which it was agreed that all the Franks and Latins should quit Jerusalem, receiving a safe conduct to the ports of Syria and Egypt; that the inhabitants should be ransomed for a sum of money; and that those who were unable to pay it should remain slaves. The whole country now submitted to the sultan, whose victorious progress was first arrested by the resistance of Tyre, which was gallantly defended by Conrad. The sultan, being foiled in all his attempts to take this place, was finally compelled to raise the siege, and to retreat to Damascus.

The capture of Jerusalem by the infidels, and the decline of the

Christian cause in Palestine, excited the deepest sorrow; the decaying zeal of the European powers was awakened, and new expeditions were fitted out for the recovery of the Holy City. In the year 1189, Philip, King of France, the Emperor Frederick Barbarossa of Germany, and Richard I of England, assembled a large force; and, with the aid of Flanders, Frise, and Denmark, filled about 200 vessels with their troops. The first armaments landed at Tyre, the only remaining inlet of the Christians into the Holy Land, and no time was lost in commencing the celebrated siege of Acre, which was maintained with an enthusiasm that mocked at danger, and by feats of valour that were the theme of wonder, even in that romantic age. This memorable siege lasted for nearly two years, and was attended with a prodigious loss of men on both sides. At length, in the spring of the second year, the royal fleets of France and England cast anchor in the bay, with powerful reinforcements, and the brave defenders of Acre were forced to capitulate. The place was taken possession of by the Christians on the 12th of July 1191.

The capture of Acre was the prelude to farther operations against the enemy. Richard determined to commence the siege of Ascalon, about 100 miles distant, and his march to this place was a continual battle of eleven days. He was opposed by Saladin with an army of 300,000 combatants; and on this occasion was fought one of the most memorable battles of this or any other age. Saladin was defeated with the loss of 40,000 men, and the victorious Richard obtained possession of Ascalon and the other towns of Judea. In the next year Richard made an unsuccessful attempt against Jerusalem; and a vigorous assault by Saladin on Jaffa was repulsed by Richard. A truce was at length concluded for three years, by which it was stipulated that the Latin Christians should have liberty to visit the Holy City without being liable to tribute; that the fort of Ascalon should be dismantled; and that Jaffa and Tyre, with the intervening territory, should be surrendered to the Europeans. Soon after the conclusion of this treaty Richard embarked for Europe; and Saladin, his great rival, did not survive many months the conclusion of peace. He died at Damascus in the year 1193.

In the meantime, in Palestine, though partial successes were gained by the armies of the Crusaders, their power was on the decline. The Latin kingdom, now reduced to two or three towns, was preserved only in a precarious existence by the divisions and civil wars that prevailed among its enemies.

This intelligence rekindled the dying zeal of the Christian world. A new crusade was commenced; and in 1216 a large force, chiefly of Hungarians and Germans, landed at Acre. The sons of Saphadim, who now ruled in Syria, collected their armies to oppose this formidable attack. But the Crusaders, rashly conducted, and weakened by divisions, advanced into the country without concert or prudence; provisions failed them; they were wasted, as usual, by famine and disease; and at length their leader, the sovereign of Hungary, resolved to quit a country where he had been exposed to hardship and danger, without glory. The crusading armies, thus weakened and discouraged, had laid aside all further idea of offensive operations, when, in the spring of the following year, a fleet of 300 vessels that had sailed from the Rhine appeared on the coast, and brought to their aid powerful reinforcements that recruited their strength, and restored their ascendancy in the field. For reasons that do not clearly appear, they now retired from Palestine, and carried the war into Egypt, where they obtained important successes. They took Damietta by storm, and spread such consternation among the infidels that the most favourable terms of peace were offered, and rejected by them; but having at length wasted their strength on the banks of the Nile, they were reduced to the necessity of bargaining for permission to retire to Palestine, by the cession of all their conquests in Egypt.

The next crusade was undertaken by Frederick II., the grandson of Barbarossa, according to a vow which had been long made, and the performance of which had been so long delayed that he was excommunicated by Gregory IX. By his marriage with Violante, the daughter of John de Brienne, King of Jerusalem, he was the more especially bound to vindicate his right to the kingdom, which he had received as a dowry with his wife. After many delays, he set sail with a fleet of 200 sail and an army of 40,000 men, and in the year 1228 he arrived at Acre. This was the most successful and the most bloodless expedition that had yet been undertaken. Without the hazard of a battle he entered Jerusalem in triumph. The Saracen power was at this time weakened by divisions; and, owing to suspected treachery among his kindred, Kamel, the reigning sultan, held rather a precarious possession of the throne. It was his policy, therefore, rather to disarm the hostility of these powerful armies by treating with them, than to encounter them in the field; and accordingly a treaty was concluded, by which Jerusalem, Jaffa, Bethlehem, Nazareth, and their dependencies, were restored to the Christians; religious toleration was established, and the contending parties of Christians and Mohammedans were allowed each to offer up their devotions, the first at the Holy Sepulchre, and the last in the mosque of Omar. The stipulations of this treaty were not faithfully observed by the Saracens, and the Christians in Palestine still suffered under the oppression of the infidels. New levies were raised in Europe for the Holy War; and a large force of French and English, led by the chief nobility of both nations, landed in Syria in 1239. Numerous battles were fought, which terminated in favour of the Saracens; and the French Crusaders, accordingly, after severe losses, were glad to purchase peace by the cession of almost all their conquests in Palestine. Next year, when the English levy under the Earl of Cornwall arrived at the scene of action, he found, to his surprise, that all the territories and privileges that had been ceded to the Emperor of Germany were lost, and that a few fortresses, and a small strip of territory on the coast, comprised all that the Latins possessed in Palestine. He immediately prepared for the vigorous prosecution of hostilities; but the sultan, being involved in war with his brother in Damascus, readily granted favourable terms as the price of peace—namely, the cession to the Christian armies of Jerusalem, Beritus, Nazareth, Bethlehem, Mount Tabor, and a large tract of the adjoining country. But the kingdom of Jerusalem, thus so happily established, was subverted by a calamity from a new and unexpected quarter. In the interior of Asia the conquests of Ghenghis Khan had brought about the most stupendous revolutions, and the barbarous hordes of the desert, flying before his conquering sword, rushed like a torrent on other nations. The Kharismians, unable to withstand this powerful invader, were driven upon Syria, and the coalesced powers of Saracen and Christian were unable to resist their powerful assault. The Christian host was overthrown in a great battle, which lasted two days, and in which the grand masters of two orders, and most of the knights, were slain. The Holy City was then taken and plundered by the invaders.

Each new disaster of the Christian arms served to rekindle the languishing zeal of the Europeans; and Louis IX. of France fitted out, in 1248, an immense armament for the Holy Land, consisting of 1800 sail of vessels, in which he embarked an army of 50,000 men. He landed in Egypt, and after storming the town of Damietta, he advanced along the sea-coast towards Cairo, when his troops were so wasted by sickness and famine, that they fell an easy prey to the enemy. The king, with most of his nobles and the remnant of his army, were made prisoners; and it was owing to the clemency of the sultan, who accepted a ransom for their lives, that Louis, with his few followers who remained alive, was permitted to embark for Palestine.

The power of the Christians in Palestine, weakened, among other causes, by internal dissensions, was now vigorously assailed by Bondocdar or Bibars, the Mameluke sovereign of Egypt and Syria. He invaded Palestine with a formidable army, advanced to the gates of Acre, and reduced the important city of Antioch, when 17,000 of the inhabitants were put to the sword, and 100,000 carried into captivity. The report of these cruelties in Europe gave rise to the eighth and last Crusade against the infidels, which was undertaken by Louis, the French king, sixteen years after his return from captivity. But in place of directing his arms immediately against Palestine, he landed in Africa, and laid siege to Tunis, which he reduced. But he perished miserably on the burning sands of Africa, of a pestilential disease, which proved fatal also to many of his troops; and thus ingloriously terminated this expedition, which was the last undertaken by the Europeans for the recovery of the Holy Land.

The Europeans in Palestine, a feeble remnant, were now confined within the walls of Acre, which was besieged by a Mameluke host of 200,000 troops that issued from Egypt, and encamped on the adjacent plain. In this, their last conflict with the infidels of the Holy Land, the Europeans fully maintained the glory of their high name. They displayed all the devotion of martyrs in a holy cause, and performed prodigies of valour. But, equalled as they were in discipline, and fearfully overmatched in numbers, by their enemies, they were overborne by the weight and violence of their attacks, and in the storm and sack of the city all either perished or were carried into captivity. Thus terminated for ever, in 1291, all those visions of glory and conquest by which so many adventurers were seduced from Europe to the Holy Land, there to perish under the complicated perils of disease and the sword. The other smaller towns which still remained in possession of the Christians yielded without a struggle to the Moslem arms, and under the religious tyranny of the infidels which succeeded, the Christians in Palestine were everywhere reduced to the lowest degree of debasement. The pilgrims who still visited Jerusalem were exposed to insult and danger; and large contributions were exacted by their oppressors for a free passage through the Holy Land. The Mameluke sultans of Egypt continued to rule over Palestine until the country yielded to the formidable irruption of the great Tamerlane in 1400. At his death Jerusalem reverted to the kingdom of Egypt, and was

Palestrina. finally subdued in 1517 by Selim I., the sultan of the Turks, under whom it has continued for more than 300 years.

In this condition Palestine remained without any remarkable event in its history, except that for nearly three centuries it was the scene of domestic broils, insurrections, and massacres, until the memorable invasion of Egypt by the French army in 1798. Bonaparte, being apprised that preparations were making in the pashalic of Acre for attacking him in Egypt, resolved, according to his usual tactics, to anticipate the movements of his enemies. He accordingly marched across the desert which divides Egypt from Palestine, and invaded the country at the head of 10,000 troops. After taking several towns, and among the rest Jaffa, where he stained his character by the atrocious massacre of 4000 prisoners, Napoleon proceeded to form the siege of Acre; and this fortress, the last scene of conflict between the Christians and infidels of former days, became a modern field of battle, in which were exhibited prodigies of valour that rivalled the most renowned deeds of those chivalric times. Notwithstanding the obstinate defence, Bonaparte persevered in a series of furious assaults against the fortress, which were all most gallantly repelled; and after a protracted siege of sixty days, a last assault was ordered, which was equally unsuccessful with all former attempts, and was attended with the loss of some of his bravest warriors. This last failure dictated the necessity of an immediate retreat, which was accomplished with difficulty, in a tedious march through the burning desert, where hardship and privation of every sort was the lot of the wayworn soldier, and the sick and wounded were left in most cases to inevitable death.

In the year 1811 a new power arose in the East,—namely, that of Mehemet Ali, the viceroy of Egypt, who, having collected large treasures and a well-disciplined army, openly renounced his allegiance to the grand signior. A war took place, in which the hasty levies of Turkey were broken and put to flight by the veteran troops of Egypt; and a series of brilliant successes added Syria to the viceroy's dominions. The people generally were disposed to hail the change of masters with pleasure, and by a well-advised and moderate system of government, Mehemet Ali might have bound them firmly to his person and his cause. But although in some respects an enlightened man, his notions of government were oriental and despotic, and the sort of European discipline and order which he had introduced into his civil and military service was chiefly valued by him as an instrument for giving more general and certain effect to his extortions. The Syrians soon discovered that, instead of being relieved from the exactions of the Turkish government, much heavier burdens were laid upon them. The forcible impressment of men for the army, and the disarming of the population, were the measures that created the most discontent, and led to such disturbances and revolts as encouraged the Porte in the design that it had always entertained, of reducing the pasha and recovering his provinces. In 1839 a Turkish army appeared on the northern frontier of Syria, and soon came into collision with the Egyptian army under Ibrahim Pasha, son of Mehemet Ali, by whom it was totally defeated, and the European powers then deemed it right to interfere to crush the ambitious designs of the Egyptian viceroy. This was accomplished in 1841, chiefly by means of a British fleet, by which Acre and other strongholds were taken for the sultan; and the pasha was at length compelled to evacuate Syria, and restore it to the dominions of the Porte. Scarcely had Syria been evacuated by the Egyptians, when the Christians, who had before supported Ibrahim Pasha, began hostilities against the Turks, while at the same time the Maronites and Druses of Mount Lebanon were engaged in fierce and bloody contests with each other; so that the Porte was unable to reduce the country to a settled state. In Jerusalem the Mohammedan population raised great obstacles to the erection of a Protestant church, in opposition to the British, French, Russian, and Sardinian consulates that had been established there; and in 1843 they proceeded to violence against the French consulate. In 1845 the insurrectionary struggles of the Druses and Maronites, who had united against the Turkish government, reached such a height that the Porte gave orders for the disarming of all the inhabitants of Lebanon; a measure which was carried out by the soldiery with much rigour and cruelty. The dispute about the possession of the holy places at Jerusalem, which began in 1850, though in itself insignificant, is of some importance, as having been one of the causes that led to the recent Russian war. The various sects of Christians, and especially the Greek and Latin churches, have been for ages involved in quarrels regarding the possession of the real or supposed localities of the great events of the New Testament history, on which their various churches and sanctuaries have been erected; and the Turkish government has been appealed to as an arbiter on both sides. Recently, however, these quarrels assumed a political aspect, from the interference of Russia on behalf of the Greek, and of France on behalf of the Roman Church. Concessions were made in 1852 to the Romanists by the Porte, which would have satisfied the French government; but within a month afterwards, a *hatti-sherif* was published in favour of the Greeks, allowing them several privileges which could not well be reconciled with those promised to their rivals. Notwithstanding these complications, a peaceable arrangement was on the point of being effected, when the Russian government interfered, and made this question one of its pretexts for a rupture with Turkey. Prince Menschikoff was sent to Constantinople nominally to effect a settlement of the question regarding the holy places, but his demands soon extended much further than this question, and affected the condition of all the Christian subjects of the sultan, so as to place them virtually under the Russian instead of the Turkish government. These demands were refused by the Porte; and the consequence was, the seizure of the Danubian Principalities by Russia. This step was followed by the declaration of war with Russia by England and France. After the conclusion of the war, the sultan published in 1856 a *hatt-humayoun* confirming the *hatti-sherif* of Gulhanie, published in 1839, and granting full liberty to all his subjects, of whatever persuasion, in the exercise of their religious rites. The political events which have recently taken place in Turkey have exercised a beneficial effect on the condition of Protestants in Syria and other parts of the empire. (D. K.)

PALESTRINA, Giovanni Pierluigi da, a most distinguished composer of music, took his surname from that small town in the Roman Campagna in which he was born. The name of his family, their station, the date of his birth, and that of his death, remain doubtful, notwithstanding the long and indefatigable inquiries of the Abate Baini, director of the Pope's chapel at Rome, whose work on *Palestrina* is the most complete and accurate yet published.[1] The probable facts stated by the abate are,—that Palestrina's parents were poor, that he was born in 1524, and that he died on 2d February 1594, aged seventy. It appears that he went to Rome in 1540, and studied music in the school established there by the French musician Claude Goudimel, the best musicians in the chief chapels of Italy being at that time natives of France, or Belgium, or Spain. In 1551 Palestrina was appointed *maestro di capella* of the Julian chapel, and was the first musician on whom that title of chapel-master was conferred. In 1554 he published his first collection of masses, four of them for four voices, and one for five. They were dedicated to Pope Julius III., who, in January 1555, appointed Palestrina one of the singers of the pontifical chapel. Palestrina had married when young, and his wife bore him four sons, the youngest of whom edited the two last books of his father's masses. When Pope Paul VI. succeeded Pope Marcellus II., he took offence at those singers in the papal chapel who were married, and expelled them on that account. One of these was Palestrina. On 1st October 1555 Palestrina was appointed chapel-master of St John of Lateran, a post which he held for about five years, and during which time he composed some of his finest works. On 1st March 1561 he improved his income by becoming chapel-master of Santa-Maria Maggiore, and held that office till 31st March 1571. In 1563 the Council of Trent having censured the profane words and music introduced into masses, Pope Pius IV. ordered this matter to be reformed. Palestrina was invited to compose a mass upon the reformed plan. He composed three for six voices. One of them (called *Missa Papæ Marcelli*) was thought so admirable that Pius IV. rewarded its author by naming him composer to the pontifical chapel, with a salary of nine scudi (about L.2) a month. Afterwards Pope Gregory XIV. increased that salary. In April 1571 Palestrina once more entered the chapel of St Peter in the Vatican, and finally became director of the

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[1] *Memorie storico-critiche della vita e delle opere di Giovanni Pierluigi da Palestrina*, &c., Rome, 1828, 2 vols. 4to.

school of counterpoint formed by Nanini. In July 1580 the death of his wife caused him great affliction; and he seems to have passed the last years of his life in very straitened circumstances. He alludes to his struggles with poverty in the dedication to Sixtus V. of his first book of the *Lamentations of Jeremiah,* for four voices, 1588. He died on 2d February 1594, and was interred in the Vatican, the following inscription being engraved on his tomb:—"Joannes Petrus Aloysius Prænestinus. Musicæ Princeps." A fine portrait of Palestrina is given in the Abate Baini's work above cited. In the church style of composition Palestrina attained a degree of excellence which has never been equalled. His style is pure, noble, and flowing. His voice parts are written with the greatest skill, each part being made to sing in a simple, free, and natural manner, and using only the best notes belonging to each kind of voice; while the whole voices concur in producing the smoothest and best effect. When Cherubini taught composition in the Paris Conservatory, he analyzed and explained the works of Palestrina as models of the highest style of church music. Besides a vast quantity of music for the church, Palestrina composed two books of madrigals for four voices, and one for five. These madrigals are admirable, though too little known in Great Britain. His published works consist of thirteen books of Masses, six books of Motets, one book of Lamentations, one book of Hymns, one book of Offertories, one book of Magnificat, one book of Litanies, one book of Spiritual Madrigals, and three books of Madrigals. Many of his unpublished compositions are preserved in the Vatican Library. The Abate Baini had prepared a complete collection in score of all Palestrina's works, but there is little prospect now of its publication. (G. F. G.)

PALESTRINA (anciently *Præneste*), an episcopal town of the Papal States, on the slope of a hill, 23 miles E.S.E. of Rome. Among its public buildings are the church of Santa Rosalia, and the old palace of the Barberini family. It still contains many remains of its ancient splendour. Manufactures of woollen cloth are carried on here. Pop. 6000. (See PRÆNESTE.)

PALEY, WILLIAM, one of the most acute of English thinkers, and one of the most graphic of English writers, was born at Peterborough, July 1743. His father, who was a minor canon in the cathedral there, was appointed, while Paley was yet a child, head master of Giggleswick grammar school in Yorkshire.

Here Paley received his education under his father's eye, and early displayed the vigour of mind for which he was afterwards so eminent. He outstripped, we are told, all his school-fellows.

While making nearly equal progress in all the school studies, the special tendencies of his genius were even then distinctly marked. He took a keen delight in examining any curious pieces of mechanism that fell in his way; and on casually seeing a trial at Lancaster about a year before he left school, is said to have been so much excited by it, that he introduced mock trials as a pastime among his school-fellows. One would have liked to see him in his juvenile attempts at sifting evidence and cross-examining witnesses. —Active in mind, he was sluggish in body, and took little part in the athletic sports of his companions; he was fond, however, of long rambles among the fields; and of angling, a sport the love of which, in after life, became a passion.

Young Paley remained under his father's eye till his sixteenth year, when he went to Cambridge (1758), and was admitted a sizar of Christ's College. On leaving home his father prophesied his son's future fame,—"He'll turn out a great man—very great; he has by far the clearest head I ever met with." He made his first journey to the university on a pony, in company with his father, and has given us an amusing account of his equestrian misadventures. His father jogged on before, and Paley trotted behind. "I was never a good horseman," says he; "and when I followed my father on a pony of my own, on my first journey to Cambridge, I fell off seven times. I was lighter then than I am now; and my falls were not likely to be serious. My father, on hearing a thump, would turn his head half aside, and say, 'Take care of thy money lad.'"

During the early part of his under-graduateship Paley was more notorious for humour, social propensities, and indolence, than for diligence and application. A singular incident, which shows his force of character in a very remarkable light, revolutionized all his habits as a student. "I spent," says he, "the first two years of my under-graduateship happily, but unprofitably. I was constantly in society, where we were, not immoral, but idle and rather expensive. At the commencement of my third year, however, after having left the usual party at rather a late hour in the evening, I was awakened at five in the morning by one of my companions, who stood at my bedside, and said, 'Paley, I have been thinking what a fool you are. I could do nothing, probably, were I to try, and can afford the life I lead; you could do everything, and cannot afford it. I have had no sleep the whole night on account of these reflections, and am now come solemnly to inform you, that if you persist in your indolence I must renounce your society.' I was so struck with the visit and the visitor, that I lay in bed great part of the day, and formed my plan. I ordered my bed-maker to prepare my fire every evening, in order that it might be lighted by myself. I arose at five; read during the whole of the day, except such hours as chapel and hall required; allotted to each portion of time its peculiar branch of study; and just before the closing of the college gates (9 o'clock), I went to a neighbouring coffee-house, where I constantly regaled on a mutton chop and a dose of milk-punch; and thus, on taking my bachelor's degree, I became senior wrangler."

Such an odd sermon from such an odd preacher, at so unusual an hour, might well startle the listener; but the instantaneous revolution it wrought shows wonderful decision of character, and might have been introduced as an illustration in Foster's celebrated essay on that subject.

He took his bachelor's degree January 1763, and for nearly three years afterwards was assistant in a school at Greenwich. In June 1766 his election to a fellowship of Christ's College brought him back to the university, where he became one of the tutors of his college. Here he delivered lectures on the subjects which afterwards occupied him in his principal writings—moral philosophy and divinity. His coadjutor was Mr Law, son of Dr Edmund Law, the master of Peterhouse, who was afterwards bishop of Carlisle, and Paley's lifelong patron.

After living about ten years as college tutor, Paley resigned his fellowship, and married. In 1775 he was presented, through his friend Bishop Law, to the rectory of Musgrove in Westmoreland; to which were soon afterwards added the vicarage of Dalston in Cumberland, and the living of Appleby in Westmoreland. In 1782 he was made archdeacon of Carlisle, and about the same time exchanged the living of Appleby for a stall in that cathedral. His income was now considerable.

In 1785 he published, in 4to, his first considerable work, the *Moral and Political Philosophy.* For the copyright the author received L.1000,—a very unusual sum for literary work in those days; but the popularity which the book rapidly acquired proved that the publisher had made a safe speculation.

In 1790 he published his *Horæ Paulinæ*, which, of all his works, gives us the fullest image of the characteristics of his mind, and is certainly entitled to be called the most original.

In May 1791 Paley lost his wife, who left him with eight

children,—four sons and four daughters. He remained a widower four years, and then married Miss Dobinson, a lady of Carlisle long known to him, and much esteemed.

In 1791, at the height of the panic produced by the French Revolution, Paley wrote his *Reasons for Contentment*,—a *brochure* which he regarded, it is said, with all an author's complacency, and pronounced the best thing he ever wrote. It consists of some rather commonplace truths very well expressed, but is quite unworthy of his partial estimate of it. It has been said that his political zeal was stimulated by the hope of a mitre; if so, he was doomed to be disappointed. But, in justice to Paley, it must not be forgotten that he was not a man likely to pay court to the ruling powers, either in this or any other way, from the mere hope of preferment.[1] He who said that the "Divine right of kings was on the same footing with the Divine right of constables," could hardly hope for favour from a monarch like George III.

In 1791 the dean and chapter of Carlisle presented him to the vicarage of Addingham; and two years after, he vacated the benefice of Dalston in exchange for that of Stanwix, which was nearer to Carlisle. This was the best of the three reasons which Paley is said to have given for the change. They were as follows:—"*First*, it saved me double housekeeping, Stanwix being within twenty minutes' walk of Carlisle; *secondly*, Its value was greater by L.50 a year; and, *thirdly*, I began to find my stock of sermons coming *over again too fast*."

In 1794 appeared his work on the *Evidences of Christianity*, which has perhaps been the most popular of them all, and was certainly best recompensed. Though the court and minister were inexorable, or insensible to his claims, preferments were showered on him by the bench. Bishop Porteous gave him a prebendal stall in St Paul's; Lincoln made him sub-dean of that see; Durham conferred on him the living of Bishop-Wearmouth: altogether, these preferments yielded considerably more than L.2000 a year. If it be ever desirable to reward merits like those of Paley in this oblique way, few men have better deserved episcopal patronage, for the services he rendered to the cause of our common Christianity were unquestionably very signal.

After being made sub-dean of Lincoln, Paley took his doctor's degree, and in his *concio ad clerum* made an unhappy slip in quantity, pronouncing *profugus* with the penult long,—an offence which was duly expiated by being made the subject of some college wit's sarcastic epigram; but he had better success when he completed his exercises for his degree. In the discourse he addressed to the clergy on that occasion (one of his best), he characterizes with much ability and force the dangers and temptations which "beset the clerical character," and here and there shows a knowledge of the philosophy of human nature not unworthy of Barrow or Butler.

In 1795 Paley took up his abode at Bishop-Wearmouth. In accordance with the principles advocated in his *Moral Philosophy*, and in accordance too, it may be added, with his benevolent disposition and his wish to live in peace with his parishioners, he agreed to commute the tithes for a fixed payment during his life. The rapid rise that took place in the value of farm produce during the following years made the tenants well contented with their part of the bargain, and it is much to Paley's credit that he never repented of his.

At the solicitation of the Bishop of Durham, he consented to act in the commission of the peace, for which, in many respects, he was admirably well fitted. In his *Moral Philosophy* he has specified the magistrate's function as one, by the discharge of which a conscientious man may, at little cost, secure some of the most comprehensive ends of benevolence: and this is true; but the office requires great patience and self-control, and our philosopher, according to his biographers, was somewhat too irascible to discharge it well.

In 1800 Paley was attacked by the complaint which ultimately proved mortal, though not till after some years of much suffering. His last, and in many respects greatest work, his *Natural Theology*, was prosecuted, and in great part written, during the intervals between the paroxysms of this painful disease. No sooner was the paroxysm over than Paley resumed his work with unflagging spirit. The reader will recollect the pleasant passage in which he half makes it a question whether the delicious sense of relief from pain be not a compensation for suffering it. A calm estimate, probably, would make every one answer in the negative; but the thought seems to have been suggested in the grateful experience of recent relief from severe suffering. Paley died May 25, 1805.

The mind of Paley was acute rather than profound—discriminating and observant rather than comprehensive. If we except the mathematics, he had little aptitude for abstract science; the complex, subtle, fugitive phenomena of consciousness he had neither analytic skill, nor, we suspect, patience, thoroughly to investigate. In almost the only place in all his works—the first two books of his *Moral Philosophy*—where refined analysis of the phenomena of consciousness was specially demanded, he is generally admitted to have signally failed. When he approaches the confines of a metaphysical discussion, we see how apt he is to resile from it; in part, doubtless, from want of congeniality with such subjects, but in part also from his predominant love of the *practical*. Indeed, from the strength of this last characteristic, he would probably still have been an indifferent metaphysician, even had his talents for abstract science been much greater than they were. As it was, the sense of the practical generally decided at once the limits within which he was disposed to speculate. But within his own province—and a very extensive and most important one it is—it may be doubted whether any mind was ever more happily equipped for its functions. In all questions that involve a practical issue, and which stop short of the investigation of the metaphysical principles of knowledge and belief; questions which men must, and will, and do decide independently of the *theories* of those principles; in all questions which involve the investigation and comparison of *facts*, and just logical deduction from them,—his powers are of the very first order. Few ever surpassed him in the discovery of apt arguments for his purpose—in the ingenuity with which he could combine apparently inconsiderable and often neglected data, and make them yield unexpected conclusions—in the selection and arrangement of his materials—in the skill with which he wrought them into his truly original structures of argumentation—in the fecundity and felicity of his illustrations, or the exquisite precision and transparency of his style; and hence, on all his works he has stamped the image of his own genius, though the subjects (with one exception) were already worn thread-bare. In surveying his ground, in determining what points to assail or defend, and in marshalling his forces, he had, in military phrase, the general's eye. His works, in their whole laying out and plan—in their adaptation of part to part—exhibit not simply strong powers of logic, but constructive genius of a

[1] There was a tradition, that on the occasion of Pitt's visit to the university, soon after his becoming premier, Paley reproved the greedy court paid to the youthful minister by preaching from the text,—"There is a lad here which hath five barley loaves and two small fishes; but what are they among so many?" The story may have originated, and probably did, in some playful pleasantry of Paley; but had he thus desecrated the pulpit, he would have deserved as grave a rebuke as the venal suitors for ministerial favour.

very high order. His imagination and his wit were both tolerably active; indeed, the latter is represented as exuberant in private life, and as making him the delight of the social circle; but in his writings both these qualities are so completely *ministerial*, that there is probably hardly a single instance in all his works where an illustration is introduced to embellish or delight, or to minister to the sense of beauty. All are either exemplifications of the argument itself (*instances*), or designed to give a more graphic and precise expression to it. His style is the just reflex of his mind. It is eminently precise and luminous both as regards diction and construction: as he is never guilty of *overdoing* in argument, but contents himself with the proofs that most speedily establish the conclusion, and there stops, so it is in his style. The chief excellence of all strictly argumentative composition must of course be perspicuity; for what is called beauty of style (as regards the greater part of its elements) there cannot be much scope. Perspicuity of style, however, Paley possesses in such perfection, that its very lucidity becomes beauty. Probably no man besides ever expressed so much scientific matter as he has expressed in his *Natural Theology* without technicalities, without pedantry, in such easy colloquial diction, with such apt and homely illustrations. It is science without the forms of it.

This lucid simplicity has often led readers to undervalue Paley as a thinker: it not only produces the effect of a perfectly translucent medium, which, the more clearly it lets us see objects, the less it obtrudes itself upon us; it is like a pure stream, which refracts the light so perfectly as always to seem to the eye more shallow than it is.

There is a natural correspondence between the mental and moral characteristics of men; so it was with Paley. His intellect was neither profound nor subtle; and, accordingly, his sympathies were circumscribed. He was also without enthusiasm; and there was, in consequence, little elevation of sentiment and no vehemence of passion about him. His *Sermons*, accordingly (though we are not to forget that they were never designed for publication), exhibit plain good sense, expressed with characteristic perspicuity, but without any of the "thoughts that breathe and words that burn" which constitute true eloquence. It must be added that they exhibit a very defective perception of the deeper spiritual truths of the gospel, and the deeper spiritual anatomy of human nature. His benevolence, however, was active and genuine,—practical, like all his other qualities,—and none the worse for being of that undemonstrative character which best harmonized with his plain, direct, practical intellect. Benevolence with him was a habit, and no mere sentiment. Few were more at home in ministering to the wants of the poor and the sick, and in devising plans for alleviating the sorrows of his parishioners.—Another marked trait of his character was his equable cheerfulness. This, too, is often found in those who, like Paley, are chiefly distinguished by plain rectitude of understanding and incapacity of the deeper emotions; for profound thought and profound feeling almost always pay the penalty of fits of melancholy as the cost of ecstasies and exaltation. This elastic spirit is pleasantly displayed in many passages of his *Natural Theology*, written as it was in the intervals of severe suffering. Nothing that he saw around, or felt in himself, could damp the buoyancy of heart, which made him exclaim, amidst the rejoicing song of birds, and hum of insects, and radiant smiles of infants,—happy by immediate donation of God,—"It is a happy world after all." All he suffered seems as little to have tinged his own spirit with sadness as the spectacle of those more comprehensive miseries of the world which would have made many a deeper but less enviably-constituted mind—John Foster's, for example—pause before it gave expression to such a sentiment, or half retract it as soon as uttered.

All the principal works of Paley exhibit his chief characteristics of mind in singular perfection: it is mirrored in them. However they may differ in intrinsic value, they are all stamped nearly in the same degree with the impress of his genius. The most faulty, owing to his erroneous *theory* of morals in the first portions, is the *Moral and Political Philosophy*. On this the remarks of Sir James Mackintosh, in his *Ethical Dissertation*, make it needless to say much here. It is sufficient to remind the reader that Paley's theory does not account (nor can any such theory) for the very *origination* of the ideas of right and wrong, duty and obligation, in the human mind; notions which are perfectly unique, as much so as those which are the product of any other distinctive faculty of our nature,—and in every case irreducible to the mere conceptions of the "prudent" and "imprudent," of "profit" and "loss," into which, if the utilitarian theory were true, they should be resolvable. Sir James Mackintosh has insisted much, and justly, on the approximate agreement among mankind in their moral judgments as an argument for man's original moral constitution; but it may be remarked that even a wider divergence in this respect, a greater diversity in the moral codes of men, would not impair the above argument against Paley's theory. It is no doubt true that there is such an approximation to agreement among mankind, and the logical force of their differences is fairly neutralized by the facts Sir James insists on. Though not unimportant, and proving clearly enough some abnormality in human nature on *any* hypothesis, these differences, which are always made one of the principal arguments against the theory of an original moral constitution of human nature, form in reality no argument at all. That distinctive moral constitution is shown in the very conception of *right* and *wrong*—moral approbation and the contrary; and there is as real, though not as pleasant, a proof of man's original moral constitution when the conception is vitiated as when it is not. It would not invalidate the argument that the eye, the organ by which the notions of light and colour are conveyed, implies a distinct faculty of our nature, were it true that no two men saw just alike; nay, if one saw green where another saw blue. Very bad eyes they would be in that case, no doubt; still, that there was the perception of light and colour at all would be the result of a distinct organism to convey them, and due to no other sense. In like manner, it may be argued that, in the present condition of man, his moral perceptions may be often vitiated, and yet that the very existence of such notions as *obligation*, *duty*, and *remorse*, show a distinct moral constitution of man, whether it be the result of some single faculty called a "moral sense," or as a distinct result of the reciprocal action of many faculties.

It is not to be denied that the want of elevation and nobility in Paley's ethical principles has unfavourably affected some of his practical applications. It is impossible to read his lax observations on "subscription," his tender dealing with what are called "white lies" and other peccadilloes, without feeling that his theory has in some cases warped his decisions, and in others has injured the *tone*, even where the decisions are not erroneous.

He seems to have formed his ethical theory very early. The subject of his Latin dissertation for the senior bachelor's prize (in 1765) was "a comparison between the Stoic and Epicurean philosophy in their influence on morals," &c.; and he awards the superiority to the latter. It must be added, that on certain occasions in life he too obsequiously followed his own theory. One of the theses he proposed (in 1762) to defend in the schools was, that eternal punishments are inconsistent with the Divine attributes; but having learned that it would give umbrage, he accepted, with grateful alacrity, the suggestion of Dr Watson, that he could insert "non" in the proposition, and take the

Paley. other side; which he accordingly did, and argued for the contrary of his own convictions with great eclat and success. It cannot become any man thus to trifle with his genuine sentiments. In like manner, when asked to sign the petition for a relaxation of the terms of subscription, he gave as his reason for refusing, that (though he heartily approved of the object) "he could not afford to keep a conscience." It would be unjust to press a joke, such as this must have been, too far (for Paley *did* "keep a conscience"), but it is impossible to help feeling that a want of due sensitiveness—a certain moral laxity on some occasions—was the consistent fruit of a moral theory which necessarily turns the thoughts too closely on the "profit" and "loss," the advantages and disadvantages of actions, and invites to a too solicitous casuistry wherever it is not absolutely shameless to exercise it.—Apart from the vice in the *principles* of his ethical theory, the treatise is not unworthy of Paley; and many portions display all the acuteness, justness of thinking, and felicity of style which so eminently distinguished him. His illustrations of the institution of property and its advantages—his remarks on the best modes of exercising benevolence—his contemptuous exposure of the excuses for not practising it—his chapter on anger and its "*sedatives*"—these and many other portions are admirable.

It is the fashion with infidelity now-a-days to speak of Paley's "Evidences" as *passé;* as having little or no relation to present controversies, and as utterly inadequate to meet those more subtle and more efficient methods of refuting the truth of Christianity, which modern astuteness has discovered. This is a stock fallacy with many infidel writers; and by mere repetition it has, among the young and ignorant, often passed current. We maintain, on the contrary, that the supposed new methods differ from the old more in form than substance; and that when they differ in form they do not affect the substance of the argument. Almost everything in the new methods that has any real bearing on the controversy has been long since propounded to the world. Nor, if we reflect, could it well be otherwise. An *asserted historic fact* is not, like a Chinese puzzle, capable of being put together in a thousand ways. Christianity professes to be *historically* true; and the only way it can be shown *not* to be so, is to show that its alleged facts are no facts at all. Now, the *mode* of doing this admits of no great choice; changes of form or detail there may be, but there can be little more. For example, it may be contended by one that Christianity originated in imposture; by another, that it was simple honesty mistaking its facts (very simple, indeed, it must have been, if it could mistake *such* facts); by a third, that it was a slow growth of popular credulity out of a slender nucleus of truth; by a fourth, that it was a result of all these. And all these hypotheses, in various ways and in different degrees, were given long ago to the world: the elder infidels depending more on the coarse imputation of fraud practising on credulity, though not to a wasteful exclusion of other less offensive suppositions on particular occasions,—the modern opponents, with improved politeness, rather dwelling on innocent self-deception and honest credulity in the founders of Christianity; though here again we find no absolute lack of infidels who prefer the curt effrontery of the elder gainsayers. But the supposition of ***these illegitimate motives rather than those*** in the authors or propagators of Christianity can constitute no variation in the *arguments* for confuting its claims as history. The mode in which the assailant acts may vary on that supposition; it may make him more cautious on this point or bold on that; or induce him to reject, if he adopt one hypothesis, some arguments which he would use if he adopted another; but it cannot affect the only point of any real importance,—namely, the value of the arguments which are to prove that Christianity is ***not historic***. As to this, it does not matter a rush what are the sentiments of the assailant as to Christ's character or that of the apostles; it is a mere question of his insolence or urbanity, his charity or malignity, about which it is hardly worth while to carry on controversy. What he has to do is to show either that the facts of Christianity are *à priori* incredible, or incredible from their intrinsical inconsistency and contradictoriness, viewed *as history*. Now, when that is attempted, we invariably come to essentially the same methods as were employed long ago. A few arguments may be withdrawn, disabled to the rear, and a few new recruits brought to the front; and more or less strategical skill may be found in marshalling the forces; but the staple of the method is, and must be, the same. If it be said—"But are you not doing injustice? Though many of the modern objections to the current Christianity are, it is true, old objections,—especially the alleged discrepancies, and *à priori* objections to miracles,—and are attended with the same result, even the elimination of all the miraculous facts and all the peculiar doctrines, yet do not the objectors say they are Christians still? Christianity is accepted by them in a certain rationalist or mythical sense. You have not a miraculous fact left, it is true, or a doctrine of Christianity which distinguishes it from the philosophy of Seneca or Epictetus; but that is all: if you have not Paul, you have Paulus; or Christ is simply 'turned into an Hegelian.'" We answer, that to get rid of the facts, these writers are first obliged to resort to the *old methods* under new disguises; and, as just said, it matters not in the interest of what particular faction of their own they thus attempt to get rid of them; only it may well be asserted that those who pretend to retain Christianity after having critically juggled it out of all its asserted facts and doctrines, and its founders out of all their brains in having believed them, are by far the worst infidels of all. They come with the rest of the rabble, "with swords and staves for to take Christ;" but they come by night, they come among the chief priests and scribes, and they betray him with a kiss.

When, therefore, opponents affirm, "The modern apologists rely on the obsolete and exploded methods, the new and more subtle attacks are evaded," it is wise to deny it, and challenge explicit proof. On the contrary, it may be shown, if we can but get them to details, that the arguments by which modern infidelity assails Christianity are, in substance, what were propounded long ago. The infidel hypotheses as to its origin are indeed various, and, unhappily for its opponents, very contradictory; but the arguments by which it is attempted to prove its unhistoric character are necessarily the same.

Thus, it is not easy to see that the *à priori* argument for the incredibility of all external revelation, based on the modern "spiritual deism," differs essentially from Lord Herbert's old-fashioned argument founded on his natural deism; nor does it matter, though the one calls the responses of the internal oracle "spiritual intuitions," and the other "innate ideas." There is plenty of scope for a "revelation," as human nature is now constituted, in confirmation or rectification of either; for never, judging by results, was any oracle less oracular.

Similarly, the assertion of the *à priori* incredibility of miracles, so often and so perseveringly insisted on in our day, as utterly inconsistent with the uniformities of antecedence and sequence in the phenomena of nature, in no way differs from the old-fashioned talk of their being "contrary to experience, and contrary to reason," which Bolingbroke and Hume, and multitudes more, expatiated upon in the course of last century; the fallacy in either case being the same, and more worthy of children than philosophers,—namely, that what we have not seen never was, and that the same uniformities of experience which we have been familiar

with, have ever existed and ever will. Old or new, the argument may well be called a fallacy, for it can never be consistently held by any class of minds, not even by the atheist; for, to him who denies that there is any presiding Intelligence which has ordained that things should be thus or thus, there is no reason why he should not believe in the possibility of any jumble of antecedents and consequents; that is, in the possibility of any number of miracles; rather he should congratulate his good fortune that he does not meet with them every day,—that he does not see men born with two heads instead of one, and going on four legs instead of two. But, at any rate, no *theist*,—no one who believes that man is not "an eternal series" (no matter whether he believes that he sprang out of the dust or was slowly developed out of a tadpole,—a monkey being one of the intermediate links), ought to insist on the *à priori* incredibility of miracles; for whether the phenomena he is compelled to admit require moments or centuries to bring them about, makes no difference as to their *character;* they as much transcend all our present experience, and as much contradict it, as any miracles that can possibly be found, whether in the New Testament or elsewhere. Doubtless we should all stare as much at seeing a tadpole transmuted into a man, as at seeing a man compacted out of the dust. It is difficult, therefore, not to doubt the logical honesty of any theist, old or new, who urges this objection, unless he believes that his "experience is the measure of all things," and that what is has ever been, and will ever be.

Again; as to the *discrepancies* that have been so much paraded in our day, the principal of these have been insisted upon from the very earliest times, and have been in all time among the stock arguments of infidelity. With what success we may see; they never have prevented, and never will prevent, the great bulk of investigators from feeling that, be they solved or be they not, they are of no avail against the prodigious accumulation of positive historic proof in favour of Christianity.

We have said that Paley's work is still a sufficient answer to the generality of modern arguments against Christianity. Even Paulus and Strauss, so far as Christianity is really assailed by any argument which attempts to prove its unhistoric character, only use the old methods; as for their *own* hypotheses,—utterly contradictory, by the way,—for accounting for its origin in defiance of history, Paley of course never dreamt of them; nor is it a matter of much consequence, for they are just becoming (one of them has become) a by-word and laughing-stock in Germany itself. Not only are they so incoherent with each other, but they imply such a dreadful compression and torture of the understanding of any reasonable creature who attempts to believe that either does really give the rationale of the Christianity of the New Testament,—both so aggravate all the difficulties of its origin, supposing it to be what they make it,—that there is not one man out of a thousand who would not sooner receive the entire New Testament, or reject it entire, than submit to the humiliation and bondage of such exegesis. It is often perfectly ludicrous, even as applied to single passages; but to go through the whole New Testament, reading plain narratives backwards or crosswise, or any way except the plain way,—dissolving facts into mistakes and myths,—is beyond all human patience. Take, for example, a single case. Let us hear how a rationalist, by no means the wildest of them, proposes to account for the history of the conversion of St Paul.

According to his account, Saul, the persecutor, must be supposed to have left Jerusalem with all the bigotry, and in the savage mood, imputed to him in the history and acknowledged by himself; with the conscientious self-approval of that pious work in which he was engaged, and which he accounted an honour,—a zeal, no doubt, as in all like cases, inflamed by recent excesses, and chafed by opposition. As he is journeying along, he is led, quite as a natural thing, and in the way of self-dialogue, into a train of reflection on the enormity of his conduct,—that conduct which he deemed but the moment before so honourable;—on the innocence of the Christians, whom he deemed but yesterday traitors, apostates, and rebels, to the ancient theocracy; and finally on the excellence of Christ, whose image to Saul must have been that of a man who had suffered on the gallows,—for such was the cross to the imagination then, however hallowed now,—the just reward of his blasphemous presumption! Now, before proceeding further, one thing is clear; that if this gratuitous theory of the persecutor's change of mood, utterly unsupported by a single syllable of history, and utterly inconsistent with the conditions of a human mind in the state of the zeal-blinded and conscientiously-bigoted apostle, be received, it must be received as an express revelation from the rationalist school; and whether Paul ever received any revelation from Christ or not, it is certain that Paulus or his friends must have received some from St Paul.

But this is not all, or rather, it is a small part of what must be admitted, if we resolve on getting rid of the supernatural, and yet leaving St Paul a man in his senses; or, perhaps, it would be more proper to say, he must be supposed a much greater fool still, in order to leave him an honest man.

Just then, at this fortunate nick of time, and while the mind of the apostle is spontaneously softening towards Christianity, a thunder-storm occurs,—one of those signal blessings, without which a *rational* interpreter of the New Testament cannot get on for more than a few pages together; and the apostle strangely imagines that it lightens revelations, and thunders in Syriac or Hebrew; and though very much frightened indeed, answers the Syriac or Hebrew thunder in Syriac or Hebrew as grammatical as its own; and is again replied to in another well articulated clap of three or four sentences, directing him where to go and what to do, in the coolest and most comprehensible way. Surely if the lightning left Paul blind, it must have made his hearing uncommonly acute!

Such is the *natural* way in which rationalists propose to account for the apostle's conversion, and yet leave him a sincere and honest man; but it surely leaves him not only bereft of the light of his eyes, but of the light of his understanding also,—as very an approach to downright idiocy as any fanatic that ever lived. Can this be he who has led the world astray, and turned it upside down? Can this subject of weak hallucinations be the man on whose words so many intelligent, wise, and learned men of different ages and countries have hung as the accents of genuine inspiration? Can this be he whose writings and conduct everywhere proclaim zeal indeed, but a very masculine understanding also,—great prudence, self-control, and discretion? Can this be he who is one of the closest reasoners, and who, in the treatment of all practical questions, exhibits a sobriety and justness of thinking which have been the admiration of the world?

Is it possible for a man to go on interpreting thus? No wonder that the rationalist hypotheses have become a thing to point at. Nor is the Straussian theory, invented to supplant them, any better.

Who can believe, for example, that the intensely vivid and natural scenes of the Gospels and the Acts are myths unconsciously growing out of incidents and associations connected with the Old Testament history? Who can believe that the myths thus formed (if any could have been formed in such an historic age) would have been of so intensely *un*-Jewish, or rather *anti*-Jewish, a character; that they would have been characterized by such unity; but above all, that they would have been swallowed by the world at large as veritable *history*, and continue to be so received,

though containing, if myths at all, marvels and wonders more astounding than poet ever feigned!

It may be safely predicted, that Paley's work will be still read and admired long after these and other equally extravagant theories have passed into oblivion. The work is not, as too often represented, confined to the "External Evidences" alone,—much of it is given to the "Internal" also; and the chapters on the Morality of the Gospel, on the Identity and Originality of Christ's Character, and on Undesigned Coincidences, are equally full of force and beauty.

The *Horæ Paulinæ* is the work of Paley which displays most originality. As to the works on *Natural Theology* and the *Evidences*, it is in the general construction, the masterly manner in which materials, for the most part already collected by others, are built into a fabric, that the author's inventiveness is chiefly seen. But the *Horæ Paulinæ* is a felicitous thought, felicitously wrought out. There is indeed a pregnant passage of Doddridge, in which he speaks of the reciprocal support which the undersigned coincidences between the Acts and the Epistles give to the historic credibility of both; and another, still more general, in the *Pensées* of Pascal, hinting a similar thought in relation to the Gospels; but there is no proof that Paley saw either; while the extraordinary sagacity with which he has dragged latent coincidences from their lurking places, and shown correspondence where none had before suspected it, is all his own. If he had seen such hints, it would as little have abated his claims to originality, as the striking passage from Origen, prefixed to the *Analogy*, detracts from Butler's. But it was honest, as Sir J. Mackintosh says, in Butler to place it there; and if Paley had really had his work suggested by the passage in Doddridge, one would hope that he would have done the like.

The greatest work of Paley, taking it altogether, is undoubtedly his *Natural Theology*. It is true that Derham, Ray, and others, had done much before him, just as Lardner had been his pioneer in relation to the *Evidences*; but in either case previous writers were to Paley only what Hiram, King of Tyre, was to Solomon; they prepared the materials, of which Paley reared the temple.[1]

Such is the skill with which the *Natural Theology* is planned and executed—such the felicitous selection and disposition of the materials—so apt are the examples and illustrations—so luminous the expression—that, to a youth of intelligence, few novels are more interesting. Paley's survey of the ground, too, and the limits within which he resolved to construct the argument, show great logical sagacity. Clearly seeing that if the immensely varied and complicated "adaptations" of the universe can be shown to have originated in conscious intelligence, it will be difficult not to grant all the concessions which theism asks for; he avoids all the darker, especially the so-called *à priori* methods, though freely leaving any such methods open to those who choose to employ them, or who can profit by them. He therefore bends his chief energies to exhibit the indications of *design* in the universe, and for this purpose nothing can be more judicious than his choice of examples. Sagaciously perceiving that the phenomena of astronomy, though best calculated to give comprehensive views of the power and wisdom of God, *supposing His existence admitted*, are, from their vastness, apt rather to confound than aid conception, and, from their comparative simplicity, less obviously the fruit of design, he takes his chief examples from animal mechanism and physiology. His illustrations are drawn from ordinary objects, from every-day life, from the road-side, and are expressed in the most colloquial language. His descriptions of the eye, of the joints, of the process of digestion, of the circulation, of the eye of the mole ("a pin-point in a cushion"), of the contrivances for the lobster's changing his shell ("by which he takes off his boots"), of the specific lightness of the bones of birds (which he recommends the reader to verify "the next time he is engaged in picking the wing

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[1] A vehement charge of comprehensive *plagiarism* was some years ago preferred against Paley. It was alleged, that for the method, materials, and illustrations of his *Natural Theology* he was mainly indebted to a work by Dr Bernard Nieuwentyt (a Dutch philosopher), which, under the title of the *Religious Philosopher*, was translated into English in 3 vols. 8vo, 1718. The only instance of plagiarism, however, given by the accuser, is the "watch" illustration with which Paley's work commences. Hence it is argued, that Paley was indebted for his "*argument*" to Nieuwentyt. If indebted for anything, it is, of course, for the *illustration*, and not the argument, which was independent of the particular exemplification chosen, and might have been illustrated by half a dozen instruments of art just as well. It is not wonderful, however, that the "watch" (at once so familiar and so well adapted to the purpose) should have been employed; and if there is any special merit in *first* employing it, neither Nieuwentyt nor Paley can lay claim to that merit; it was employed, for example, by John Howe in his *Living Temple* (part i., ch. iii.) for the same purpose of illustrating the argument from design.

But certain *coincidences of expression* are also insisted on as tending to show that Paley had read the passage in Nieuwentyt. It is very possible; for Paley refers to his work in one place, and thus shows that he did not wish to conceal that he had been hunting for materials there as well as in the works of Derham, Ray, and other writers, to whom, in general terms, he acknowledges his obligations. But whoever reads the parallel passages in the two writers, and compares the tedious diffuseness of the one with the point and vigour of the other, will feel, that if the particular illustration was suggested to Paley by the Dutchman, everything in the passage which one would care to claim for Paley is still his.

In fact it is absurd to charge Paley with plagiarism for having selected matter from other writers; his whole work proceeds on that supposition; it is the manner in which he has employed his materials (in themselves common-place enough) that stamps his work as original. The *facts* of science he deals with, he did not *discover*; he knew perfectly well that he must be indebted for every one of them to others. But the same charge of plagiarism might be brought against any formal treatise either of science or history, for nine-tenths of the substance of it must exist in previous writers.

Such charge, if it had any force at all, might much more reasonably be brought against Paley for the use he has made of Derham and Ray; for he is more indebted to these than to the Dutchman. But he who is at the trouble of comparing them with Paley will soon find, that though the materials must of necessity be much the same, the interval is wide enough to leave Paley's originality, in all that is really claimed for him, unquestionable.

If anybody suspects that Paley has been indebted to Nieuwentyt for more than to Derham and Ray, we fancy a very slight inspection of the *Religious Philosopher* will undeceive him. It is a work of considerable scientific attainment, considering the times; but there is neither just method nor co-ordination of parts in it; it rambles over the whole field of human knowledge; it exhibits none of Paley's exquisite tact in selecting and rejecting materials in relation to their aptness for the purpose; it contains a great many crudities and not a few errors, both as regards fact and inference (the author, for example, questions the truth of the Copernican theory, and doubts whether the doubt can ever be decided); while the style is for the most part diffuse to tediousness. We have no hesitation in saying, that if, out of these three ill-compacted volumes, Paley had evoked such a work as his *Natural Theology*, by selections, by rejections, by condensation, by re-arrangement, and by diffusing over the whole the vivid lights of his vigorous mind and style, his claims to originality would have suffered as little abatement as that of Shakspeare (on whom a similar charge was once fastened), because in a few of his plays he has condescended to make use of materials of inferior dramatists, and turned by his magic touch their lead into gold.

The truth is, as just said, that the merit of Paley's work is that of having wrought materials, open to everybody, into a beautiful fabric; and to blame him that his materials were got from other quarters is much as if it were charged upon a great architect that his stone was not of his own quarrying, nor his bricks of his own burning.

The impress of Paley's very peculiar mind is on this work as on all the rest, and would alone show that it was no plagiarism, unless

of a chicken"); these, and many similar felicitous passages, will immediately occur to every reader. Painting by words has rarely been carried further than by Paley in many of the graphic passages of this masterly treatise.[1]

The argument, as he says, and as we all know, is *cumulative;* and every new instance of adaptation augments our conceptions of the Divine power and wisdom; but the *principle* of the argument is as well established by fifty examples as by five thousand, and to an ordinary understanding is more likely to appear conclusive; for multiplicity and complexity of "adaptations" will add nothing to the clearness of the reasoning, while they may easily bewilder and confound. Particular examples *must* always be taken; and it may be doubted whether advancing science will ever find any, for ordinary readers, at once so comprehensible and so much to the purpose as those Paley has selected.

Equally just and cautious are the observations of Paley on the mode in which the argument bears on the "Divine benevolence," the transition to which, from the indications of power and wisdom, is confessedly of some difficulty in the theistic argument. Contending that the indications of the former attributes are unlimited (whether illimitable or not) in extent and variety, he contents himself with showing that the immensely preponderant evidence, the *direct* and *obvious* purpose of almost all the "adaptations" in nature, indicates the Divine beneficence also. But he does not deny or evade the difficulties of the subject. The widely-extended phenomena of *evil,* for the permission of which we must believe, but cannot see, that there are sufficient reasons, will always *limit* the argument in this direction, till we come to higher illumination than Reason alone affords us.

Various objections have been taken in these latter days against Paley's book, to which we must make a reference, though it must be brief.

Some theists complain that he does not take *other* methods—that he does not do *this,* that he does not do *that;* that he does not appeal to man's moral instincts, to his intuitive convictions of a Deity, sense of the infinite, and so on; that he is busy rather about the "means and machinery" by which the Deity works, than the "ends for which He works;" that he is more busy about the "reasons of belief," than the "object of faith;"—with much more to the same purpose, or rather to no purpose; for surely the question ought to be, not what a theist can accept as a sufficient dissertation on the Divine Existence and Perfections, but what an atheist will find it most difficult to evade; nor, again, whether a theist may not prefer another line of argument for himself, but whether he can suggest any which an atheist will find it less difficult to understand and embrace;—in other words, whether Paley does what he intends to do, and whether what he intends to do, be, with *reference to those whom he addresses,* the best adapted to produce a conviction of the existence of a personal Intelligence that has constructed and presides over the universe. If man can be brought to admit his argument, that one admission will pave the way for every other involved in the ordinary theory of theism. Nor, probably, was there ever a man who, admitting that of all the stupendous and complicated phenomena of the universe there has been an adequate personal intelligent Cause, hesitated long to admit all the corollaries to which his moral instincts, and the intimations of the Infinite within him would train him on; which then and then alone, cease to be whispers, and become articulate. He would feel little difficulty in inferring that this supreme Power and Intelligence were not only unlimited, but illimitable; and though he could not prove it (else he would be infinite himself), he would never doubt it. And even if any one, conceding a self-subsistent intelligent Cause of all things, possessed of power and wisdom adequate to account for their existence and conservation, were silly enough to deny His infinitude (of which, since his whole faculties would be lost long before he could embrace the dimensions of the attributes he *did* acknowledge, he could never judge), there would still be a GOD to *him*—a being known as such by the only proofs by which we can ever *practically* know that there is a God at all; known as the Creator, the Governor, the Disposer of all things. To *us* that is infinite which is without limit; to demonstrate the illimitable is beyond us; and if to *demonstrate* that God is infinite be necessary to a knowledge of Him, only God can know that God exists at all.

Some will say there is no better way in this controversy than that of appealing at once to a direct intuitive consciousness of an infinite God? But what if atheists deny that they have any such? What if they affirm that if there be any such voice within, it is, by itself, a whisper, or inarticulate? What if the majority even of theists say that such whispers are confirmations when made distinct, but are not first-hand grounds of conviction? What if they say that their convictions are so far dependent, at the very outset, on this question of the "Order" of the universe, that supposing confusion reigned in the natural world while the mind retained all its present powers (were that possible), they doubt whether any "intuitions" they have, would have satisfied them of the existence of a Deity, or even induced the faintest suspicion of one?

However, if any think some other way, *à priori* or otherwise, more effectual, Paley leaves people to take it. For ourselves, we do not believe there is any mode of *argument* so likely to meet the case of those *who profess to be atheists,* nor one which gives them so much trouble to reply to or evade. If any one choose to make the experiment with other methods, he will find, we suspect, that considerations which will well serve to enlarge, exalt, or intensify our belief, when once Paley's conclusions are admitted, are easily evaded if insisted on alone. The argument from design is the one which, in all ages and nations, has been the most efficient for conviction,—the argument which, as the philosopher and the vulgar, the heathen and Christian feel, leaves man "without excuse,"—which gives point to the question, equally understood by science and ignorance, "He that formed the eye, shall He not see? He that planted the ear, shall He not hear?" "The invisible things of God from the creation of the world, are clearly seen, being understood by the things that are made, even His eternal power and godhead."

The argument from the *moral* constitution of man is indeed equally strong, and more direct. But all one can do is, to appeal to the atheist's conscience; and if he denies that it is like ours, argument is at an end. And certainly he is as able here as anywhere else to take refuge in chance as accounting for moral as well as other phenomena; and it must be added, that it is too often the part of his nature with which man is most inclined to sophisticate.

Another objection recently taken up with much logical formality by some theists, is, that not "marks of design," as Paley urges, but "order" in the universe, is the great point to be insisted on; that it is this which renders the argument valid. We cannot say we see much in the distinction. That which gives force to the consideration of "order" in the world is that also which gives force to

all of them be so. We have said nothing about the moral improbability of Paley's being *consciously* a plagiarist; but, considering the entire character of the man's intellect, it is about the last meanness of which we should suspect him.

[1] Paley's homely science, in these and other passages of his great work, is beautifully illustrated in an article on the "Works and Character of Paley," inserted in the *Quarterly Review,* vol. xxxviii., pp. 305–335.

"marks of design;" it is because what we call order indicates "design" that we so call it. A system which discloses "order" must disclose adaptations of part to part, and of subordinate parts to the whole, and therefore "design."

Another and more subtle objection is, that whether we call that which justifies Paley's conclusion the evidences of "order" or "marks of design," "Paley does not sufficiently investigate the metaphysical principles of belief which impel the human mind to infer intelligence from such indications. It may perhaps be said that he considered this both beyond his province, and not at all necessary. But it may be affirmed, that man, in so inferring, acts upon the strictest principles of induction, and, unless the very constitution of his mind be altered, must, *whether his conclusion be right or wrong*, so infer. Man sees that in all the products of intelligence he *can* examine, these marks of design are found; where intelligence, he is sure, does *not* act, he sees the marks of *design wanting*. It is inevitable with him, therefore, to think it infinitely probable, when he meets with "marks of design" in any object, that they are due to intelligence, and not unconscious chance or necessity, or unconscious anything else. If, to-morrow, men met with any works as evidently designed for a purpose, as a watch or a steam-engine, but so completely beyond any present development of human power as to cause doubts of their human origin, and so unlike those of nature as to cause doubt whether they had the same origin with these, there is not one in a million who would not at once infer that intelligence produced them, though what sort of being it was in whom that intelligence resided,—whether he had two heads or one, seven senses or ten, six pairs of eyes or twenty,—we could not tell from the "marks of design" alone. Familiar with multitudinous products, possessing certain similar characteristics, which *are* the fruit of intelligence; and failing to see, where we know that intelligence does not act, any such products; men would at once infer, as the infinitely greater probability (and this, on subjects where *demonstration* is impossible, is to them *certainty*), that such newly-found specimens of "adaptations" as we have above imagined, were due to intelligence; just as confidently as Robinson Crusoe inferred, when he saw the solitary imprint of a footstep on the sand (though he had seen no traces of anybody having been on his island till that moment but himself), that it *was* a print of a foot; and did not begin to speculate as to whether it was not *possible*, though infinitely improbable, that some chance motions of the winds and waves might have produced the ominous impression. It is much the same with the phenomena of nature. From what we know of *analogous* phenomena, we cannot but ascribe them to intelligence, if we act on the principles of the inductive philosophy at all. Hence, as before said,—whether the inference be right or wrong,—thus men have always inferred, and thus they always will; and so the atheistical hypothesis, even if true, is certain of rejection. The evidence, though not demonstrative, is just as sure as that which leads us to believe that if a man throws sixes fifty times running, the dice are loaded. This, too, suggests the answer to another objection, to which a passing allusion may be made. It is that urged by Hume, and, with all his customary plausible subtlety, before Paley wrote. He admits the validity of the ordinary mode of reasoning as applied to our fellow-men, and to any works of theirs, but pretends that we cannot reason similarly in relation to a work (if it be a work) so *unique* as the universe; to effects so immeasurably beyond our adequate comprehension. "We have never seen," he says, "the great Artificer at work." The answer is (as Chalmers and many more have justly said), that it is not necessary that we should see "the Artificer at work," or even comprehend his work as a whole. Men, in general, reason just in the same way of that which exhibits *indications* of purpose and design, whether they have ever "seen the artificer at work or not;" and would do so even if, in a millionth case, such *indications* did *not* originate in design. It will not be denied that they thus reason when they see a machine or an instrument evidently so constructed as to subserve a given purpose, though they may never have seen one like it before, and though they may never have seen any artist at work on any part of it. The atheist may say they have seen *analogous* things done; the answer is—Just so: and men reason in the same way to the intelligent origin of the works of creation. He will perhaps rejoin, "But they have seen very *similar* things done." We answer, It may be, and sometimes is, the case, that there is less similarity between certain instruments of art and certain other instruments of art,—for example, an air-pump and a microscope,—than between certain instruments of art and certain instruments of nature, say an eye and a telescope; but the indications of design in the former case would be quite sufficient to settle the question of an originating Intelligence; why not in the latter?

Another favourite argument of many modern atheists is, that if any thing at all be inferred as to the attributes of an unknown Cause of all things, from any analogies in ourselves, we must infer that God not only has power and wisdom, but an organization also like ours; that he acts as we do; and that his power and wisdom must be manifested in similar ways; so that between Hume's argument and this, it is impossible atheism should fail. "You can infer nothing," says Hume, "respecting the author of a work so unique." "If you infer anything analogous to man in Him," say these astute opponents, "you must infer everything analogous."[1] To this ridiculous argument it might be sufficient to ask whether, if a man saw an exact imitation of a bird's nest, without positively knowing it to be an imitation, and so did not know whether it was the work of a man or a bird, he must infer that, because whoever made it must have had *some* properties analogous to those of the bird (otherwise there would not have been the same work), he must necessarily have wings and feathers also!

The editions of Paley's works, separately and collectively, are numerous. The edition of the *Natural Theology* by Lord Brougham and Sir Charles Bell is too well known to require commendation. The fullest account of his life is that by Meadley; but it is not worthy of its subject. (H. R.)

PALIANO, a town of the Papal States, in the province of Frosinone, 7 miles N.W. of Anagni, and 32 E.S.E. of Rome. It is surrounded with walls of considerable strength; and contains a large baronial castle, which was for a long time occupied as a residence by the powerful Colonna family. This family was descended from Pierre Colonna, a vassal of the pope in the eleventh century, and counted among its members Pope Martin V., as well as numerous prelates and generals. Pop. about 4000.

[1] Indeed, it is a favourite misrepresentation of theirs, that the language of writers on natural theology, in consistency with some supposed logical necessity, degrades the Deity into a laborious "mechanic." The answer, of course, is, that it is a mere misinterpretation of the obvious meaning of these writers. All they mean to assert is, that there must be power and intelligence in the supreme Cause of all, proportioned to the production of the phenomena ascribed to him; just as there must be in man, proportioned to the phenomena of *his* power and intelligence; but though, in expressing this, they necessarily use figurative language derived from the analogy of man's nature, they plainly do not intend to imply that the *modes* in which wisdom and intelligence on the part of God and man are respectively exerted or manifested are the same; or that what is *long-sought, laborious, and successive* in man's mind is at all so in God's. And as this is the meaning of these writers, and their sole meaning, so it may be doubted whether there ever was an atheist who really misunderstood it.

PALIMPSESTS.

Palimpsests.

PALIMPSEST (in Greek παλίμψηστος, a word formed from πάλιν, *again*, and ψάω, *I wipe*, *cleanse*, or *rub*), is a term applied to a manuscript, from its having been twice cleaned or twice prepared for writing. The name has been supposed by some etymologists to be derived from the *obliteration* or *erasure* of the original writing; but it is rather founded upon the *re-polishing* (ψάω), or *re-preparation for writing*, of the parchment or other material on which the original had been written. It is easy to remove the traces of writing from parchment by rubbing it with pumice-stone or some similar substance, especially if the writing be of some antiquity; and if the surface be afterwards smoothed and polished, no one, by merely looking at it, would suppose that it had ever been written on. The practice of thus preparing parchment and other writing materials a second time for use existed among the ancients; and the material so re-prepared was known by them under the same name of palimpsest; but they also applied that term to leaves or books which were so prepared that one writing could easily be expunged to make room for another, and which were used by authors for correcting their works or submitting them to revision. In this sense palimpsests are mentioned by Cicero, Plutarch, and Catullus. Cicero (*Ad Familiares*, vii. 18) praises the frugality of his friend Trebatius in writing upon a palimpsest, but at the same time playfully expresses his wonder as to what may have been the original writing, which could have been of less importance than the letter for which it had been displaced; and Catullus (xxii. 5) ridicules a bad author for not writing his works at first on palimpsests, but entering them at once, crude and uncorrected, in fine and costly books. In a word, the palimpsest alluded to in these and similar ancient authorities was one of the devices to supply the place of the modern slate or scribbling-book, and served the same purpose as the wax tablet (*tabula cerata*).

There seems little doubt, however, that, besides this temporary expedient, the practice of preparing parchment or papyrus a second time for permanent use, and of writing short pieces, and even entire books, upon such material, was well known in classic times, not only among the Greeks and Romans, but also among the Egyptians. (Wilkinson's *Egyptians*, iii. 151.) But when it is remembered that, except the charred papyri of Herculaneum, and the funereal rolls of the Egyptians, no actual remains of the writing of the ancients have reached our time, it need hardly be said that no palimpsest re-written in the classic period has yet been discovered.[1]

The palimpsest manuscripts which have proved so valuable a mine for the research of modern scholars are of more recent date, and had their origin in the dearness and scarcity of writing materials from the seventh century downwards. During the early Roman empire, the comparatively abundant supply of papyrus from the Egyptian market precluded the necessity of having recourse to what was, at best, the tedious and clumsy process of re-preparing the material already used; and from the time when Theodoric the Great, in the beginning of the sixth century, abolished the duty on the importation of papyrus, the scribes and copyists of the West confined themselves in great measure to its use, except for more solemn and important documents. But at a later period, when the complete division of the empire rendered the intercourse with the East at once difficult and irregular, the old expedient was revived; and as, in the anarchy consequent on the successive occupations of Italy by its barbarous conquerors, the ancient arts and manufactures fell into decay, and the home production of parchment became exceedingly limited, it came to pass at last, when the Saracen conquest of Syria and of Egypt deprived Europe entirely of the papyrus, that the art of cleaning and re-preparing parchment already written upon furnished almost the only writing material sufficiently cheap for the uses of the less opulent copyists of the West. And hence it is that the practice of copying upon re-prepared parchment, if we are to judge from the specimens which have reached our time, came into use at a somewhat earlier period in the western division of the empire, where the want of the papyrus was earlier felt. Re-written Latin manuscripts are met with which appear to have been re-transcribed so early as the eighth, and even the seventh century; but in the Greek palimpsests the second writing commonly dates no earlier than the eleventh, and even the twelfth or thirteenth century. It has commonly been supposed that this practice of the mediæval scribes was the occasion of a vast and reckless sacrifice of ancient manuscript; and many writers have ascribed to the demand which it occasioned, coupled with the imputed indifference, and even hostility of the period towards ancient learning, that wholesale disappearance of so many Greek and Roman classics which modern scholars have to deplore. But the palimpsest manuscripts hitherto discovered furnish little evidence of any intentional destruction of *perfect* ancient writings. All the remains of Greek and Roman literature contained in the very largest palimpsests which have been deciphered, or which are known to exist, are in so miserably mutilated and fragmentary a condition, as to suggest, in most instances, the belief that, when broken up for the purpose of being re-used, the originals were already imperfect, and perhaps cast aside as useless. Bruns' palimpsest of Livy contained only a fragment of the ninety-first book; the re-written manuscript of Pliny's *Natural History*, discovered by Mone, has but a small portion of a few of the early books; Pertz's *Granus Licinianus* is but a scrap; and a palimpsest of St Jerome's *Commentary*, mentioned by Mone (*Lateinische und Griechische Messen*, 162), contains parts of no fewer than seven different works. Even the larger and more important palimpsests deciphered by Mai,—the Cicero *De Republica*, the Plautus, and the great palimpsest of the historians,—are all unhappily in such a state of imperfection, as to make it impossible to suppose that the copies of the original authors on which the transcriber laid his hand were other than fragments, already of little value from their defective condition. Some palimpsests, indeed, are made up of miscellaneous fragments from isolated leaves of different writers, seemingly little better than the refuse of some book-shop or library.

But, whatever may have been the condition of the originals which were selected for re-transcription by the mediæval copyists, even the fragments of ancient writing which they have thus been unconsciously instrumental in preserv-

[1] And yet a relic of that time, of equally, or even more perishable material, has been preserved. In the year 1840 two ancient waxen tablets (dating from A.D. 169) were discovered in a state of high preservation—one in a gold mine in the village of Abrudbânyá in Transylvania, the other in the immediate vicinity, with the wax and the characters inscribed upon it almost perfect. They are described by Dr Massmann in a dissertation published at Leipsic in 1841. The tablets are of the triptych form—one of fir, the other of beech. Their form and construction exactly answer to the description of the *tabulæ ceratæ* given by our antiquarians, but the writing upon them runs from right to left, beginning upon what we should call the last page, and ending at the bottom of the third. See also an article by Dr Detlessen in the *Sitzungs-berichte der Kaiserl. Academie der Wissenschaften*, vol. xxiii., pp. 601 and following.

ing are unquestionably of deep interest, and in many cases of great value, for the modern cultivators of ancient learning. With the profound and far-seeing critical sagacity which distinguished him, Montfauçon (*Palæographia Græca*, p. 223) early called attention to the fruits which might be expected from a careful examination of these buried treasures; nor has the exploration (although it has not resulted in the recovery of any *complete* work of antiquity) disappointed his expectations. The labours of the learned in this department have already resulted in many great discoveries, and have given promise of many more. Some invaluable fragments of ancient works, believed to be entirely lost, have already been recovered; and the hopes which may fairly be entertained of future acquisitions from the same source will best be estimated by a short account of what has actually been effected within the present century.

The value of ancient manuscripts has long been rightly appreciated; and hence in every part of Europe they have been collected at great expense, and preserved with the utmost care. For some time after the invention of printing it was indeed thought that, when the contents of a manuscript had been copied, and multiplied by means of that invaluable art, the original was rendered useless. But, as different manuscripts of the same work often vary in particular readings, it was soon found necessary to examine and collate a number of them, in order to ascertain the preferable readings; and without this previous care, conjoined with critical discrimination, a new edition of an ancient work would not now be well received by the learned. Such, then, is the most direct and obvious use of ancient manuscripts; which, when duly collated, furnish the means of restoring texts that had been corrupted or mutilated in the course of frequent transcription.

But, on a more minute examination of a certain class of manuscripts, it appeared that some of them might have a value hitherto unsuspected, by supplying more ancient copies than were previously known, and even furnishing portions of important works which were supposed to be entirely lost. These were manuscripts in which the attempt to obliterate some more ancient writing, in order that the parchment might be again used to receive another work, had been so far ineffectual that traces of the ancient writing still remained discernible, and capable of being partially or entirely deciphered by the patience and ingenuity of literary explorers. Certain manuscripts of respectable antiquity were thus found to conceal others several centuries older, and frequently of much superior interest and value. The number of such manuscripts, or portions of manuscripts, which existed in the several great libraries of Europe must have been very considerable. One of the earliest editions of the *Clementine Constitutions* (1476) was actually printed on palimpsest parchment. Many have been preserved in our own time; and a fresh impulse has been recently given to the zeal of the learned by the interesting discovery, that many of the long-neglected manuscripts of the churches and monasteries of the Levant are of the same palimpsest class. The character and appearance of different palimpsests differ very considerably. In some the ancient writing has been so imperfectly effaced, whether by washing, or by rubbing with pumice-stone or some similar substance, that the more modern writing interferes but little with the distinctness of the original; so that it may be deciphered by a practised eye, or at least can be so far revived by certain simple applications, and by exposure to the light, as to be read with little difficulty. In others, however, in which, besides the sponge and the pumice-stone, the scraping-knife had been freely used, it is only by the use of very powerful chemical agents, which shall be described hereafter, and by the aid of strong lights and lenses of considerable magnifying power, that the contents can be discovered. In some palimpsests the modern scribe has exactly preserved the form of the ancient sheet, and has divided his pages in the same manner; but, more commonly, the new writing exhibits an entire disregard of the order of the original. Sometimes, where the original page was divided into two or three columns, the modern matter is written over them all in one unbroken line; sometimes the original sheet is folded double, or even cut in half; sometimes the page is turned upside down; sometimes the new writing runs diagonally across it; sometimes (most perplexing of all) it follows closely line for line, and even letter for letter, the tracks of the original, so that the characters blend and run into each other, and the distinction between new and old is only discernible from the uncertain test of the different colour of the inks, or of the diversity of the form of the characters. These difficulties are tenfold exaggerated where the characters of the original were minute, and where the modern writing is of the same size and in the same language. We shall see examples hereafter in which the original has been *twice* written upon; and others in which, if we reckon corrections, no fewer than four different writings are found in the same palimpsest.

In the ages which immediately succeeded the invention of printing, the attention of scholars was so engrossed by the numberless manuscripts of ancient authors which abounded in all the great centres of learning, that the hidden stores of palimpsest literature were unobserved or disregarded. But so soon as the first harvest, so to speak, had been gathered in, and men began to prize even the gleanings which had escaped the early labourers, the value of these buried treasures did not long remain unnoticed. It is true that, as has been already observed, all the palimpsests hitherto discovered have been but fragments, and that a large proportion of them consist of works previously known in a much more complete form. But it will be seen, nevertheless, that, even already, several of those which have been deciphered have contributed to fill up a very considerable gap in the lost literature of the ancient world; and even those which contain works already known and published have this important advantage for the purpose of criticism, that they supply copies of these works earlier by several centuries than the very earliest of the original manuscripts of the same works already in existence. The immense importance of this circumstance, especially for the uses of the biblical critic, it is impossible to overrate.

The fruits which may yet be anticipated from the full development of these curious and interesting researches will be best understood from a short history of the successes which have been already obtained. For the sake of clearness, we shall consider—*first*, Sacred palimpsests; and, *secondly*, Palimpsests in profane literature.

Biblical palimpsests.

I. By far the most important relics of the first class are the Biblical Palimpsests.

The first rescribed biblical manuscript of which any important use was made appears to have been *Codex Ephremi*, or *Codex Regius* of Paris. The more modern writing in this manuscript contains certain works of St Ephrem the Syrian, in Greek; the more ancient seems to have contained the whole of the Old and New Testament, in a character and style of Greek writing which Dr Tischendorf of Leipsic assigns to the fifth century. Of this manuscript there are 209 leaves remaining, 145 of which belong to the New Testament, and comprehend nearly two-thirds of the entire text; but the leaves appeared to the first explorers so miserably confused and misplaced, and with so many chasms of various kinds, that sometimes scarcely a word could be deciphered in a whole leaf. Nevertheless, the difficulties occasioned by these defects and mutilations have not deterred critics from endeavouring to make the most of the *Codex Ephremi*. It was first observed and examined by Jean Boivin, from whom Küster obtained several important readings, which he inserted in his reprint of Mill's Greek Testament in 1710;

and Wetstein afterwards, at the instance of Bentley, collated with great diligence all that it contains of the text of the New Testament. Griesbach considers this as the most ancient manuscript collated by Wetstein; and there can be no doubt that the readings thus obtained confer a particular value on his edition. For a long time, however, nothing of real importance was done in the work of deciphering it; but at last, in 1834–5, M. Hase, by the use of a chemical preparation known by the name *tinctura Giobertina*, succeeded in reviving the ancient writing to a degree far beyond the expectation of the first explorers; and in 1840–1 Dr Tischendorf devoted himself to the task of preparing for publication the New Testament fragments, which he finally accomplished in 1843. In 1845 he completed the work by the addition of those fragments of the Old Testament which are contained in the palimpsest. An additional source of the interest and the value which attach to this curious palimpsest is the circumstance that, previously to its being turned to its modern use by the transcriber of St Ephrem in the thirteenth century, the original had undergone three distinct corrections, by different hands and at remote intervals, in the sixth, ninth, and eleventh or twelfth centuries; most of which corrections are still distinctly traceable, and supply an interesting practical commentary on the history of the text.

The next discovery amongst manuscripts of this description was one of a very interesting kind. Ulphilas, bishop of the Goths in the fourth century, is known to have translated the whole Scriptures into the language of that people, who had lapsed into Arianism. For this purpose he invented for them a new character, consisting of letters borrowed chiefly from the Greek. This work, however, had long been lost, with the exception only of the part containing the four Gospels, which is preserved in the University Library at Upsal, in a manuscript called *Codex Argenteus*, from being written chiefly in letters of silver. But in the year 1755, F. A. Knittel, having been appointed archdeacon of Wolfenbüttel, began to explore the treasures contained in the Augustan Library in that city; and in the course of his researches a palimpsest manuscript[1] of the *Origines* of Isidorus of Seville was pointed out to him as containing, under that writing, the translation of the Epistle to the Romans by Ulphilas, together with two other Greek fragments of the Gospels. The first of these (known to biblical critics as the *Codex Guelpherbytanus* A) consisted of forty-three leaves containing parts of each of the four Gospels. It is believed to be of the sixth century, and its readings have been highly valued. The second (called *Codex Guelpherbytanus* B) consisted of thirteen leaves containing parts of St Luke and of St John. It seems to be of the same period with the last. Knittel's interest, however, was principally fixed on the fragment of Ulphilas. On examination, it proved that the manuscript did not contain the whole Epistle to the Romans, but only a portion of the latter part, viz., the eleventh and following chapters, as far as the thirteenth verse of the fifteenth, accompanied by a Latin version written in parallel columns, which is in itself of no slight interest, as it is earlier than the revision of the Vulgate by St Jerome. Knittel immediately set himself to work on this curious fragment; and although, from the state of the leaves to be deciphered, the difficulty of the task was great, yet his zeal carried him through; and towards the end of the year 1758 he announced the intended publication by subscription. Various obstacles, however, retarded its appearance till the year 1762, when the laborious decipherer was enabled to publish the whole in quarto, with twelve large plates, accompanied by an account of the manuscript, and copious illustrations of its contents. The diligence of Knittel omitted nothing that could render useful the recovered fragments both of the two Greek manuscripts and of the Gothic version. The latter, in particular, he carefully compared with the *Codex Argenteus* at Upsal, and ascertained that the Wolfenbüttel palimpsest did not form part of the same, but only of a similar manuscript. From the different fragments he extracted all the various readings. These fragments were reprinted by Busching in 1773, and by Zahn in 1805. But by far the most important contribution to our knowledge of the version was made in 1817 and the following years, by the celebrated Angelo Mai (of whom we shall have occasion to speak more at large under the head of "Classical Palimpsests"), and his friend and fellow-labourer, Count Carlo Castiglione, from five different palimpsests discovered by Mai in the Ambrosian Library at Milan, and containing, under modern transcripts of various authors,—St Gregory the Great, St Jerome, Plautus, Seneca, and the Acts of the Council of Chalcedon,—nearly four hundred pages of fragments of the Gothic version of the Epistles of St Paul, of the Gospel of St Matthew, and some of the books of the Old Testament. All the fragments of this version, from whatever source, were collected into the edition of Gabelentz and Löbe, which appeared in successive parts at Leipsic, from 1836 to 1845; and a complete critical edition has still more recently been published by Dr Massmann (Stuttgart, 1855). The next in the order of time among the biblical palimpsests is that of Dr Barrett of Trinity College, Dublin; an elegant volume (Dublin, 1801), containing a great part of the Gospel of St Matthew, copied from a rescribed manuscript in the library of that college. This palimpsest appears to have been rewritten in the twelfth or thirteenth century upon portions of much more ancient books. The most important of these, however, was the portion which contained the copy of St Matthew's Gospel, whereof this fragment remained, written in uncial letters; and, judging by the usual marks of antiquity, it seems to belong at least to the sixth century. A part of Isaiah in Greek, and some of the Orations of Gregory Nazianzen, were likewise found in it, but were considered as of less moment. What remains of St Matthew's Gospel is printed on sixty-four engraved fac-simile plates, each representing a page of the manuscript, and containing from twenty-one to twenty-three lines, disposed in a single column, with the text in the ordinary Greek character upon the opposite page. This valuable fragment commences with part of the genealogy, at verse 17, chapter i., and extends, with occasional chasms, to chapter xxvi., verse 71; and it is also represented in an equal number of pages printed in the ordinary Greek character. Copious prolegomena are prefixed, giving an exact account of the state and characters of the manuscript; and subjoined is a careful collation of the *Codex Montfortianus*, in the same library, with Wetstein's edition. Unfortunately, however, the text, as printed in the ordinary Greek characters, is by no means a perfectly accurate transcript of the engraved plates; and this circumstance, as well as the defective condition of many of the pages, having created a general desire for the re-examination of the Dublin palimpsest, Dr Tregelles, in 1853, by the aid of active chemical agents devised by more modern manipulators, succeeded in bringing to light "*all* the older writing, hardly even a letter excepted." It is to be regretted, however, that, in the re-binding of the manuscript since its publication by Dr Barrett, some portions of the ancient writings have been lost, through the efforts of the ignorant workman to give an air of neatness to the volume, by *squaring the leaves and paring them to an even edge.*

By far the most important discovery in modern biblical

[1] This manuscript is the celebrated *Codex Carolinus*. Its acquisition by the Wolfenbüttel Library is comparatively recent. But Cardinal Mai (*Classici Auctores*, i. 43) claims it, on the authority of Niebuhr and on intrinsic evidence, as once the property of the monastery of Bobbio, one of the many colonies of the early Irish monks in Italy, Switzerland, Southern Germany, and France.

Palimpsests.

palimpsest literature, is that of the palimpsests comprised in the collection of manuscripts recently collected from the monastic libraries of the Levant, and deposited in the British Museum and the Bibliothêque Imperiale at Paris.

In one of these (known as the *Codex Nitriensis*, from the monastery of St Mary Deipara, in the desert of Nitria, whence it was obtained) Dr Cureton discovered (besides a most valuable fragment of the *Iliad*, of which we shall speak later) forty-five leaves containing fragments of the Gospel of St Luke, over which had been written a Syriac translation of the Monophysite treatise of Severus of Antioch against Grammaticus. The later writing was so heavy and so black, and the erasure of the original had been so successful, that it was exceedingly difficult to decipher it; but it was successfully collated in 1854 by Dr Tregelles, and was prepared by him for publication, had he not been anticipated by Dr Tischendorf in the collection to be described hereafter. These fragments are believed to be of the sixth century, and even of the early part of that century.

Another Syriac manuscript, in the British Museum, examined by him, contains a few palimpsest leaves, which are of extreme antiquity, and the under writing of which consists of fragments of St John's Gospel. The Greek characters resemble very closely those of the well-known *Codex Vaticanus*; and the Greek original of the palimpsest is especially curious, as having been at least *twice* written over in Syriac; so that it belongs to the class (of which we shall see two other examples) of *thrice-written* manuscripts.

No modern biblical editor, indeed, has laboured in the field of palimpsest literature with such perseverance and with such success as Dr Tischendorf. In addition to his re-collations and reprints of almost all the most valuable early editions of the sacred texts, he has, with infinite industry and research, given to the public many most curious and valuable fragments of the Old and New Testaments, collected by himself from palimpsest sources. A few of these are of western origin; but the greater and much more important portion is from the Syriac and Armenian palimpsests of the collection already described. They are for the most part contained in his magnificent publication, *Monumenta Sacra Inedita*, vol. i., 1855, vol. ii., 1857. The first volume is entitled *Fragmenta Sacra Palimpsesta; sive Fragmenta cum Novi tum Veteris Testamenti ex quinque Codicibus Græcis Palimpsestis antiquissimis nuperrimé in Oriente repertis. Addita sunt Fragmenta Psalmorum Papyracea, et Fragmenta Evangelistariorum Palimpsesta; item Fragmentum Codicis Frederico-Augustani, nunc primum eruit atque edidit* Œnoth. Frid. Const. Tischendorf, Lipsiæ, 1855. This most beautiful volume consists of fragments deciphered from seven palimpsests, of which five were brought from the East: one is preserved in the Barberini Library at Rome, and one in the Library of St Mark's at Venice. The first, the modern writing of which is Armenian, contains forty-eight pages of fragments of the New Testament—of the Gospels, of the Acts, and of the Epistles of St Paul to the Corinthians and to Titus. The second, under some Greek lives of saints and a homily of John of Damascus, contains large fragments of the book of Numbers and some portions of Isaiah. The third, in which the modern writing consists of the lives of four saints—Euthymius, Sabas, Abram, and Theodosius—in Arabic, contains fragments of Numbers, Deuteronomy, Joshua, Judges, Kings, and Isaiah; and the fourth and fifth, which were both re-written in Armenian, contain other fragments of the books of Kings. Dr Tischendorf's second volume is entitled *Fragmenta Evangelii Lucæ et Libri Genesis, ex tribus Codd. Græcis, quinti, sexti, octavi sæculi; uno Palimpsesto ex Libya in Musæum Britannicum advecto; altero celeberrimo Cottoniano ex Flammis erepto; tertio ex Oriente nuperrimé Oxonium perlato*, Lipsiæ, 1857. The most important among the contents of this volume are the fragments of St Luke's Gospel, already referred to as discovered by Dr Cureton in the *Codex Nitriensis*. They extend to ninety-five pages. The volume also contains fragments of the Gospel of St John, from a palimpsest, re-written, with some hymns of Severus the Monophysite, in Syriac; a few pages of Ezekiel, also from a Syriac palimpsest; and two pages of the third book of Kings, from a palimpsest partly Coptic and partly Syriac.

Such are the most remarkable contributions to the original text of sacred Scripture from palimpsest sources. These contributions are in all likelihood but an earnest of what may yet be anticipated; but even these are of a value which only scholars who are acquainted with the limited extent of the ancient sources of biblical criticism now available can fully appreciate. Perhaps, out of all the existing manuscripts of the original texts, the *Codex Vaticanus* and the *Codex Alexandrinus* are the only ones which exceed in antiquity some of the precious fragments thus unexpectedly recovered. We need hardly add that, unlike most other originals, every scrap of the sacred text, however minute, possesses a value of its own, entirely independent of the context or connection; and, therefore, that no fragment, however minute or however mutilated, can be overlooked by a biblical critic who is animated by the true spirit of his craft.

Of the other sacred palimpsests which have been as yet made public, the most important are a series of fragments of the early liturgies, both of the Greek and of the Latin churches, discovered in the library at Karlsruhe, in a manuscript re-written with St Jerome's *Commentary on the Gospel of St Matthew*. These interesting remains were published (with a fac-simile) by Francis Joseph Mone at Frankfort in 1850 (*Lateinische und Griechische Messen, aus dem zweiten bis sechsten Jahrhundert*). Many other fragments of the same character—liturgies, sacramentaries, rituals, canons, homilies, &c.—are known to exist. A few of them have been published by the same editor and by Cardinal Mai; and much information on the obscure but important subject of the early liturgies may be expected from a complete and careful examination and comparison of them all.

Classical palimpsests &c.

II. In ancient profane literature the additions from palimpsest sources have been much more numerous and considerable, consisting of large fragments of lost Greek and Roman classics, and of the text, and commentaries on the text, of ancient Roman law.

Bruns.

The first editor of a palimpsest relic of classical literature was Paul James Bruns, the coadjutor of Dr Kennicott in his great work of Hebrew collation. In 1773 Bruns discovered at Rome a fragment of the ninety-first book of Livy, in a rescribed manuscript of the Vatican collection; and in the same year it was published by the discoverer himself at Hamburg, and by Signor Giovenazzi at Rome. The fragment in question, which has been admitted as undoubtedly genuine into the later editions of Livy, contains part of the war with Sertorius in Spain; and the only subject of regret is, that this part is so small. Bruns first visited the Vatican on a mission from Dr Kennicott in reference to Hebrew collation; but having been thus fortunate in the investigation of a palimpsest, he renewed the inquiry in this country, and endeavoured to ascertain the number of such manuscripts in the Bodleian Library at Oxford. An account of his researches will be found in the *Literary Annals of Helmstädt*, which appear to have been conducted by Bruns during the years 1782, 1783, and 1784. A small portion of the ninety-first book of Livy, which Bruns failed in reading from the manuscript, was afterwards successfully deciphered by Niebuhr, who also supplied some other deficiencies, and published the entire book, together with another Ciceronian fragment, at Berlin in 1820.

Mai.

It remained, however, for another distinguished labourer in the new and interesting field of inquiry which had thus been indicated rather than explored, to surpass all his pre-

decessors and contemporaries, not only in discovering rescribed manuscripts, but also in extracting from them works or parts of works which were long considered as irrecoverably lost. We allude, of course, to the Abate Angelo Mai, doctor of the Ambrosian Library at Milan, afterwards first keeper of the Vatican, and finally (1838) cardinal librarian of the Roman Church, whose researches in this department were so extensive and important that he may truly be called the hero of palimpsests, and the discoverer of a new world of letters. (See MAI.) It was not till the year 1814 that Monsignore Mai made himself known by the partial discovery of lost works. A year earlier, indeed, he had employed himself in translating a large portion of the oration of Isocrates *De Permutatione*, which Mystoxides, a learned Greek, had published from a manuscript in the Ambrosian Library more perfect than any of the codices which had been followed by the editors of Isocrates. The quantity thus inserted in the oration increased it by at least one-half; and the same additional matter has since been found in some of the Vatican manuscripts. In publishing this translation, however, Mai modestly continued anonymous. But his name was destined soon to be illustrated by far more important labours.

1. His researches amongst palimpsest manuscripts commenced with certain hitherto unpublished fragments of three orations of Cicero, namely, those for Scaurus, Tullius, and Flaccus. These orations had been written in a quarto form, but had been partly erased and folded into an octavo size to give place to the sacred poetry of Sedulius. The newer writing was judged to be as old as the eighth century, and the original to be not later than the second or third. The manuscript had belonged to a very ancient monastery at Bobium, or Bobbio, in the Milanese, founded by St Columban, who had also formed its library; and in the collection obtained from the same venerable institution the greatest part of the rescribed manuscripts has been discovered. "In examining carefully some manuscripts in the Ambrosian Library at Milan," says Mai in his preface, "I observed that one of great antiquity was a palimpsest. This manuscript had belonged to the convent of Bobbio, a monastery in Liguria, situated in the midst of the Apennines, which was founded by St Columban in the year 612, and the monks of which obtained considerable reputation for learning as well as sanctity. Gerbert, a Frenchman by birth, who became pope under the name of Silvester II., and attained so much celebrity for learning that he is one of those who, in the rude popular tale, are reported to have sold their souls to the devil, was head of this monastery in the tenth century, and added greatly to the reputation of the place, as well as to the contents of the library. The Cardinal Frederigo Borromeo, who founded the Ambrosian Library at the beginning of the seventeenth century, purchased the principal part of the collection at Bobbio and brought it to Milan. Whilst I was examining these manuscripts," he adds, "I remarked that one, which contained some of the writings of Sedulius, a Christian poet, was a palimpsest; and on looking very closely and attentively I discovered traces of the former writing under the latter." He then read the titles, *pro Scauro*, *pro Tullio*, and *pro Flacco*, and was able, with some trouble, to decipher the whole of the fragments of these three lost orations, written in large and very beautiful characters, each page being divided into three columns. The oration for Scaurus was accompanied by *scholia*, elegantly written in small letters of a square form; and there were others in characters of a ruder form, but still ancient. These three fragments, together with the scholia (which Mai considers the production of Asconius Pedianus), were published at Milan, 1814, in one volume 8vo.

2. In the course of the same year Monsignore Mai produced a second volume, containing various fragments of three other orations of Cicero, with some ancient annotations and commentaries never before published. The portions thus recovered belonged to the orations against Clodius and Curio; to that *De Ære alieno Milonis;* and to the oration *De Rege Ptolemæo*. Of the oration *De Ære alieno Milonis* no other fragment was known until this discovery. These treasures had lain concealed under a Latin translation of the Acts of the Council of Chalcedon, and were adjudged by the discoverer to belong to the fourth century. The palimpsest from which they were discovered had formed part of the collection obtained from Bobbio. The older writing was in very large and handsome characters, but less beautiful than that which contained the fragments of the three orations mentioned in the preceding paragraph; and there were only two columns in each page, a circumstance which seems to indicate that the writing is somewhat less ancient. The contents of these two volumes the learned editor afterwards united into one, which he published in 1817, with corrections of the fragments that had first appeared, and some additional notes and illustrations. The great antiquity of the practice of rescription is sufficiently attested by these various fragments of Cicero's orations; indeed it is supposed that the speech for Scaurus was obliterated in the eighth century. But Latin manuscripts appear to have been more frequently subjected to this treatment than Greek manuscripts, or those in any other language. It is true, that in the "Collection of Greek Papyri from the British Museum," there is an ancient palimpsest papyrus, in which the original was the enchorial Egyptian, and the second writing is Greek. But this is a very rare instance; and even of this papyrus, it would be difficult to show that the date of the second writing is earlier than that assigned to the earliest Latin palimpsests.

3. The year 1815 proved very rich in discovery, and gave birth to no fewer than three volumes of unpublished works. One of these is peculiarly valuable and curious, as containing large portions of several orations of Symmachus, in whom, as Mai expresses it, breathed the last inspiration of Roman eloquence. The epistles of this famous orator were the only productions of his pen previously extant; but in these recovered fragments we have a copious specimen of his eloquence in two panegyrics on Valentinian, one on Gratian, a gratulation addressed to the father of the orator on his being appointed consul, and parts of several other works of the same kind, making eight in all. Mai likewise deciphered a portion of a panegyric of the younger Pliny which was contained in the same palimpsest, but of which only the various readings are here given. The original manuscript is supposed to have belonged to the seventh or eighth century. These interesting fragments were reprinted at Frankfort in 1816 in one vol. 8vo.

4. The same year another very ancient palimpsest was found in the Ambrosian Library, containing all the comedies of Plautus which have reached us, except four; and a fragment of the *Vidularia*, a lost comedy, of which all that previously remained consisted of about twenty lines, preserved by Priscian and Nonius. The ancient writing in this manuscript is exceedingly beautiful, and is supposed to be of the time of the Antonines; the more modern, consisting of part of the Old Testament in Latin, is conjectured to be of the seventh century. Mai deciphered a number of various readings, together with about sixty inedited lines belonging to the different comedies; and restored the following spirited lines of the *Stichus* (act i., sc. 5), which had previously existed in an imperfect state:—

> "Famem fuisse suspicor matrem mihi,
> Nam postquam natus sum, satur nunquam fui;
> Neque quisquam melius referet matri gratiam,
> Quam ego matri meæ retuli invitissimus."

This, therefore, is an important discovery, not so much on

account of what has actually been recovered, as by reason of the expectations which it is calculated to encourage. For if Monsignore Mai found a Latin Bible containing almost an entire copy of Plautus, it cannot be affirmed that any classical author is irrecoverably lost until every Bible in manuscript, and every other writing upon ancient parchment, has been diligently examined. There is no moment at which some important discovery may not be made, provided the labour of scrutinizing parchments be persevered in. That there are many palimpsests in the public libraries of Great Britain, particularly in the Bodleian at Oxford, which is singularly rich in manuscripts, can scarcely admit of a doubt. The number of manuscripts in Spain, and her vast mass of archives, have long been equally famous; nor is it impossible that several lost works, or portions of works, by Latin authors, may yet be found in that country. Although the search for manuscripts that are directly and obviously valuable may have proved fruitless, yet a very different result may follow when parchments are examined with a view to ascertain whether a lower stratum of writing exists beneath the sterile surface, and whether some of the most precious remains of ancient genius and eloquence may not be covered or concealed by the rubbish of chroniclers and ecclesiastical writers. It is true that much has perished irrecoverably. In the Protestant parts of Europe the most frightful havoc was committed at the Reformation. Huge volumes containing the ancient services abounded in all the churches and monasteries. Most of these had been brought directly from Rome; and in the days when books of this kind were transcribed, it may, by some, have been considered an act of piety to erase profane writings, especially if imperfect, in order to make way for the sacred offices. From the very nature of these books, indeed, there can be little doubt that much *ancient* parchment entered into their formation; and as they were carefully preserved, exempt from accident or injury, there can be little doubt that in many, perhaps in most of them, there existed under the rescription the remains of more ancient writings. Wherever they could be found they were consigned to the flames without mercy, in virtue of enactments which enjoined the destruction of all popish books; and inestimable chances of discovery were thus for ever lost to the world. But great as was the destruction which took place at the Reformation, enough still remains to warrant the conviction, that were there more Mais to examine and decipher palimpsest manuscripts, there would be numerous additional and most important discoveries. Who knows but that, in the most paltry and unpromising volume, may be found the works of the most eloquent of historians?—that

Pellibus exiguis arctatur Livius ingens?

5. The next discovery effected by Mai, from a manuscript of the same class, was that of the remains of the orator Fronto, who had flourished in the reign of Hadrian. This writer, though by birth an African, was in his day esteemed almost a second Cicero; yet of his writings little more remained than a few scattered sentences, preserved in the works of other authors. Mai, however, by his acuteness and perseverance, was enabled to recover a very considerable portion of Fronto's works, which he published at Milan in 1815, in 2 vols. 8vo, under the title of *M. Cornelii Frontonis Opera inedita, cum Epistolis item ineditis Antonii Pii, M. Aurelii, L. Veri et Appiani, necnon aliorum Veterum Fragmentis.* The contents of the first volume consist of one book of epistles addressed to Antoninus Pius, two books to Marcus Aurelius, and two to Lucius Verus; two books of letters to friends; several letters addressed to Marcus Aurelius, on the subject of the *Feriæ* at Alsium, a town in Etruria; and one to Lucius Verus, in which the orator laments the death of his grandson, one of the children of his son-in-law Victorinus. The second volume exhibits a considerable portion of two books, *De Orationibus*, addressed by Fronto to Marcus Aurelius; parts of various orations and epistles; and also a portion of an address to Antoninus, entitled *De Bello Parthico*, consoling him for the reverses experienced in the Parthian war. Then follow some important fragments under the title of *Principia Historiæ;* a few playful prolusions on lighter subjects; and a book of epistles written in Greek. The work is concluded with a collection of all the fragments of Fronto's works which have elsewhere been preserved, and with copious illustrations of those which were then for the first time published. In the palimpsest from which these curious remains were deciphered the more recent writing formed part of the Council of Chalcedon; but the manuscript was unhappily much damaged, and altogether in a very imperfect state. Fronto was a voluminous writer, and composed works upon various subjects, amongst which was an Invective against the Christians. He had a great reputation as an orator, and was accounted the Cicero of his time, although his style, which is said to have united the *siccum* and the *grave*, does not very well accord with such a distinction. The writings of so remarkable a person would, in any circumstances, be an object of interest; but they become doubly curious from having been thus marvellously brought to light.

6. In the meanwhile, Mai was preparing another publication of similar origin, which, in 1816, he gave to the world under the following title, viz., *Interpretes Veteres Virgilii Maronis; Asper, Cornutus, Haterianus, Longus, Nisus, Probus, Scaurus, Sulpicius, et anonymus; e Veronensi Palimpsesto;* and about the same time he discovered the palimpsest of the Gothic Bible of Ulphilas, his edition of which has been already described among the biblical palimpsests.

7. Mai now entered upon a more enlarged and important scene of action. His distinguished merit in this new field of discovery having obtained for him the notice of Pius VII., he was by that pontiff appointed keeper of the Vatican Library, and speedily justified this preferment by a discovery more interesting and valuable than any which he had hitherto made. In a palimpsest volume, which had formed part of the manuscript collection originally brought from Bobbio, and which contained, in the exterior writing, part of the commentary of St Augustin on the Psalms, he found that the interior or more ancient writing had consisted of the long-lost books of Cicero *De Republica*, the most celebrated of all his works, and of which nothing had been known, in modern times, beyond the fragments preserved in the writings of Macrobius, Lactantius, Augustin, Nonius, and others. This precious volume had been purchased by Paul V. more than two centuries before, with the knowledge that it was a palimpsest, and that it contained part of Cicero's treatise *De Republica*, though, by some strange neglect, it was reserved for Mai to bring its contents to light. It was still in excellent order; the characters were large and plain; and in the leaves which remained there was scarcely a page that could not be deciphered; but many of the pages were wanting; and there seemed reason to apprehend that the same deficiency would often occur in future discoveries, because the work last inscribed might not have been co-extensive with the original writing obliterated, and because, when the volume had been taken to pieces for the purpose of rescription, the whole of the leaves that contained the original writing might not have been put together again, but some of them applied to other purposes, and leaves taken from other works, or of new parchment, inserted in their place. But however this may be, in these invaluable pages a very considerable part of the first and second books of the celebrated treatise in question was found so perfect as to be completely recovered by the labour and sagacity

of Monsignore Mai. The portions of the work thus rescued from oblivion were published at Rome in 1821, with copious notes and illustrations, particularly an accurate account of the various chasms occasioned by the loss of original leaves, and accompanied with such a restoration of the four remaining books as could be effected from the less perfect portions of the manuscript, and the various fragments preserved by Sigonius and other critics. A finer specimen of editorial skill, learning, and sagacity is nowhere to be found.

The part of this important treatise which has thus been unexpectedly brought to light, is amply sufficient to give a clear insight into the plan and style of the dialogues, as well as into the characters of the various interlocutors under whose names the illustrious author chose to develop his own opinions. These were, the second Scipio Africanus, and his friend Lælius; L. Furius Philus; M. Manilius, whom Cicero elsewhere praises for his knowledge of the law; Sp. Mummius, the brother of Mummius Achaicus; Q. Elius Tubero; P. Rutilius Rufus; Q. Mucius Scævola; and C. Fannius, son-in-law of Lælius. The introduction to the first book is nearly complete; but that which stamps the highest value on the work is the luminous philosophy of the author on the subject of government and policy, as expounded by Scipio, the principal interlocutor, with unrivalled eloquence and felicity of expression. We now understand the grounds upon which the ancients preferred this to all Cicero's philosophical works; and on the whole, notwithstanding its still imperfect state, it is unquestionably one of the most interesting acquisitions that have been made in the department of classical literature since the original publication of the ancient authors soon after the revival of letters. May we not indulge the hope that eventually other important additions will be made to the invaluable fragment which Mai so laboriously and skilfully brought to light?

8. The zeal and the industry of Mai did not relax from success. On the contrary, soon after the appearance of the fragment of Cicero's treatise *De Republica*, he gave to the learned world another elaborate publication, containing, —1. Juris Civilis Antejustinianei Reliquia inedita; 2. Symmachi Orationum partes; 3. C. Julii Victoris Ars Rhetorica; and, 4. L. Cæcilii Minutiani Apulei Fragmenta de Orthographia. These remains were also recovered from a rescribed manuscript in the Vatican Library, and were, as usual, accompanied by notes, appendices, and illustrative plates.

9. But a much more valuable and generally interesting discovery awaited him. Students of Roman history have long deplored the miserably imperfect condition in which almost all its writers, native and foreign, have come down to our time. Of the works of the Greek writers upon Roman affairs,—Polybius, Diodorus Siculus, Dionysius of Halicarnassus, Appian, Dion Cassius, Iamblichus, and the writers of the later empire, Dexippus, Eunapius, Menander of Byzantium, &c.,—but a very small portion has been saved, and even that in far from a satisfactory condition, whether as to completeness or as to correctness of text. Now, by a rare literary favour of fortune, Mai was enabled, in one single publication, to restore to the world large extracts of each and all these historians, which, both in extent and in historical importance, far exceed all the contributions to their respective texts which, up to this day, had been made since their first publication in the fifteenth and sixteenth centuries. The original of the palimpsest in which these precious fragments lay buried was a sort of commonplace-book, which had been compiled by the order of the learned Emperor Constantine Porphyrogenitus, and in part, indeed, designed and executed by himself. It consisted of extracts from the most eminent authors, arranged under different *τίτλοι*, or heads, originally fifty-three in number. Of these fifty-three heads, however, only two were known before Mai's discovery. Every trace of the rest, with the exception of the names of twenty-two, had been lost; and the variety and the value of the selections from the ancient writers which they must have contained are best estimated from the portions which have been recovered. The palimpsest thus brought to light by Mai contained the title Πέρι Γνώμων, *De Sententiis;* and although, like every other palimpsest as yet discovered, very far from perfect, it comprised a large number of extracts from the lost books of the historians enumerated above. Of the thirty-five lost books of Polybius, for instance (out of forty of which his History originally consisted), the palimpsest supplies copious extracts from all but the last,—from the sixth to the thirty-ninth inclusively,—amounting, in the whole, to 100 quarto pages. The gaps in the *Historical Library* of Diodorus Siculus, of which twenty-six books out of forty have perished, are no less happily supplied. The extracts in the palimpsest commence with the sixth, and extend to the fortieth; making, in the whole, above 130 pages. Nine of the twenty books of the *Roman Antiquities* of Dionysius of Halicarnassus have perished. The Vatican palimpsest contained extracts from them all, to the extent of 64 quarto pages. The fragments of Dion Cassius recovered from the palimpsest are far from filling up the lamentable hiatus in his vast but sadly-mutilated History; but they are by much the most important and most considerable that had hitherto come to light; and they fill no fewer than 100 pages. The recoveries from the other historians are less considerable; but, even in themselves, they are of great value, although, in contrast with the superior extent and importance of the fragments named above, they will be comparatively overlooked. In one word, the appearance of this "Historical Palimpsest" of Mai, as it has been styled, may be regarded as an epoch in the search for the lost literature of Greece and Rome. It appeared, not as an independent work, but as one of the volumes of a vast collection of works in every department of ancient literature, sacred and profane, collected from the unpublished manuscripts of the vast store-house of the Vatican, filling ten immense quarto volumes, and entitled *Scriptorum veterum Nova Collectio*, 1831–8. The "Historical Palimpsest" was Mai's last great work in that line. Each of the three great collections which he subsequently published,—the *Classici Auctores ex Codicibus Vaticanis editi*, 10 vols. 8vo, 1828–38; the *Spicilegium Romanum*, 10 vols. 8vo, 1839–44; and the *Nova Patrum Bibliotheca*, vols. i.–vi.;—contains some interesting fruits of his old spirit of research,—fragments of Lucan, of Juvenal, of Persius, of Gargilius Martialis, and of Aristotle; but their materials are almost exclusively drawn from the unpublished manuscripts of the Vatican.

Niebuhr.

Long, however, before Mai had withdrawn from the work of palimpsest exploration, another labourer of high qualifications, who has been incidentally named already, Niebuhr, had entered the same field of inquiry. The library of the Chapter of Verona had long been famous for the number of the manuscripts contained in it; and it was also known to be remarkably rich in those which related to jurisprudence. In the *Verona Illustrata* of Maffei, published in 1732, the author had given an index to all the manuscripts, and particularly mentioned several leaves of parchment, some of which treated of prescriptions and interdicts, whilst others contained fragments of the Pandects and part of the work of an ancient jurisconsult; "quai codici, se si fossero conservati, niente si ha in tal genere, che lor si potesse paragonare." The leaves in question were afterwards bound up in a small volume, composed of fragments of different manuscripts; and extracts from both were published by Maffei, with a fac-simile of the characters, in his *Istoria Teologica.* But these curious relics attracted little attention, or rather were altogether forgotten, until the successful researches of

Mai had awakened and animated the curiosity of the learned. In the year 1816, Haubold revived the recollection of them by printing at Leipzig a treatise entitled *Notitia Fragmenti Veronensis de Interdictis*, which appears to have attracted considerable notice. In the same year Niebuhr, passing through Verona on his way to Rome, as Prussian envoy to the court of the Vatican, visited the Library of the Chapter, and, during two days which he passed at Verona, took an accurate copy of the fragment *De Præscriptionibus et Interdictis*, and also transcribed another, *De Jure Fisci*. But if this had been all, the labours of these two days, however meritorious, would perhaps have soon been forgotten. Fortunately for letters, however, he examined another manuscript, then numbered xiii., and found that the exterior writing contained some epistles of St Jerome, whilst a more ancient writing appeared underneath. On further examination, Niebuhr perceived that the latter contained the work of some ancient jurisconsult; and having applied the infusion of galls to folio 97, he so far restored the characters as to be able to transcribe the portion of the original text therein contained. He then communicated his discovery to Savigny, and with the assistance of the latter, published in a periodical work the specimen transcribed, accompanied with an ingenious commentary, in which he maintained that the manuscript referred to contained the Institutions of Gaius, the great Roman jurist, probably, under Marcus Aurelius, whose person and history have furnished such a theme for speculation to writers upon Roman law; and that the fragment *De Præscriptionibus et Interdictis* formed part of that work.

The result fully established the soundness of this conclusion. Two other labourers were therefore sent by the Berlin Academy of Sciences to work the mine which Niebuhr had thus happily opened; and, having obtained the permission of the Chapter, they transcribed the manuscript almost entirely, only about one-ninth part of the whole, or rather less, being found illegible. The transcript was immediately submitted to the Academy, and the Institutions of Gaius first appeared at Berlin in the year 1820. The manuscript from which this invaluable relic of ancient jurisprudence was recovered consists of 127 leaves, which have been *thrice* written upon. The more recent writing, which is in uncial characters and of considerable antiquity, contains some of the works of St Jerome, chiefly his epistles, of which there are twenty-six. The more ancient is of two kinds; the one remarkable for its antiquity and elegance, and the other intermediate,—that is, written *over* the first and *under* the third or last writing. The former of these is that in which the Institutions of Gaius were written; so that the intermediate kind had superseded the work of the Roman jurisconsult, but had, in its turn, yielded to the third and last writing. As to the age of the original manuscript, Niebuhr very early expressed an opinion that it was older than the time of Justinian; and Kopp, judging from the forms of the letters, the contractions, and various other indications, arrived at the same conclusion. It is creditable to the literary curiosity of Germany that the first edition of this work was almost immediately sold off. Blume, who had been concerned in the first transcription, paid another visit to Verona, where he re-examined the manuscript with great care; and the fruits of his labour appeared in the second edition, which was published in 1824. In the following year a third edition appeared at Leipzig, without the notes of Göschen, and with the modern instead of the ancient orthography, which had been religiously retained in the two Berlin editions. Gaius was somewhat late in attracting attention in France, where learned lawyers were once so abundant; but the translation of M. Boulet had the effect of partially awakening the curiosity of his countrymen, by rendering this invaluable relic of Roman jurisprudence more easily and generally accessible.

Niebuhr's contribution to Roman Law was followed up by Peyron, who, from a palimpsest of the Turin Library, published in 1824, *Codicis Theodosiani Fragmenta Inedita*, 4to, by Drs Pertz and Gaupp, who printed a portion of the Digest of Justinian, from a Neapolitan palimpsest, at Breslau in 1823.

Palimpsests recently discovered.

The reader will be more interested, however, in the history of the classical palimpsests. Dr Fridegar Mone, son of the well-known scholar of that name already alluded to, discovered, during the year 1854, in a Benedictine monastery in Carinthia, a manuscript of St Jerome's Commentary on Ecclesiasticus, the under writing of which consisted of portions of the first, eleventh, twelfth, thirteenth, and fifteenth books of Pliny. The original is exceedingly ancient. Dr Mone even ascribes it to the second century, and it was not without the utmost difficulty that he was enabled to decipher it. As Pliny's *Natural History* has come down to us entire, the recovery of these fragments is less important than would be a similar discovery of a lost classic, but their value nevertheless will be fully acknowledged by every critical scholar who is aware of the very obscure and seemingly corrupt condition of Pliny's text; and who recollects the light which has been thrown upon the last six books by the new readings from the Bamberg manuscript which Sillig gave in the last volume of his edition of 1831–6. Dr Mone has printed his Carinthian palimpsest in a type nearly fac-simile. (*C. Plinii Secundi Naturæ Historiarum Lib. I., XI., XII., XIII., XV., Fragmenta*, edidit Fridegarius Mone, D.Ph., 1855.)

The oriental collection, to the palimpsests of which biblical criticism has been, as we said, so largely indebted, has also afforded some important contributions to classical literature.

In the *Codex Nitriensis* already described, in addition to the fragments of St Luke deciphered and published by Dr Tischendorf, there was also discovered, under the same Syriac treatise of Severus of Antioch, a second palimpsest, containing large fragments of the *Iliad* of Homer. The original *Codex Nitriensis* was one of a collection of Syriac and other oriental manuscripts purchased for the British Museum from M. Pacho. When first examined, it was found to be defective; but fortunately the missing leaves were discovered in a second collection brought from the east by Dr Tattam; and the *Codex* now contains twenty-three quires (of five leaves each), twelve of which are occupied with the Homeric palimpsest. The whole has been carefully deciphered by Dr Cureton, and published in fac-simile, at the expense of the trustees of the British Museum, in a beautiful volume, entitled *Fragments of the Iliad of Homer, from a Syriac Palimpsest*, edited by W. C. Cureton, M.A., London, 1857. These fragments comprise in all 3873 lines; and although all their contents were previously known, yet their high critical value will be best understood from the circumstance, that the original from which they are printed is more ancient by several centuries than the oldest known manuscripts of the *Iliad*—than the celebrated "Townley Homer," than the "Bankes Papyrus," than the papyrus now in the possession of Mr Harris at Alexandria, and the Ambrosian palimpsest discovered by Mai. As a specimen of palimpsest typography, the book is one of the most beautiful hitherto produced.

Another, and still more curious fruit of the Syriac palimpsests, and the last[1] which we have to record, was published a few months since at Berlin, from a codex in the

[1] Some slight fragments of Lucan, Seneca, Aulus Gellius, and Hyginus the fabulist, deciphered by Niebuhr; of the *Phaëton* of Euripides, published by Hermann (Leipsic, 1821); of Sallust, Pliny, and Lucan, discovered by Pertz; and a few minor scraps, might also be mentioned; but they do not require any detailed notice.

same collection of the British Museum—*Gai Grani Liciniani Annalium quæ supersunt, ex codice ter scripto Musæi Britannici Londinensis, nunc primum edidit Karolus Augustus Fridericus Pertz, Ph.Dr.*, Berolini, 1857. The palimpsest was first observed, and in part transcribed, by the father of Dr Pertz, the well-known historian and antiquary of that name; but it was not till the year 1856 that the younger Pertz completed the transcript, which appears to have been a task of exceeding difficulty. The codex, as will be collected from Dr Pertz's title, is a *thrice-written* manuscript; and it differs from the similar palimpsest of the Institutions of Gaius in having its outermost or most recent writing in the Syriac language, and in the most difficult and complex form of the Syriac characters—the cursive letters. The second writing is in Latin, and contains portions of the work of some unknown grammarian (the chapters *De Verbo* and *De Adverbio*), of whom we only learn that he flourished between the second and fifth centuries of our era. The lowest and earliest writing is in large uncial characters, and contains portions of five books of the Roman history of an annalist called Gaius Granus Licinianus, who is named by Macrobius and by the commentator on Virgil Servius, but of whom nothing else is known. The recovered fragments present intrinsic evidence of having been written after the History of Sallust and before that of Livy: they are from the twenty-sixth, twenty-eighth, thirty-third, thirty-fifth, and thirty-sixth books; and they regard a period of great interest, A.U.C. 509–676. The least incomplete chapters are those which regard the Cimbrian war, the civil war, and the Mithridatic war; but it must be owned that the recovered fragments throw little new light even upon these events. This recovery, nevertheless, is very interesting, both for itself and for the hope which it seems to hold out, that in other quarters which yet remain to be explored, and which at present seem to promise as little for ancient western literature as the long-forgotten monasteries of the Levant, we may yet disinter, from some thrice, or even more frequently re-written codex, the most precious of the long-lost treasures of antiquity.

The general appearance and characteristics of palimpsests will best be understood from inspection. There are few of the great libraries which do not possess at least a specimen or two; and even from the fac-similes which accompany most of the palimpsest publications, a very good idea of the original may be formed, especially from those of the Cureton palimpsest of the *Iliad*, those of Tischendorf, and the small plate of Pertz. In most cases, however, the palimpsest is represented, not in its original form, but in that which it presents after it has been chemically treated for the purpose of being deciphered. Cardinal Mai, in some of his plates, represents both appearances.

The method of manipulating palimpsests, for the purpose of deciphering the ancient writing, depends partly on the condition of the manuscript, partly on the ink in which the original was written. In some, indeed, the ancient writing is quite readily deciphered without any preparatory process whatever; in others, on the contrary, the original is found to have been so carefully and so successfully effaced, that no amount of skill or perseverance will avail to the complete decipherment of their contents.

To comprehend the process of restoration, it must be understood that there were two methods employed by the ancients in effacing the original writing—the wet and the dry. The first consisted in moistening the surface of the parchment, washing it with a sponge, and rubbing it down with pumice-stone. Of the second there were two different forms; either the entire line was scraped away with a broad scraping tool or blade, or the operator followed the course of each separate letter, and obliterated each in succession with the point of the tool. The ink, again, was of three kinds—metallic (which was that commonly used), vegetable, and animal; and as the action of the ink, whatever may have been its composition, was not confined to the surface, it is found that, even after the superficial trace of colour has been partially or entirely removed, its unobserved presence may still be detected by careful scientific treatment.

The first method, and one frequently adopted by Mai, is simply to wash the page with an infusion of galls, and expose it for a time to the action of light and air. This application, in Mai's hands, was in many cases sufficient to restore the buried writing so far that, in good clear light, it could be deciphered by any practised palæographer.

In other cases, however, the effect of this treatment is to blacken the parchment, and to render both the old writing and the later entirely illegible. M. Peyron of Turin, the editor of the fragments of the Theodosian Code described above, having experienced this effect, adopted a prescription suggested by his colleague Giobert, professor of chemistry in the same university. The parchment is first carefully washed in common water; it is then dipped in diluted muriatic acid, and finally in prussiate of potash. This treatment, which had already been suggested by Blagden in the *Philosophical Transactions* for 1787, proved entirely successful; and a preparation founded on it is now known by the name *tinctura Giobertina*. Dr Pertz, in the effort to decipher his palimpsest of Granus Licinianus, was struck by the singular circumstance, that the same mode of treatment *did not succeed equally with both sides of the parchment.* The chemical agent employed by him was a preparation of sulphuretted ammonia—(his formula is, N^2H^5S, aqua × –), which he found perfectly successful in reviving the characters *upon the outer surface of the skin*, as this surface, from its hardness and the closeness of its grain, had been but little defaced by the process of rubbing. But the inside of the skin, being softer and looser in texture, and therefore having been impressed to a greater depth by the process, remained almost entirely unaffected by this application. For the inside of the parchment, therefore, Dr Pertz found it necessary to have recourse to the agent already referred to,—the *tinctura Giobertina*,—for which he gives two different formulas,—*cfy* + 2K, and CyK + CyFe. In deciphering the fragment of Livy, which he published from a Berlin palimpsest (Berlin, 1848), Dr Pertz used a mixture of the ordinary preparation of sulphuretted ammonia and the *tinctura Giobertina* in equal parts.

Where the ink of the original is a vegetable product (as in the case of a palimpsest of the Gallican Psaltery described by Mone, p. 40), the palæographers have failed to restore the original writing sufficiently for the purpose of being deciphered. For inks which contain animal substances (as milk or the blood of the cuttle-fish, the μέλαν of the ancients), Dr Mone directs that the manuscripts be placed in a close vessel filled with oil, and heated to 400° R.

Much, however, it need hardly be added, will depend on the experience and judgment of the manipulator. Many useful suggestions will be found in the prefaces of Mai and other editors, and especially in F. J. Mone's *Lateinische und Griechische Messen;* Pertz's *Gai Grani Liciniani Annalium quæ supersunt;* and Fridegar Mone's *De Libris Palimpsestis, tam Latinis quam Græcis*, Karlsruhe, 1855. (C. W. R.)

PALINDROMUS, or PALINDROME (πάλιν, *again*, and δρόμος, *a course*), a verse or sentence which runs the same when read either backwards or forwards. Such is the verse,

Roma tibi subito motibus ibit amor.

Some people have refined upon the palindrome, and com-

Palinode || Palissy.

posed verses, each word of which is the same read backwards as forwards; for instance, that of Camden :—

Odo tenet mulum, madidam mappam tenet Anna.
Anna tenet mappam madidam, mulum tenet Odo.

PALINODE (πάλιν, *back*, and ὁδός, *a way*), a discourse contrary to principles formerly avowed; and hence the phrase *palinodiam canere* means a recantation. (Macr. *Saturnalia*, vii. 5.) The term is properly applied to a piece in which a poet retracts the invective of a former satire.

PALINURUS, or PALINURI PROMONTORIUM (*Capo Palinuro*), was a mountainous headland on the coast of Lucania, between Velia and Buxentum. It derived its celebrity, as well as its name, from Palinurus, the pilot of Æneas, who, according to Virgil and other Latin authors, was cast ashore and buried near the promontory. It was also well known for its well-sheltered haven, which still bears the name of *Porto di Palinuro*.

PALISSY, BERNARD, commonly called "The Potter," was born about 1509, in the diocese of Agen in France, or, according to some, at Chapelle Biron, a poor hamlet near the small town of Biron in Perigord. His father is said to have been a glass-worker, who exercised his craft, like the rest of his fraternity in those days, in the recesses of a forest. Young Bernard's education was accordingly sadly neglected; but, "as a child, he rolled upon the moss, and ripened with the chestnuts," which, in the long run, proved not quite so bad a school for the youth as might have been supposed. With some skill as a worker in painted glass, he, at the age of eighteen, set out to study nature, to see the world, and to earn his bread. The succeeding nine or ten years of his life were spent in wandering over France in all directions; painting a window now and then; constantly prying into the secrets of nature in woods and fields, by rivers and roads; talking with a wise man when he found one; studying his Bible as he went, and eagerly reading what scraps of philosophy came in his way. It was during these journeyings that he first became acquainted with the Reformed doctrines, which he subsequently espoused, and for which he had ultimately to suffer. In 1538 Palissy took up his abode in the little town of Saintes, married, and gave up wandering. During these years his eye chanced to light upon a beautiful enamelled cup of Italian manufacture, when, without the slightest knowledge of the art, he too resolved to make enamels as well as any Italian. He set about his experiments with uncommon ardour; but nothing came of it meanwhile, he says, but "great cost, loss of time, confusion and sorrow." His attention was diverted for a time by the duties of surveyor of the salt-marshes of Saintonge, to which he had been appointed; but the discovery of white enamel again became his care. Failure upon failure mocked his enthusiasm: his neighbours jeered him, his wife became petulant, and his children clamoured for bread. Then, with genuine childish simplicity, he comported himself, he says, "as if I were not zealous to dive any more into the secret of enamels," and took duly to glass-painting, and eschewed folly. But no sooner had his domestic affairs begun to assume a more prosperous aspect, than the little pet at the coy enamels was got over, and he took to his furnaces again. The furnaces soon burnt up all the fuel, and consumed all the Potter's money. In his extreme need, he flung the flooring of his house to the flames, and when that was done, the furniture followed it. No wonder that his poor wife became now positively sulky. The Potter was clearly mad now, in the eyes of all sensible people. But mad or not, he discovered his enamel, and became the greatest potter in France.

Sixteen years had been spent on this discovery, and Palissy was now bordering on fifty; yet he had accomplished his purpose, and he met with the patronage which success generally secures. In 1557 or 1558 he published a book without his name, which is either now lost or cannot be authentically identified. In the first collected edition of the Potter's works, by MM. De Saint Fond and Gobet, the *Declaration des Abus des Médecins* is supposed to be the missing treatise, and is printed accordingly among Palissy's works. High and mighty patrons now sought the humble shed of the artisan; and among the foremost was the Constable Montmorenci, who employed him to decorate his Chateau d'Ecouen, near Paris. It has already been noted that the Potter was a stanch Reformer. Reform was unfortunately not a commodity in equal demand with enamelled clay among the great and luxurious of France in those days. On the contrary, old men and simple maidens had more than once met death on the martyr's scaffold, even in remote Saintes, and under the eyes of the devout Palissy. This had not the effect of silencing the outspoken, courageous Potter; it rather made him more vehement in his denunciation of the oppressors. But for his skill in clay, his head would doubtless have fallen with the rest; but to imprison or behead old Bernard was equivalent to depriving many wealthy people of the luxury of his decorative art—a thing not to be thought of. This it was that delivered him from the Bordeaux dungeon and from the massacre of St Bartholomew's. In 1563 he published his second book, containing treatises on four subjects,—viz., agriculture, natural history, gardening, and fortification, with an appended history of the troubles in Saintonge. Here, as elsewhere, the strong original genius of the man comes out, sometimes in quite startling anticipations of scientific theories, which centuries were needed to develop and verify. Under royal patronage, the Potter removed to Paris; and at the age of sixty-five became "Master Bernard of the Tuileries." His sons aided him in his art; and he not only continued to prosecute his study of natural history, but commenced a course of lectures in the capital on scientific subjects, which were published in 1580. The doctrines of this, his last book, were a century or two in advance of his time; and it is this work which has obtained for him the admiration of men like Buffon, Haller, and Jussieu. The sturdy old Huguenot had religious enemies in abundance, who had long been anxious for his head; and when the Potter was in his seventy-sixth year, Henry III. gave way to their importunities. He was thrown into the Bastile, where he lay for the next four years. The king visited him in his dungeon one day about the end of that period, and held out to him the alternatives of recantation or death. "Sire," said the old man of eighty, "the Guiscarts, all your people, and yourself, cannot compel a potter to bow down to images of clay." Next year both king and potter had gone to their account: the former fell by the hand of the assassin, and the latter died in calm hope in the Bastile. (See *Life of Bernard Palissy of Saintes*, by Henry Morley, 2 vols., Lond. 1852.) The last and best edition of Palissy's works is entitled *Œuvres Completes de Bernard Palissy, avec des Notes et une Notice Historique*, par P. A. Cap, 8vo, Paris 1844.

Palladio.

PALLADIO, ANDREA, a celebrated Italian architect, was born at Vicenza in 1518. He began life as a sculptor, but was afterwards induced by his friend Trissino the poet to direct his attention to architecture. His generous patron took Palladio with him to Rome on three several occasions, where the young artist made a diligent study of the best specimens of ancient architecture of which that city could boast. Returning to his native town in 1547, he set zealously to work both as a practical architect and as an illustrator and expounder of his favourite art. He attained an unbounded popularity as a master of architectural design. Noble and commoner vied with each other to overwhelm the rising artist with commissions; and Pope Paul III. summoned him to Rome to obtain his professional

advice regarding St Peter's. An estimate of Palladio's character as an architect will be found in the article ARCHITECTURE. He gave the world the benefit of his artistic studies at Rome in his *Antichita di Roma*, published at Rome in 1554, and frequently reprinted. His greatest work, however, was his *Architettura*, in four books, published at Venice in 1570, and frequently reprinted, re-edited, and translated. It appeared in London in 1715, in two folio volumes, under the title, *Architecture, in English, Italian, and French, with Notes and Observations by Inigo Jones; revised, designed, and published by Leoni.* This edition was often reprinted and re-edited, and appeared both in French and Italian. The best edition of the *Architettura* is that of Vicenza, in Italian and French, in four large folio volumes, 1776–85. A new edition of his works was published in Paris, 1825–42, in folio. Palladio died in August 1580, while engaged on his greatest work, the Teatro Olimpico at Vicenza.

PALLADIUM (Παλλάδιον), an image or statue of the goddess Pallas Athene or Minerva, kept carefully hidden, and revered as the safeguard of the place where it lay. Among the ancient images of the goddess, by far the most celebrated was the Palladium of Troy, said to have been thrown from the top of Olympus by the hand of Zeus, and to have been picked up and preserved by Ilus on the building of the city. This statue was about 3 cubits high, and represented the goddess sitting with a spear in her right hand, and in her left a distaff and spindle. The safety of Troy was universally regarded as depending upon the preservation of the Palladium. Ulysses and Diomede were accordingly commissioned during the Trojan war to steal it. They effected their object despite the wrath of Pallas, who is said to have infused temporary life and motion into her image to intimidate the impious Greeks. (Virgil, *Æneid*, ii. 164, &c.) According to other accounts, the genuine Trojan Palladium was conveyed by Æneas to Italy, and was subsequently preserved with the utmost secrecy and veneration in the temple of Vesta. To account for the discrepancy in these traditions, some have alleged that the image stolen by the Greeks was simply an imitation of the real one; while others affirm that Troy contained two Palladia equally genuine. In Greece, Argos and Athens both claimed the honour of possessing the ancient Trojan Palladium; and in Italy, the cities of Rome, Lavinium, Luceria, and Siris put forward similar pretensions.

On passing into European languages, the word *palladium* came to signify any peculiar law or privilege regarded as the safeguard of the liberties of the people, or, in general, whatever affords effectual protection and safety. The term *palladium* has also been applied to a metal discovered by Dr Wollaston in 1803, associated with platinum, from which it is obtained, and which it resembles in colour and lustre.

PALLADIUS, surnamed "Sophista," or "Iatrosophista," a Greek medical writer, flourished during some period between the third and ninth centuries. The only record of his life is, that he was the author of three Greek treatises, which are still extant. The first treatise, entitled *Scholia in Librum Hippocratis "De Fracturis,"* was published in the twelfth volume of Chartier's *Hippocrates and Galen*, fol., Paris, 1679. The second treatise, entitled *In Sextum (Hippocratis) "Epidemiorum" Librum Commentarius*, has been inserted in the original Greek in Dietz's *Scholia in Hippocratem et Galenum*, in 2 vols. 8vo, 1834. The third treatise, entitled *De Febribus Concisa Synopsis*, has been published by Ideler in his *Physici et Medici Græci Minores*, 8vo, Berlin, 1841.

PALLADIUS *of Helenopolis*, one of the early Christian fathers, is generally supposed to have been born in Galatia about 367. An intense admiration for the practice of asceticism seems to have early become his distinguishing characteristic. Assuming the monkish garb at the age of twenty, he set out on foot to visit the cells of the most famous solitaries in the different parts of the Roman empire. The devout pilgrim trudged through Upper Egypt, Lybia, Syria, Palestine, Mesopotamia, and Italy, dropping in upon the ghostly fathers in the midst of their solitary devotions, marking their austerities and mortifications of the flesh, and drinking in greedily the strange stories about visions and miracles which fell from their reverend lips. All these observations and fables he began faithfully to record, after he had ultimately settled down in the see of Helenopolis in Bithynia. The book was finished about 420; and from being addressed to Lausus, a chamberlain at the imperial court, came to be known by the name of the *Lausiac History*. Palladius spent the latter part of his life in the discharge of the duties of the bishopric of Aspona. The date of his death is uncertain. The *Lausiac History*, both in the original Greek and in an old Latin version, is contained in the *Bibliotheca Patrum*, fol., Paris, 1644 and 1654. There is a Greek work, entitled *A Dialogue about the Life of St Chrysostom*, which has been ascribed to the Bishop of Helenopolis, but which is now generally attributed to another writer of the same name and the same period. (See Smith's *Dictionary of Greek and Roman Biography*.)

PALLADIUS, *Rutilius Taurus Æmilianus*, a Roman writer on agriculture, probably flourished in the fourth century. The only record of his life and labours is a treatise, *De Re Rustica*, in fourteen books. The first book introduces the subject, the twelve next treat of the agricultural operations of the twelve months of the year, and the last describes in elegiac verse the art of grafting. The work rose to high repute in the middle ages. It appears to have been often transcribed; and it was nearly completely incorporated in the *Speculum* of Vincent of Beauvais. In modern times editions have appeared by Ernesti, in 1773; and by Schneider, in his *Scriptores Rei Rusticæ*, 4 vols. 8vo, Leipsic, 1794. Among the various translations into different languages is the English version of T. Owen, 8vo, London, 1807.

PALLAS. See MINERVA.

PALLAS, PETER SIMON, a distinguished naturalist and geographer, born on the 22d of September 1741, was the son of Simon Pallas, a surgeon in the Prussian army, and professor of surgery at Berlin. He received the early part of his education in his father's house, and his instructors bore ample testimony to the rapidity of his progress. At the age of fifteen he began to attend medical lectures; and he applied himself so closely to practical anatomy, that in 1758 he was found qualified to deliver a course of public lectures on that science. In the same year he went to Halle, and became the pupil of Segner, continuing also his studies of zoology, and, in particular, of entomology, with great assiduity. In 1759 he removed to Göttingen, where he made a variety of experiments on poisons, and on other active medical substances, and commenced his observations on parasitical animals. In July 1760 he went on to Leyden, in order to attend the lectures of Albinus, Gaubius, and Muschenbroek; and at the end of the same year he took his degree of Doctor of Physic. The following summer he proceeded to England, principally with the view of completing his medical education, although he devoted the greater part of his time to the active pursuit of natural history, being assisted and encouraged by the friendship of Peter Colinson and of some other British naturalists, which procured for him, a few years afterwards, the distinction of having his name inserted in the list of the foreign members of the Royal Society, at the early age of twenty-three. He visited several parts of the coast of England, in order to examine its marine productions; and his love of natural history enabled him to profit in a similar manner

by an accident which detained him for some time at Harwich, on his return to the Continent, in the spring of 1762.

Having paid a visit to his native city, he went again to the Hague, and established himself as a resident there under the patronage of Gaubius. On occasion of the publication of a miscellaneous work on zoology, which he dedicated to the Prince of Orange, he proposed a plan for an expedition to the Cape of Good Hope, and to the Dutch East Indies, which he offered to conduct in person; but although the project was encouraged by Gaubius, and approved by the prince, his father's interference prevented its execution, and obliged him to return to Berlin. His filial affection, however, was not strong enough to induce him to refuse the invitation of the Empress Catharine to St Petersburg, where he accepted, in the year 1767, the appointment of professor of natural history in the Imperial Academy of Sciences.

The first few months of his residence at St Petersburg were employed in preparing his *Zoological Gleanings* for publication, and in making catalogues of some collections of natural history. It was now that the more active career of his public life was about to commence; and in 1768 he undertook, in common with Falk, Lepechin, and Guldenstädt, the conduct of an expedition sent out by the empress, for the joint purposes of observing the transit of Venus, and of investigating the natural history and geography of Siberia and the neighbouring countries. The object of their researches for the first summer was the province of Kasan, and the winter was passed at Simbirsk; the next year they examined the shores of the Caspian and the borders of Calmuck Tartary; after which they returned through Orenburg, and passed the winter at Ufa. In 1770 Pallas crossed the Uralian Mountains to Catharinenburg, and, after examining the mines in that neighbourhood, proceeded to Tobolsk. The next year he went to the Altaic Mountains, traced the course of the Irtysch to Kolyvan, went on to Tomsk, and observed the natural freezing of quicksilver at Krasnoyarsk, on the Yenisei, in Lat. 56. 30. N. He proceeded in March 1772 by Irkutsk across the Lake Baikal, as far as Kiatka, and returned to Krasnoyarsk. In 1773 he visited Tara, Astracan, and Tzaritzin, on the Volga, and returned to St Petersburg in 1774, after an absence of six years. About ten years later he was made a member of the Board of Mines, with an additional salary of L.200 a year; and he was complimented with the title of a Knight of St Vladimir. The empress purchased his collection of natural history for a price one-third greater than his demand, and allowed him, at the same time, to keep it in his possession for the remainder of his life.

In 1794 he took a journey into the Crimea, and was captivated with the beauty of the country and its productions; the climate also appearing to be such as his health was supposed to require, he obtained from his munificent patroness not only permission to establish himself there, but a grant of a large and fertile estate, and a sum of 10,000 rubles to assist him in his outfit. He was thus enabled to build a little palace rather than a country house, in which a traveller from the north of Europe was sure to receive the most obliging hospitality, as Dr Clarke has made well known to the English reader. It appears, however, that the air was not altogether exempt from the miasmata, which are the causes of paludal fevers; and some other circumstances, besides the distance from all civilized society, seem to have made the old age of Pallas more cheerless than he had anticipated to find it, in the independence and tranquillity of his patriarchal establishment at Akmetshet (Simpheropol.) About ten years after the period of Dr Clarke's travels, he undertook a journey to Berlin to pay a visit to his brother, and died there in September 1811.

Linné the younger has given him a genus, *Pallasia,* in his *Supplementum Plantarum;* a compliment to which his unremitting labours in every department of natural history had amply entitled him. His collection of dried plants was purchased by Dr Clarke's fellow-traveller, Mr Cripps, and passed into the possession of Aylmer Bourke Lambert. The general character of Professor Pallas's acquirements appear to have been that of extent and variety, together with fidelity. He was not the author of any new theories or improved systems: and it has sometimes been observed, as by Murray in his *System of Vegetables,* that his descriptions were somewhat defective, from the omission of correct specific distinctions; but this omission is of such a nature as to affect a compiler or a book-maker much more than an actual student of natural history, who is studying for his own improvement only, and who is capable of entering into a detailed examination of the objects concerned. To such a detail the principal part of Professor Pallas's works have relation; and it is impossible to enumerate the whole of his memoirs without making a pretty extensive catalogue of the productions of the various kingdoms of nature.

1. His *Dissertatio Inauguralis de Insectis viventibus intra Viventia,* 4to, Leyden, 1760, containing a systematic account of intestinal worms, is said to have been previously published in another form at Gottingen a short time before he went to Leyden. 2 We find in the *Philosophical Transactions* for 1763, p. 62, a short note on the Cold observed at Berlin the preceding winter. 3. In the volume for 1776, p. 186, a Description of the Jaculator Fish, or *Sciœna jaculatrix* of the Indian Ocean, which catches insects by darting drops of water at them. This description is repeated in the *Spicilegia Zoologica,* fasc 8. 4. *Elenchus Zoophytorum,* 8vo, Hague, 1766; containing nearly 300 species; Dutch by Boddaert, with figures, 8vo, Utrecht, 1768. 5. *Miscellanea Zoologica,* 4to, Hague, 1766; consisting of descriptions and dissections 6. *Spicilegia Zoologica,* 4to, Berl. 1767–1780. Of this valuable collection of memoirs, intended for the description and illustration of new or little-known species of animals, there appeared in the whole fourteen fasiculi; some of them were published by Professor Martin during the author's absence in Siberia. We find, amongst other articles, an interesting account of the musk-deer, of various species of the antelope, and on the different varieties of sheep, both wild and tame; the latter has been published in English, *On Russian and Tartar Sheep,* 8vo, Edinburgh, 1794 7. In the *N. Act. Acad. Nat. Cur*, vol. iii., p. 430, *Phalœnarum biga;* an account of two species of moth, of which the females are without wings, and spontaneously fertile. 8. A variety of miscellaneous papers, by Pallas, appeared in the *Stralsund Magazine,* which began to be published at Berlin in 1767. They chiefly relate to the Winter Residence of Swallows, vol. i., p. 20; to Hydatids found in the abdomen of ruminant animals, and supposed to be a species of Tænia, p. 64; to the Birds of Passage of Siberia, p. 145, from Heller's Notes; to Firman's supposed discovery of the Origin of the Belemnite, p. 192; to Some Peculiarities of Insects, p. 225; to a Poison supposed to be prepared in Siberia from the Sitta or nut-hatch, p. 311; to the Elk or Moose-Deer, p 382, from Heller's papers; and to the use of the Sphondylium in Kamtschatka, p 411. 9. Collections relating to the Mongol Tribes, published in 1776, and showing that they are distinct from the Tartars. 10. Professor Pallas's contributions to the *Memoirs of the Imperial Academy of St Petersburg* are also very numerous, and on miscellaneous subjects. In the *Novi Commentarii* we find an account of the *Tubularia Fungosa,* vol. ii, observed near Wolodimer; *Lepus pusillus,* and Fossil Bones of Siberia, vol. xiii.; Quadrupeds and Birds observed in 1769, vol. xiv. 1; Remains of Exotic Animals in Northern Asia, vol. xviii., especially the skulls of the rhinoceros and the buffalo; *Tetrao arenaria, Equus hemionus,* and *Lacerta apoda,* vol. xix.; the last also in *Geneesk. Jaarboek,* ii. In the *Acta* for 1777, ii., An Account of the Teeth of an Unknown Animal, like those which have been found in Canada; Observations from Camper's Letters, on a Myrmecophaga and a Didelphis, and *Equus asinus* in the wild state. In the volume for 1779, ii., a Description of Plants peculiar to Siberia; *Capra Caucasica,* also in Lichtenberg's *Magazine,* ii. For 1780, part i., *Galeopithecus vitans,* part ii., On the Variations of Animals, and *Didelphis brachyura.* For 1781, part i., *Felis manul,* a new Asiatic species of Felis; ii., on some species of Sorex. In the volume for 1783, New Species of Fishes; and 1784, On some New Marine Productions. 11. The *Observations sur la Formation des Montagnes, et les Changemens arrivés au Globe, particulièrement à l'égard*

de l'Empire Russe, published separately, 4to, Petersburg, 1777, were also inserted in the *Acta* of the Academy for 1777, having been read at a public sitting before the King of Sweden. A translation of this discourse is inserted in Tooke's *Russian Empire*, and some remarks on it are found in the *Journal de Physique*, vol. xiii. 12. The most considerable of the separate publications of Pallas was the account of his travels, entitled *Reise durch verschiedene provinzen des Russischen Reichs*, 3 vols. 4to, Petersburg, 1771–3–6; French, 8vo, Paris, 1803; English, 2 vols. 4to, London, 1812; a work of the highest authority in geography and natural history. 13. It was in the course of these travels that Pallas observed in Siberia an insulated mass of native iron which he described in a paper addressed to the Royal Society of London, and printed in the *Philosophical Transactions* for 1776, p. 523; a substance which has become the subject of many discussions, from its resemblance to some of the specimens of well-ascertained aerolites; the author mentions also the remains of an unmineralized rhinoceros, which had been found in the same country. 14. In the *Beschaftigungen Naturforschenden Freunden*, published at Berlin about 1777, we find a letter on the *Acipenser ruthenus*, or sturgeon, vol. ii., p. 532; and An Account of a Monstrous Horse, vol. iii., p. 226. 15. Some Mineralogical Observations, addressed to Born, are published in the *Böhmische Abhandlungen*, vol. iii., p. 191. 16. In the Swedish *Handlingar* for 1778, we have the *Alauda Mongolica*, and the *Sturnus Dauuricus*; the *Anas glocitans*, in 1779. 17. *Novæ species Glirium*, 4to, Erlangen, 1778. 18. *Icones Insectorum, præsertim Rossiæ Sibiriæque*, 4to, Erlangen, 1781. 19. *Enumeratio Plantarum Procopii a Demidoff*, 8vo, Petersburg, 1781. 20. Another channel in which a number of Pallas's most valuable essays appeared is the work entitled *Neue Nordische Beyträge*, which he published at St Petersburg and Leipsic in 1781 and the following years. The most remarkable of the subjects of these are A Great Exotic Animal found in Kasan in the year 1776; on the Migration of the Water-Rat on the Volga, and Observations on Tæniæ, vol. i.; further Remarks on Tæniæ; on American Monkeys bred at St Petersburg; on the *Ardea helias*; on the *Culex lanio*, sometimes fatal to cattle, on the Phalangium, or Scorpion Spider; and on Copper Island, in the Sea of Kamtschatka, vol. ii.; on Two Birds; and on the Labrador Stone, vol. iii.; on a Cross of the Black Wolf with the Dog; on a Mine; on the Oriental Turquois; and Mineralogical Novelties from Siberia, vol. v. 21. In the *Physische Arbeiten* of Vienna, we have a geological Essay on the Orography of Siberia, vol. i. 1. 22. *Flora Rossica*, f. vol. i., Petersburg, 1784; ii., 1788, published at the expense of the empress. 23. *Tableau Physique et Topographique de la Tauride*, 4to, Petersburg, 1795; German, in *N. N. Beyträge*, vii.; a work derived chiefly from the observations made by the author in his travels of 1792. 24. A Monography of the Astragali is mentioned by some of his biographers. 25. He edited also Guldenstadt's *Reisen durch Russland und in den Caucasischen gebirgen*, ii., v., 4to, Petersburg, 1787–1791. 26. He also compiled and arranged the two first and most valuable of the four volumes of the *Vocabularia Comparativa*, 4to, Petersburg, 1787, in which he attempted to make some improvements in the Russian orthography.

(Coxe's *Travels*; Clarke's *Travels*; Tooke's *Russian Empire*; Halleri *Bibliotheca Anatomica*; Aikin's *General Biography*, vol. x., 4to, London, 1815; Chalmers' *Biographical Dictionary*, vol. xxiii., 8vo, London, 1815; Dryander, *Catalogus Bibliothecæ Historico-Naturalis Josephi Banks, Bart.*) (T. Y.)

PALLAVICINO, Ferrante, an Italian litterateur, who owes his celebrity as much to his misfortunes as to his genius, was descended from a noble family, and was born at Piacenza about 1618. He received an excellent education, and gave early proof of very great abilities. In compliance with the desire of his parents, he entered the church, took the habit at the monastery of the Augustine friars at Milan, and joined the house of his order at Venice. For a time he bore a high character for piety and learning, but a love intrigue with a fair Venetian led to his deserting the monastery, and was the beginning of a course of debauchery and general misfortune which ended only with his life. Need drove him to authorship; and among other minor efforts, he wrote a collection of satirical letters, called *The Courier Robbed of his Mail.* It was bitter against the Spaniards, whom the author disliked, but the Inquisitors licensed its publication. The secretary of the republic, however, declined giving it his *imprimatur*, which caused Pallavicino to vow vengeance upon that functionary. On returning from a residence in Germany, where he at once acted as chaplain to the Duke of Amalfi, and played the libertine, he resolved to wreak his anger upon all who had endeavoured to prohibit his manuscripts. He re-cast and enlarged his *Courier*, and got a bookseller to pass it secretly through the press. When on the eve of completion, however, a pretended friend, who played the spy, disclosed the matter to the Pope's nuncio, and the unfortunate author was thrown into prison. Having obtained his liberty, mainly by the aid of one of his mistresses, he wrote a piece called *La Buccinata overo Butarella per le api Barberini*, consisting of a bitter satire on his enemies the Barberini, with a dedication, expressive of the most exquisite contempt, to the Nuncio Vitelli. The ecclesiastic adopted the foulest means of revenge. He bribed a base Frenchman to decoy the unsuspecting poet into the hands of a gang of *sbirri*. Pallavicino was conveyed to Avignon, and, on pretence of carrying contraband goods, was thrown into prison. A mock trial was got up, at which he made a skilful defence; but it was all to no purpose. He was sentenced to death, and lost his head upon the scaffold on the 5th of March 1644, at the age of twenty-six. In addition to the productions already alluded to, Pallavicino wrote a number of smaller pieces, all characterized by that happy grace and fine genius which his larger works display. His *Opere Permesse*, edited by Brusoni, with a Life of the author, were published at Venice in 4 vols. 12mo, 1655; but his *Opere Scelte*, Geneva, 1660, is the edition most prized by the curious.

PALLEE, a town of India, in the Rajpoot state of Joudpore, 108 miles S.W. of Nusseerabad, and 351 S.W. of Delhi; N. Lat. 25. 48., E. Long. 73. 24. It is an ancient town, and was formerly surrounded by walls; but these were destroyed at the request of the inhabitants; as they made the place an object of contest in the civil wars of Joudpore. Pallee belongs immediately to the sovereign of Joudpore, and is not subject to any inferior feudal lords. He obtained from it an annual revenue estimated at L.7500. It is a place of considerable trade, as it stands at the intersection of the commercial routes from Cutch to the northern provinces, and from Malwah to Sinde. Pop. estimated at 50,000.

PALLIUM and Palla were generic terms applied, like ἱμάτιον and φᾶρος, to an outer garment worn by the Greeks, and occasionally by the Romans, both male and female, but so extensive in signification, that we find these words not unfrequently employed to denote a blanket or rug, rather than a "cloak" or "garment." The article so designated was a piece of cloth, always rectangular in shape and frequently square, varying in colour and material according to the rank or taste of the wearer. It was generally manufactured from wool, flax, or cotton; and certain qualifying epithets or specific designations were given to the pallium to indicate the diversity in the materials from which the cloth was made. The most graceful and convenient mode of wearing the pallium was first to pass it over the left shoulder, then to draw it behind the back and beneath the right arm, and then to throw it again over the left shoulder. A very common mode of wearing the pallium was to fasten it with a brooch over the right shoulder. It was not unfrequently, however, folded about the body, simply with the view of protecting the wearer from the cold, and without any regard to grace or convenience. Diogenes Laërtius (vi. 6, 13) informs us that the cynic Antisthenes "first doubled his pallium," a contrivance afterwards imitated by the rest of the fraternity, and especially by Diogenes, who slept and died in his one. This was the more necessary, however, in the case of those stern sages, as they, contrary to the usual custom, often went without a tunic. Socrates also adopted the practice of discarding the underclothing. The pallium worn by boys was different from that used by men; but women sometimes wore

the pallium of the other sex. Where means would allow, however, the Greek ladies generally adorned their persons with pallia smaller in size, finer in texture, and more gorgeously coloured than those worn by men; although it was by no means a rare thing to see the more effeminate class of men attire themselves in the splendid pallium of the ladies. The *toga* among the Romans answered to the pallium among the Greeks; and so strong was the prejudice of the former nation in favour of their peculiar blanket, that they invariably regarded the adoption of the pallium by any Roman as an affectation of Grecian or foreign manners. Hence the employment of the national epithet *togatus* by the Romans, to distinguish themselves as the nation of the toga or gown from all other nations.

PALLIUM is the name applied in the Roman Catholic church to that peculiar vestment bestowed by the Pope upon all patriarchs and archbishops. It was formerly customary for those functionaries to make a pilgrimage to the Holy City for the purpose of receiving the pall, but other means are now adopted for delivering it to them. The material for the ecclesiastical pallium is obtained from the wool of two lambs slain on the eve of St Agnes. This symbol of the plenitude of ecclesiastical power is deposited on the tombs of St Peter and St Paul, where it is left all night. It is afterwards, when duly consecrated, laid aside by the subdeacons until demanded by those for whom it is designed, whether in person or by proxy. The modern pallium of the church is a short white cloak ornamented with a red cross, which encircles the neck and shoulders, and falls down the back. These palls are purchased from his Holiness at a very considerable sum; and no archbishop can perform the duties of his office before receiving the pallium, nor is it legitimate for him to use that of his predecessor. (See Ersch and Gruber's *Encyclopädie*, article "Pallium.")

PALM. See under *Palmæ* in BOTANY, Nat. Ord. 251.

PALM OIL. See OILS.

PALM-SUNDAY, the name given to the Sunday immediately preceding Easter, from the boughs of palm trees which used to be carried to the church on that day by the worshippers, in imitation of those which were strewn in the way of Christ when he went up to Jerusalem. (Fuller's *Church History*, p. 222.) The author of the *Festival*, as quoted by Brand (*Popular Antiquities*), says,—"It is called Palme Sondaye for bycause the palme betokeneth vyctory, wherefore all Crysten people sholde bere palme in processyon in tokennynge that he hath foughten with the fende our enemye, and hath the vyctory of hym." Branches of willow, box, and yew being more accessible than palm, are generally employed in Roman Catholic countries, and go by the general term of palms. The palm branches, on being borne to the church, are thrown together in a heap, and after being duly blessed by the priest, the worshippers carry portions of them away again, in the belief that they thus afford a sure protection against "winter stormes and thunders." (See Barnaby Googe's translation of Naogeorgus in his *Popish Kingdome*, 1570.) A wooden ass, surmounted by a rider of the same material, seems also occasionally to have formed a part of the procession on Palm Sunday. The author of the *Pylgremage of pure Devotyon*, 1551, gives a satirical glance at this practice in his preface when he says,—"Upon Palme Sondaye they play the foles sadely, drawynge after them an asse in a rope, when they be not moche distante from the wooden asse that they drawe." As appears from authorities quoted by Brand, it was customary also to deck private dwellings and churches with the branches of the palm at this interesting season. (Vol. i., p. 120, Bohn's edition.) The ceremonies of Palm Sunday were retained in England for a considerable time after other practices peculiar to the Church of Rome had been abandoned. This ceremony was to be retained by an express declaration of Henry VIII. in 1536; but in the reign of Edward VI. it seems to have ceased. It is still customary with boys, however, in some parts of England to "go a palming," and gather slips of willow, flowers, or buds at this season. In Russia, the Greek Church seems to hold a very solemn procession on Palm Sunday.

PALMA, a town of Spain, in the province of Cordova, at the union of the Genil and Guadalquivir, 30 miles S.W. of Cordova. The streets are wide and well paved, and the buildings generally good. The court-house, jail, church, convents, school, hospital, &c., are the chief public establishments. The principal manufactories are oil-mills; but flour, soap, earthenware, bricks, &c., are likewise made here. Some trade is carried on in timber, corn, fruits, oil, and cattle. Pop. 5528.

PALMA, a town of Naples, province of Terra di Lavoro, stands on a beautiful hill to the N.E. of Vesuvius, 4 miles S. of Nola. It contains several churches and convents, an old castle, and a feudal mansion belonging to the King of Naples. Pop. 6789.

PALMA, a town of Sicily, province of Girgenti, and 14 miles E S.E. of that town. It has several churches, and many good houses. On a hill to the west stands the large square castle of Monte Chiaro. Some trade is carried on in almonds and sulphur. Pop. 8400.

PALMA, GIACOPO, surnamed "the Old," an eminent Italian painter, was born near Bergamo about the beginning of the sixteenth century. He was a patient and laborious artist, and studied to catch the grace of Titian, and the clear expression and lively colouring of Giorgione. Accordingly, an elaborate refinement and a harmony of tints became his characteristic excellences Among other great pictures, he painted "Saint Barbara" for the church of Santa Maria Formosa at Venice, and a "Madonna" for San Stefano di Vicenza. He is also the supposed artist of a portrait which has been warmly eulogized by Vasari as "a performance of astonishing perfection and singular beauty." His death took place at Venice in the forty-eighth year of his age. Several pictures ascribed to Palma, including some that are not well authenticated, are found in the galleries of Dresden, Vicenza, Venice, Vienna, and other European towns.

PALMA, *Giacopo*, surnamed "the Young," was the grand-nephew of the preceding, and was born at Venice in 1544. Many favourable circumstances combined to assist him in his progress towards eminence. After receiving his first lessons from his father, a painter of some repute, he exercised his hand in copying from Titian and the best of the native masters. Then being sent to Rome at the expense of the Duke of Urbino, he spent eight years in copying from the antique, and in studying Michael Angelo, Raphael, and especially Polidoro. On his return to Venice, when Tintoretto and Paul Veronese were monopolizing all the employment in that city, Vittoria, an eminent sculptor and architect, patronized him, gave him advice, and brought him into notice. By these means did Palma attain to such a reputation that, on the death of his two great rivals, he began to be overwhelmed with commissions, and his pictures came to be appreciated for their rich and animated composition, and their fresh and transparent colouring. Yet it was this very rise in popular estimation that led to his decline in art. The hurry resulting from his numerous and pressing engagements betrayed him into negligence. Unless when he was allowed to take his own time, and name his own remuneration for any particular painting, he was wont to dash off pictures which were little else than rough draughts. This evil influence did not stop with his death, in 1628. It affected the rising artists of the same school, and introduced the most corrupt period of Venetian art. One of Palma's most celebrated pictures is his "Plague

of the Serpents" in St Bartolomeo. (Lanzi's *History of Painting*.)

PALMAS, Las. See Canary Islands.

PALMI, or Palme, a town of Naples, in the province of Calabria Ultra I., on the shore of the Bay of Gioja, occupies one of the most beautiful situations on this beautiful coast. It stands on the flat top of a rock rising steeply from the sea, and is surrounded by gardens and orange and olive groves; while the mountains in the background are covered with luxuriant forests of chestnuts. From the town is obtained a magnificent view of the Italian coast on the N.; the strait and town of Messina, and in the distance Mount Etna, on the S.; and the northern shores of Sicily, with the Lipari Islands, on the W. The streets are regularly built, and many of the houses are very handsome. In the public square there is an elegant fountain in the shape of a palm tree. Part of the town was destroyed by the earthquake of 1783, but it has since been restored. It contains several churches and some silk factories. There is some trade in oil, wines, &c. Pop. 6600.

PALMUS, a measure of length used both by the Greeks and the Romans. The Grecian *palmus* was of two sorts,—the greater (σπιθαμή), which contained nine finger-breadths, and the less (παλαιστή), which contained four. The Roman *palmus* was also of two sorts,—the greater, which contained twelve finger-breadths, or about 9 inches English; and the less, which contained four finger-breadths, or about 3 inches English. The greater *palmus* was taken from the length of the hand or span, the less from the breadth of it. (See Weights and Measures.)

PALMYRA, or Palmira (Gr. Παλμύρα, Ptol. Appian; Παλμίρα, Joseph.), "The City of Palm Trees," is the name given by Greek and Roman authors to an ancient city of Syria, which is called by the sacred historians *Tamar* or *Tadmor* (Heb. תָּמֹר, 1 Kings ix. 18; תַּדְמֹר, 2 Chron. viii. 4,—words having the same signification), and which is still known by the Arabs under the name *Tedmor*. The identity of Tadmor with Palmyra is not only inferred from the similarity of the names, but rests also on the authority of Josephus. It stands in an oasis in the Syrian desert, about half-way between the Euphrates and the Orontes, and about 140 E.N.E. of Damascus; N. Lat. 34. 24., E. Long. 38. 20. Tadmor is said in the passages of Scripture already cited to have been built by Solomon; but it cannot be thence inferred that no city had previously existed on this site. On the contrary, there are considerations which lead us to suppose that Solomon only enlarged, and, as Josephus informs us, fortified, the more ancient town of Tadmor. It is plain that the site of the town must always have been important as a station in the desert while any route of travel led across this region; and that this existed at a very early period, appears not only from the communication between Mesopotamia and Palestine, as early as the time of Abraham, but from the mention by Moses of Indian products, such as cinnamon (Exod. xxx. 25), which were probably conveyed by this route to the West. The object of the Hebrew monarch in taking possession and increasing the size of Tadmor evidently was, to retain in his own hands the profitable traffic with India by means of the Euphrates and the Persian Gulf; and the place is accordingly described by ancient writers as inhabited chiefly by merchants, and proverbial for its wealth and luxury. This Indian trade is with much probability conjectured by Volney to have been the cause of many of the wars and revolutions of the East in ancient times, and it was probably this as much as any other motive that directed the continual efforts of the Assyrian and Babylonian emperors against Palestine and Phœnicia, until both of these once powerful nations were reduced under their supremacy. As long as Jerusalem and Tyre continued to flourish, Palmyra occupied a very subordinate position, and it is not mentioned in the history either of the expedition of the younger Cyrus or of the campaigns of Alexander. The decline of its rivals, however, under the successors of Alexander, paved the way for the subsequent accession of power acquired by Palmyra.

It is first mentioned by the Roman historians as a place which Marcus Antonius attempted to plunder, upon pretence that it had not observed a just neutrality between the Romans and Parthians. Under the early Roman emperors, Palmyra was an independent city, and a place of some importance, holding a position between the two great empires of that time, the Roman and the Parthian. In 130 A.D. Palmyra submitted to Adrian, and from this period rapidly increased in wealth and power. Though nominally subject to Rome, it had a senate and popular assembly of its own, as is seen from the inscriptions found among the ruins. In the middle of the third century, when the Roman empire was weakly governed by Gallienus and Valerian, Palmyra rose to its highest degree of power. When the defeat and captivity of Valerian by the Persians, in 260 A.D., had so much weakened the empire that its adversaries seemed to be in a fair way of becoming masters of all the eastern provinces, Odenathus, a noble of Palmyra, took up arms against Sapor, the Persian monarch, whom he defeated, and expelled from Syria and Mesopotamia. For these services he was rewarded by Gallienus with the title of Augustus, and acknowledged as his colleague in the empire.

Odenathus enjoyed his sovereignty but a very short time, being murdered about the year 266 by his nephew, who was soon afterwards put to death by Zenobia, the wife of Odenathus. This celebrated woman, who assumed the title of Queen of the East, was not more remarkable for her bold and martial achievements than for her intellectual acquirements, and for the patronage she bestowed on literature, particularly in the person of Longinus, the greatest philosopher of his age. By his advice, she wrote a letter to Aurelian, who had assumed the purple in 270, declaring her independence,—a step which did not fail to provoke the hostility of that emperor. He accordingly passed over into Asia, and routed the forces of the Queen of the East, under the command of Zabdas, in two separate engagements fought near the gates of Antioch, and under the walls of Emesa. Zenobia finding it impossible to collect a third army, withdrew to Palmyra as her last resource, and prepared for a desperate resistance.

"The Roman people," says Aurelian, in an original letter, "speak with contempt of the war which I am waging against a woman. They are ignorant both of the character and of the power of Zenobia. It is impossible to enumerate her warlike preparations of stones, of arrows, and of every species of missile weapons. Every part of the walls is provided with two or three balistæ, and artificial fires are thrown from her military engines. The fear of punishment has armed her with a desperate courage. Yet I trust still in the protecting deities of Rome, who have hitherto been favourable to all my undertakings." The courage of the queen was supported by the hope of aid from Sapor of Persia. That monarch died, however, during the course of the siege, and the unfortunate heroine, driven to the last extremity, resolved to fly. Mounting her fleetest dromedary, she scoured the desert for 60 miles, but was overtaken and captured by Aurelian's light horse on the banks of the Euphrates. She was brought a captive to the feet of the emperor, and her capital soon afterwards surrendered.

After the surrender of Palmyra, Zenobia was conveyed as a captive to Rome, to grace the conqueror's triumph; while many of her advisers, and among the rest Longinus, were put to death. Aurelian had hardly set foot on the shores of Europe, when intelligence reached him of the massacre of the governor and garrison he had left at Pal-

myra. Without a moment's deliberation, he turned his face eastward, and the fated city felt the full weight of his resentment. The destruction of Palmyra took place in 273 A.D.; but, in pity for the remnant of the inhabitants, permission was granted to rebuild and occupy it. (See Gibbon's *Decline and Fall*, vol. ii., chap. xi.) After this period, however, the city gradually declined. It was indeed enlarged by Diocletian, in whose reign it was a military station, and Justinian strengthened its fortifications; but the decline of the Roman empire seems to have soon led to the abandonment of the place. It was taken by the Saracens under the caliph Abu Bekr, the successor of Mohammed, and was a place of some importance in the wars between the different factions of the Prophet's followers. In the twelfth century Palmyra was visited by Benjamin of Tudela, who states that it was then surrounded with a wall, and inhabited by 2000 Jews. In 1400 it was plundered by Tamerlane; but after this period Palmyra is not again mentioned in history. Until nearly the end of the seventeenth century the magnificent ruins of Palmyra were known only to the Arabs, by whom, in 1678, an expedition by certain English merchants at Aleppo was rendered abortive; and after the success of a second attempt in 1691, the description they gave of the remains received little credit. These earlier reports were, however, confirmed by Wood and Dawkins, who visited Palmyra in 1751, and published a full account of the ruins they found there. But these descriptions were regarded as somewhat exaggerated by Irby and Mangles, who examined the place in 1816. Since that period several other travellers have visited Palmyra, and given accounts of its remains.

The ruins stand at the eastern foot of a chain of hills extending north and south, and they present, on the first view, an extremely fine appearance,—contrasting by the pure whiteness of their innumerable columns with the yellow sand of the desert. The Arabian village of Tedmor consists merely of a collection of mud hovels in the court of the great Temple of the Sun; but all the rest of the ruins are free from the incumbrance of any modern structures. The inhabitants of both sexes are well shaped, and the women, though very swarthy, have good features. They are veiled, but do not so scrupulously conceal their faces as the eastern women generally do. They stain the ends of their fingers and the palms of their hands red, their lips blue, and their eyebrows and eyelashes black. They have large rings of gold or brass in their ears and nostrils, and appear to be healthy and robust. The numbers of the inhabitants are continually fluctuating. Mr Addison, who visited the ruins in 1835, states that there were then only twelve or fifteen families in the village; while in 1851, when the Rev. J. L. Porter was there, the place contained seventy or eighty families, though since that time he states that it is reported to have been deserted by nearly half the people, on account of a private quarrel. They live chiefly by trading with the Bedouins and the people of Damascus, to which city they convey large quantities of salt, obtained from the desert south of Palmyra. A few small gardens are cultivated, producing vegetables and corn; and in these still flourish a number of the palm trees that once gave its name to the city. As the whole of the ruins are covered to some height with drifting sand, which seems to have come down from the eminences to the S.W. of the town, it is probable that some change has taken place in the surface of the country; for the splendid buildings and colonnades would scarcely have been erected in a position where it would require constant labour to keep them clear of sand. Although some travellers have represented the buildings of Palmyra as constructed of marble, the material almost universally employed is white limestone from the adjacent hills, which are of that formation. Several shafts, however, are of Syenite granite, one of which, 30 feet long and 3 in diameter, must have been conveyed with immense labour and difficulty from Upper Egypt, a distance of nearly 200 miles. The ruins of Palmyra cannot properly be compared with those of Bâ'albek, for, though less gigantic, they are far more extensive and various. The ancient walls, which may still be traced, and which are supposed to be those of Justinian, have a circumference of 3 miles; while we have reason to believe that the ancient city extended far beyond these limits, and if we may believe the Arabs, covered an area 10 miles in circumference. "Here," says Addison, "over an immense area, we wander through the ruins of long porticoes leading up to ruined temples and unknown buildings. Now we see a circular colonnade sweeping round, with its ruined gateway at either end; now we come to the prostrate walls or ruined chambers of a temple or a palace; anon we explore the recesses of a bath or the ruins of an aqueduct; then we mount the solitary staircases, and wander through the silent chambers of the tombs, ornamented with busts, inscriptions, and niches for the coffins stored with mouldering bones; and from the summits of funereal towers, five storeys in height, we look down upon this mysterious assemblage of past magnificence, and beyond them upon the vast level surface of the desert, silent and solitary, stretching away like the vast ocean, till it is lost in distance." (Vol. ii., p. 286.) The capitals of the columns, and the more delicate sculptures, have been much injured by the sciroc wind of the desert; but those parts which have been sheltered from its corroding influence present the most beautiful and minute carving.

Like many other ancient cities of Syria, Palmyra contains a grand colonnade, which extends from S.E. to N.W., and is intersected near the middle by another at right angles to it. At the S.E. extremity is a triumphal gateway, with three arches; and at the intersection of the two colonnades are four stone platforms, which once supported as many statues. The avenue consisted of four rows of columns, of which it must have contained upwards of 1500, more than 150 still remaining. They are 57 feet high, including the bases and capitals, and finely proportioned, though the details are not so tasteful as those of the great temple. A richly-sculptured entablature surmounted the columns, and must have added to the magnificent appearance of the whole when entire. This colonnade seems to have been one of the places set apart by the Palmyrenians for monuments to their distinguished citizens, as most of the pillars have brackets projecting from them for supporting statues, and inscriptions below containing the name of the individual. One of these inscriptions is important, as establishing, by its date and the historical persons mentioned, the fact that the era in use at Palmyra was that of Seleucus, B.C. 312. The dates found on the various columns, however, cannot be taken as fixing the period when the colonnade itself was erected; but they give evidence that this must have been previous to 238 A.D. From the grand avenues many smaller colonnades diverge in various directions, leading to the numerous temples and other buildings that occupy the space around the avenues. This seems to have been an ornamental part of the town, kept quite distinct from the rest, which lay more to the north. It is impossible to describe all the various buildings which crowd the site of the city of Zenobia, and which are, many of them, remarkable for elegance and beauty. The most magnificent of these, however, the great Temple of the Sun, deserves a more particular account. It stands on a rising ground near the south-eastern end of the town, and must have presented, when entire, a most splendid appearance. The outer court, a perfect square, 740 feet every way, was inclosed by a lofty wall pierced with numerous richly-carved windows, between which, on both sides, are Corinthian pilasters surmounted by a frieze and cornice. On the west side was

the grand entrance, consisting of a portico of ten pillars, 138 feet in length, approached by a magnificent staircase. All this, however, has been disfigured by a huge square tower, built by the Saracens, who used the temple as a fortress. The central door, whose sides and lintel are composed of single blocks of stone, is 32 feet in height and 15 in breadth; and is surrounded with beautifully-carved vine branches and clusters of grapes; while the two side doorways are half the size of the central one. The interior area, which was paved with large square stones, was surrounded on every side but the west, where there was a single row, by a double range of pillars 37 feet high, each having on a bracket the statue of some distinguished individual. The number of the columns was 390; but of these only about 60 now remain. In the centre of the area, on a raised platform, stood the temple itself, towering above the adjacent edifices. It stands north and south, having its door on the west side, facing the grand entrance; and it is surrounded by a row of Corinthian columns 64 feet high, and a cornice running all round, with boldly-carved wreaths of flowers and fruit. The door is 33 feet high by 15 wide, and has over it an eagle with outspread wings, similar to that in the temple at Bâ'albek. The roof of the temple is entirely gone, and the interior has been much defaced by the fanaticism of the Mohammedans, who employ the southern end as a mosque. At each extremity of the building, which is 134 feet long, exclusive of the colonnade, is a semicircular vaulted chamber, with a richly-sculptured roof, that at the north end having representations of the signs of the zodiac. This magnificent temple is considered by Porter, as a whole, to be scarcely surpassed by any in the world. "The temple of Minerva at Athens, and a few of its fellows,—the *chef d'œuvres* of ancient Greece,—are undoubtedly more beautiful in their stern simplicity, and in the brilliancy of their marble columns. Bâ'albek, not less chaste in its sculpture, is more gigantic in its proportions; but the cloistered court at Palmyra, with its long lines of statues, and the temple itself towering high over all, formed a picture unique and unequalled by any of these." (Vol. i., p. 238.) Besides the temples and colonnades, there are at Palmyra numerous tombs, many of which are curious and interesting. There seem to have been two cemeteries near the town, one of which, supposed to be the more ancient, as it contains no Greek inscriptions, lies in the plain to the S.W., while the other occupies the sides of the valley through which the road leads westward. Some of the tombs are hewn out of the rock; others are towers several storeys in height. They generally contain receptacles for coffins, arranged in tiers; most of them have inscriptions, and many are adorned with sculpture. One of the aqueducts that supplied the city with water runs through the valley in the west from a source in the northern mountains. It is built of hewn stones, and is 8 feet high by 4 broad. There was also another aqueduct, the source of which is not known, but of which traces have been observed to the N. of the great temple. From a fountain, near which is an ancient altar of Jupiter, to the S.W. of the city, flows a sulphureous stream, which supplies the modern inhabitants, and waters their few gardens. The inscriptions on the various columns and buildings of Palmyra are numerous, and are written both in Greek and in the Palmyrene characters, which have a considerable resemblance to the Hebrew. The earliest date that has been found in Greek is 314 of the Seleucian era (A.D. 2); but the Palmyrene inscriptions are believed to be much more ancient. As many of the tombs have never been opened, and as the Palmyrene tongue has not yet been deciphered, it is possible that some additions to our knowledge of ancient history may be derived from these inscriptions, though most of the Greek ones contain little more than names and dates. Of the more modern buildings at Palmyra, the only one that deserves notice is the Saracenic castle, which stands on the hills to the N.W. of the town, commanding a fine view of the whole of the ruins. It is said by the Arabs to have been built by Man Ogle, a Druse prince; but it is now entirely deserted.

Such is the present condition of the renowned city of "Palmyra, central in the desert;" a city which was once the seat of wealth and of learning—the capital of a nation that defied the power of Rome—the chief emporium on a route by which of old the wealth of India was conveyed to the West—and which, though now traversed only by the wandering Bedouin or the adventurous traveller, seems likely to become again the highway to the East. The wretched huts of the present inhabitants, contrasting with the splendour of the ancient remains, show how fatal to Palmyra has been its conquest by the followers of the Prophet. (See *Damascus and Palmyra*, by Charles G. Addison, London, 1838; *Five Years in Damascus*, by the Rev. J. L. Porter, A.M., F.R.S.L., London, 1855.)

PALO, a town of Naples, province of Bari, stands on a steep rock rising above the left bank of the Sele, 11 miles S.W. of Bari. It contains two convents, and has manufactories of soap. Pop. 4650.

PALOMAR, SAN ANDRES DE, a town of Spain, province of Barcelona, and 4 miles north of that town. It contains a small church of Moorish style, a court-house, and several schools. Weaving, spinning, and lace-making are carried on; and the town is in a flourishing state. Pop. 4345.

PALOMINO DE CASTRO Y VELASCO, ACISCLO ANTONIO, "the Vasari of Spain," was born of a good family at Bujalance in 1653. He received an excellent education at Cordoba in grammar, philosophy, theology, and jurisprudence; but his taste for art triumphed over his love of letters. Cordoba was visited by Valdés Leal in 1672, and by Alfaro in 1675. They were both painters of reputation, and they bestowed much care on the instruction of Palomino. Both did what they could to stimulate him in the study of his art, and both strove to smooth his way to advancement. Having a vague hankering towards the church, he took minor orders sometime before 1678, when, on the advice of Alfaro, he repaired to Madrid to prosecute the study that lay nearest his heart. Here painting and mathematics, the society of artists and men of letters, occupied his time till the death of his friend Alfaro in 1680 called him to complete the pictures left by that artist on the easel. Palomino soon afterwards married a lady of rank, was appointed alcalde of the Mesta, and was thus raised to the rank of nobility. He continued to prosecute his art with some degree of success; and in 1688 was made painter to the king. He visited Valencia in 1697, where he remained three or four years, and left behind him a number of feeble frescoes in the principal churches there. Salamanca, Granada, and Cordoba were visited successively in a professional capacity between 1705 and 1715. It was during the latter year that the first volume of his great work on art made its appearance. On its completion in 1724, it bore the title *El Museo Pictorico y Escala Optica*, 2 tom. fol., Madrid, 1715–24. The first volume contains some valuable disquisitions on painting, much silly gossip about miraculous images, and numerous practical hints to artists, at once prolix and pragmatical. The portion of his work devoted to the biography of Spanish artists, entitled *El Parnaso Español Pintoresco Laureado* ("The Picturesque Laurelled Spanish Parnassus"), without being remarkable for accuracy, is nevertheless a perfect storehouse of facts, traditions, and quaint, facetious stories, of which subsequent writers have freely availed themselves. There is an honest, garrulous simplicity about his narrative; and, curious to say, he is much more given to praise than to blame his brethren of the brush when he has occasion to be critical. As a writer he does not stand much

higher than as an artist; yet the learning and industry which he brought to bear upon his history of art have formed the mainstay of his reputation, and have preserved his name from oblivion. The latter days of Palomino were spent as a churchman. His wife dying in 1725, and his own health having given way, he received priest's orders during the same year. He died on the 13th of August 1726. Palomino's History was partially translated into English in 1739; an abridgment of it in the original appeared at London in 1744, afterwards translated into French, with additions, in 1749; and a reprint of the entire work was issued from the press at Madrid in 1797. (See Stirling's *Annals of the Artists of Spain*, vol. iii., pp. 1120–1134.)

PALOS, a small seaport of Spain, province of Huelva, on a bay of the Atlantic. From this place Columbus sailed, August 3, 1492, on his first voyage; and here he landed, March 15, 1493, after the discovery of America. Here also Cortes landed in 1528, after the conquest of Mexico. In the neighbourhood is the convent where Columbus, asking alms, was received by the prior, Juan Perez de Marchena, through whose influence at court he was permitted to undertake his voyage.

PALOTA, a market-town of Hungary, county of Veszprim, 13 miles W. of Stuhlweissenburg. It contains a castle, several churches belonging to different sects, a synagogue, and an orphan hospital. There are here several mills and woollen factories.

PALU, or PALOO, a town of Asiatic Turkey, pashalic of Diarbekir, stands on the eastern branch of the Euphrates, at an elevation of 3292 feet above the sea, 55 miles N. of Diarbekir. It has a castle; and is surrounded by a rich and well-cultivated country, with numerous gardens and vineyards. About three-fifths of the population are Mohammedans, and they are almost the sole landowners and farmers. The Armenians, who form the rest of the inhabitants, are heavily taxed. Weaving, dyeing, and tanning are actively carried on. Pop. about 5000.

PALUDAMENTUM was a habit among the Romans, differing little, if at all, from the chlamys. It was worn by the officers and principal men in time of war, who were therefore called *paludati;* and this distinguished them from the common soldiers, who, because they wore the *sagum,* were called the *sagati.* The *paludamentum,* which was generally white or red, came down to the knees, or lower, was open in front, hung loosely over the shoulders, and was fastened across the chest by a clasp.

PAMIERS, a town of France, in the department of Ariège, capital of an arrondissement of the same name, stands on the right bank of the Ariège, 11 miles N. of Foix. It is a neat and cheerful place, containing a cathedral with a brick Gothic tower, several other churches, a convent, bishop's palace, court-house, several schools, and a large hospital. It is the seat of a court of the first resort; and has manufactures of nails, files, paper, serge, and woollen cloth. Some trade is carried on in corn, wool, horse-hair, &c. In the village of Carlat, not far from Pamiers, the celebrated Bayle was born in 1647. Pop. (1856) 7267.

PAMIR, or PAMERE, an elevated region in Central Asia, to the N. of the Hindu Koosh Mountains, forms a part of Independent Tartary. It contains the lake from which the Oxus takes its origin; and has some mountains rising to the height of 1900 feet above the sea. The inhabitants of this country are Kirghises, who pursue a wandering and pastoral mode of life. The pasturage is good, but the climate is very cold, and snow lies in some parts all the year round.

PAMPAS, vast plains in South America, extending over an area of 1,620,000 square miles, and occupying nearly the whole of Patagonia, and all the central part of the Argentine Republic. They are traversed by numerous rivers; and while in some parts they are covered with grass, in others the ground is of a swampy and marshy character.

PAMPAS DEL SACRAMENTO, extensive plains occupying the N.E. and less known parts of Peru, having an area of about 60,000 square miles. They are of great fertility, and in many parts have been cultivated. In some places they are covered with dense and luxuriant forests.

PAMPHILUS, a benevolent promoter of learning in the early church, is said to have been born at Berytus in the latter half of the third century. After studying under Pierius at Alexandria, he settled as a presbyter at Cæsarea in Palestine, and began to devote his life to the advancement of Scriptural knowledge. He formed a valuable ecclesiastical library, founded a theological school, and multiplied the copies of the Holy Scriptures. At the same time, all these appliances were used by him with the most liberal-minded philanthropy. All who were animated by a love for sacred learning were kindly welcomed into his library or his school; and all the poor who were eager to read the Divine word for themselves, were presented with a copy of the Bible from his hands. This self-sacrificing life was nobly brought to a close in 309 by a brave endurance of the pains of martyrdom. Pamphilus was the author of an *Apology for Origen*, in five books, a work which was continued by his pupil and admirer Eusebius in a sixth book. The first book alone is extant in a Latin version by Rufinus, and has been inserted in Delarue's edition of Origen.

PAMPHILUS, one of the most distinguished of Greek painters, was born at Amphipolis in the fourth century B.C., and studied at Sicyon under Eupompus. The high opinion which he entertained of the requirements of an artist became the most prominent feature of his career. While studying as a pupil, he thought it necessary to make himself a proficient in all the general learning of the day. After he had succeeded his master as head of the Sicyonian school, he established a comprehensive system of artistic training. All sciences that related either directly or indirectly to painting were included in the subjects of study; the duration of the course was extended over ten years; and the art of delineating was laid down as the fundamental element in the education of all those who were free-born. The result of this thorough-going method soon became palpable. The master and some of his pupils outstripped all other artists in the composition of their pictures; such painters as Apelles were attracted by the growing reputation of the school; and the above-mentioned principle touching delineation came to be adopted throughout the rest of Greece. The close attention which Pamphilus devoted to tuition must have left him little time for the private practice of his art. Accordingly, the only pictures of his whose names are recorded are the "Heraclidæ," "The Battle of Phlius," "Ulysses on the Raft," and the "Cognatio" or "Relationship." The last is supposed to be a family group.

PAMPHYLIA, a province on the S. coast of Asia Minor, was bounded on the N. by Pisidia, on the E. by Cilicia, and on the W. by Lycia and a part of Phrygia. Its limits appear to have never been accurately defined, and to have been different at different times. However, its northern boundary was generally held to be Mount Taurus; and, according to Strabo, it extended from Olbia on the W. to Ptolemais on the E. The inhabitants of Pamphylia, as the name of the country imports, were at first a collection of many different races. These were recruited in course of time by Cilicians and bands of emigrant Greeks. Yet the smallness of the country rendered it unable to play any important part in history. Along with the rest of Asia Minor, it fell successively into the power of the Persians, the Greeks, and the Romans. The principal towns of Pamphylia were Olbia, Attalia (Adalia), Perge, Aspendus, and Side (Eski Adalia); its chief rivers were the Catarrhactes (Duden-Su), Cestrus (Ak-Su), Eurymedon (Kapri-Su), and Melas (Scheher-Su.)

PAMPLONA, a city of Spain, the capital of the province of Navarre, and an episcopal see, in N. Lat. 42. 50., W. Long. 1. 42., 220 miles N.N.E. of Madrid. It is situated in a plain on the left bank of the Arga, closed on three sides by the Pyrenees, and forming what is called the *Cuenca* or bowl of Pamplona. The site is level, except on the N., where there is a descent towards the suburb. Owing to its position, its general climate is cold and humid; heavy snows and rain accompany the N. and N.W. winds in winter, while in summer the S. wind brings excessive heat. The purity of the air, however, and cleanliness of the town, render it tolerably salubrious. Pamplona has always been the frontier key and principal fortress of Navarre, commanding the plains. The fortifications form a rectangle, of which the N.E. and N.W. sides, La Magdalena and La Rochapea, face the river, which has a semicircular bend to the N. about the town. On the S.W. side, La Taconera, stands the citadel, constructed by Philip II. in 1571, after the model of that of Antwerp. It is a pentagon, and is separated from the city by an esplanade. It is calculated to contain 7500 men, but the barracks and store places are in very bad condition. The streets of the town are regular and broad, running generally N.E. and S.W.; and the cleanliness of the town is secured by a system of sewerage superior to anything of the kind in Spain. There are three plazas, of which the principal, De la Constitucion, formerly Del Castillo, has a side of 146 yards, and contains a theatre built in 1843, and the Casa de Diputacion. The plaza is converted on festivals into a Plaza de Toros, and has in the centre a fountain surmounted by a statue. The Plaza de San José contains the cathedral and its residencies. The cathedral, one of the finest in Spain, is a Gothic structure built in 1397 by Carlos III., who is here interred; the previous building, also a re-erection by Don Sancho in 1123, having fallen into ruin, and nothing now remaining of it but a portion of the cloisters. The principal façade is Corinthian, heavy and unsuitable, and was erected in 1783 from the designs of Ventura Rodriguez. Remarkable in the choir are the figures of saints and prophets, of English oak, carved in 1530 by Miguel Ancheta, a native sculptor. There are three parish churches besides that of Saint John Baptist in the cathedral; the church of San Saturnino and that of San Nicolas de Bari are of the twelfth century. There are ten conventual buildings in the town, now mostly devoted to other purposes. There are, besides the citadel, seven buildings for military purposes; four barracks, one in the ancient palace of the kings of Navarre, the others in convents; a military hospital; and a powder magazine. Of places of amusement, there are the theatre already mentioned; two buildings for ball-playing, one of which, El Trinquete, a fine hall with two galleries, is the most frequented; and a fine Plaza de Toros, capable of holding 8000 spectators. The six fountains of the city are supplied by means of a superb aqueduct from Monte Francoa, 2¼ leagues in length, built from the designs of Ventura Rodriguez at the end of last century. This fine work suffered much damage in the last civil war. Pamplona has always been distinguished for its love of letters and attention to public instruction. The institute of secondary instruction has fourteen professors, with good museum and library, and an average attendance of about 300 pupils. It is situated in the Plaza de San José, by the cathedral. The Academy of Design is a fine hall in the lower storey of the Franciscan convent, is supported by the municipal funds, and numbers about 150 pupils, partly gratuitous. There are, besides, a normal school for male and one for female teachers; an infant school; a public boys' school, attended by about 600 pupils; a girls' school, conducted by the nuns of Sta. Catalina de Sena, attended by about 500 pupils, of whom above a third are gratuitous; and several other private establishments. There are three hospitals,—the General Hospital for sick, the Casa de Misericordia, and the Casa de Maternidad, which is also an orphan and a foundling hospital. Of the public gardens and paseos, the finest is that of La Taconera, which is also the most frequented in summer. The district of country near the town is tolerably fertile, producing a considerable quantity of grain and seeds, and the light-red wine called *chacoli*. By the river are many irrigated gardens, from which the town derives most of its vegetables. Besides agriculture, the only branch of industry of any importance is the manufacture of linen. Grain is exported to the mountainous regions of Navarre and Guipúzcoa. The weekly provision markets on Saturday are well supplied, and the market-places are numerous and commodious. The yearly fair, and feast of San Fermin, patron of the city, takes place 29th June to 18th July, and on these days the town is filled with the unusual concourse of people from all parts of the country. The tradition is, that the town was founded by Tubal, A.M. 1840; historically, its foundation is due to Pompey the Great, from whom it derived its name of Pompeiiopolis, now corrupted to Pamplona. It was captured by Euric the Goth in 466, and afterwards by the Franks in 542, under Childebert. Charlemagne dismantled it in 778, in which state it remained till the eleventh century, when the three districts of the town were separately fortified. The continual intestine contests of these three fortresses caused Carlos III., in the beginning of the fifteenth century, to destroy the interior walls, and strengthen the common bulwarks. He also erected the citadel on the site now occupied by the Plaza de Toros and the Basilica de S. Ignacio, built over the spot where that saint was wounded in defence of the citadel against André de Foix in 1521. In the late French war it was taken by stratagem by the French under D'Armagnac, and remained in their power till recaptured after a blockade by Wellington in 1813. In the civil war that followed the death of Ferdinand VII., Pamplona was the strong place of the liberals. The citadel was seized and held for a short time by O'Donnell in September 1841. Pop. (1848) 15,715.

PAN, the god of shepherds among the Greeks, was the son of Mercury, and of a nymph, the daughter of Dryops. He was born a noisy, grinning, hairy infant, fully equipped with horns, a puck-nose, a beard, a tail, and the feet of a goat. As soon as his mother saw her monstrous offspring, she fled from him in horror, and left him to the care of his father. Wrapped up in hare-skins, he was carried by Mercury to Olympus, and was there exhibited to the delighted gods. He was then given out to nymphs to be nursed. The young divinity grew up to be possessed of every rustic accomplishment. His goat-feet could walk lightly and gracefully through the mazes of the dance; his hands could wander nimbly and skilfully over the stops of the pastoral pipe; and his piercing sight, dashing recklessness, and wild lusty halloo, made him the very paragon of hunters. Adorned with all these qualifications, Pan settled down in Arcadia, and undertook the avocations of a rural deity. During his hours of business he protected flocks, bees, and game, and attended to the interests of shepherds, husbandmen, and hunters. A less beneficent part of his employment was to strike sudden fright into large herds of cattle, to startle travellers in lonely places of the forest, and to throw armies into irretrievable rout with a causeless alarm, which was called after him *Panic* terror. In his hours of leisure he took his mid-day slumber in a grotto, practised upon the syrinx, made love to the nymphs, and conducted with dance and song the greenwood merry-makings of the rustic divinities. He would occasionally pay a visit to Bacchus, a god to whom he was always welcome, on account of his loud-ringing voice, and his musical and calisthenic accomplishments. Occasionally also would his fondness for the sea lead him down to the coast to patronize fishing and marine amusements. Pan had many temples

and shrines erected to him in Arcadia. There were also many other places in which his worship was observed. Among these was Athens, where a chapel was dedicated to him in consideration of the aid he had given to the Athenians at the battle of Marathon. His sacrifices were milk and honey. In addition to his best-known character as a god of Arcadia, Pan had also other characters. He was identified with the Faunus of the Romans and the Mendes of the Egyptians. He was also latterly considered as the *universal* god of nature, as the impersonation of the *universe*—τὸ πᾶν.

PANÆNUS, a distinguished Greek painter, was the nephew of the great sculptor Phidias, and flourished at Athens in the fifth century B.C. His principal engagements were of a public nature. He ornamented with painted stories of the gods the Olympian statue of Jupiter which his illustrious uncle had executed. He was also employed to paint with a mixture of saffron and milk the roof of Minerva's temple at Elis. But his masterpiece was the "Battle of Marathon," which constituted one of the decorations of the "Poecile" at Athens. It contained portraits of the Greek leaders Miltiades, Callimachus, and Cynægirus; and of the Persian leaders Datis and Artaphernes. A further peculiarity was, that it represented the fight in four different stages of its progress. In the first the armies were about to engage; in the second they were maintaining an equal contest; in the third the Greeks were beginning to rout their foes; and in the fourth the Persians were escaping in disorder on board their ships.

PANÆTIUS, a celebrated Stoic, was a native of Rhodes, and flourished in the second century B.C. After learning grammar at Pergamum under Crates of Mallus, he settled in Athens as a student of the Stoa. Under Diogenes of Babylon and Antipater of Tarsus, the successive heads of the Stoical school, he rose to eminence and repute. The great Roman, Scipio Æmilianus, became his friend, and chose him for a travelling companion; and the Stoics, on the death of Antipater, elected him for their master. It was in this latter capacity that Panætius established his reputation as an original expounder of the ethical doctrines of his school. He modified the severely abstract maxims of the Stoa into a form more suitable for practical life; supplied their defects from the systems of Aristotle, Xenocrates, Theophrastus, Dicæarchus, and Plato; and clothed them in the fascinating garb of simile and rhetorical ornament. *Rectitude* was defined to be "living in conformity with our natural impulses." The *virtues* were divided into *contemplative* and *active;* and the *useful* and the *honourable* qualities in actions were declared to be coincident. The principal work in which Panætius embodied these principles was a treatise *On Duty* in three books. It is not extant, but its contents have been incorporated in the first two books of Cicero's *De Officiis.*

PANAMA, a town of New Granada, on the southern shore of the isthmus of the same name, stands on a tongue of land projecting into the Bay of Panamá, N. Lat. 8. 57., W. Long. 79. 30. The plan of the town possesses some regularity, but is not entirely uniform; the principal streets extend across the peninsula on which it is built. The streets are better cleaned than in most of the Spanish towns in America. It is for the most part substantially built in the old Spanish style, and all the larger houses have interior courts, or *patios,* as they are called. The chief public edifices are—an elegant cathedral, several convents, a nunnery, and a college. The fortifications of the town consist of high walls and irregularly-constructed bastions, which have been added at various times, as the protection of the place required. The harbour of Panamá is sheltered by several islands at some distance from the land. These form one of the finest roadsteads in the world, with very safe anchorage. The trade of the place is very considerable, and is likely to be much increased by the railway which has been recently constructed between this place and Aspinwall, on the Atlantic shore of the isthmus, although the immediate effect of this improvement has been to reduce the importance of Panamá in comparison with Aspinwall. Quinine bark, cacao, India-rubber, hides, pearl oysters, and other articles, are exported from hence to Europe; and it is expected that most of the trade formerly carried on round Cape Horn will now pass through Panamá. The town was originally built by the Spaniards, on a spot about 3 miles to the east of the modern town; but it was burned down in 1670 by Sir Henry Morgan, the bucaneer, and afterwards rebuilt in its present position. Pop. 6000.

PANAMA, or DARIEN, *Isthmus of,* connects the continents of North and South America, and forms a state of the republic of New Granada. Its shape is that of an arc of a circle, curving towards the N., and inclosing the Bay of Panamá on the S. Both sides of the isthmus are indented by several creeks and harbours, of which the most important are Port Escoces and Navy Bay on the N., and the harbours of Panamá and San Miguel on the S. The interior of the isthmus is little known. Part of it is occupied by the Cordillera, or great mountain chain which extends through the American continent; but this mountainous region is interrupted by tracts of low level ground. These plains are well watered, thickly wooded, and rich in minerals and the vegetable produce of tropical countries. Besides the railway from Aspinwall to Panamá, a canal has been proposed from Port Escoces to San Miguel. The breadth of the isthmus varies from 30 to 70 miles, being narrowest at Panamá. The chief river of Panamá is the Chagres, which flows first westward, then northward, and falls into the Atlantic, after a course of 80 or 90 miles, for 44 of which it is navigable by barges. Before the construction of the railway it was of much importance, as goods were conveyed by it part of the distance across the isthmus; and the town of Chagres, at its mouth, was the chief port on the north side of Panamá. This was, however, at best a wretchedly-built and very unhealthy place, with a shallow and unsheltered harbour, and is now quite deserted, having been supplanted by the new town of Aspinwall on Navy Bay. Pop. of the state of Panamá, 138,108.

PANAON, a small island in the Philippine group, lies between those of Leyte and Mindanao, N. Lat. 9. 55., E. Long. 125. 8. Its length is about 18 miles, and its circumference 45 miles. There are several small rivers in the island.

PANATHENÆA (Παναθήναια), an ancient Athenian festival in honour of Athena, the protectress of Athens. Harpocration and Suidas refer the institution of this festival to Erichthonius IV., King of Athens, who lived before Theseus. Theodoret alone says that the feast was established by Orpheus. But be this as it may, till the time of Theseus it was never a particular feast of the city of Athens, and was simply called *Athenæa;* that prince, however, having united all the people of Attica into one republic, they afterwards assisted at the festival; and hence the name *Panathenæa,* or the feast of all Attica. In effect, all Attica was present; and each division of the people sent a bullock for the sacrifices, and for the entertainment of the vast multitude of people assembled. There were two festivals under this denomination, the greater and the lesser. The greater Panathenæa were celebrated in the third year of each Olympiad, probably on the 28th of Hecatombæon; the less, annually. Though the celebration of neither employed at first more than one day, yet in after times they were protracted for the space of many days, and solemnized with greater preparations and magnificence than at their first institution. The ceremonies were the same in the greater and the lesser Panathenæa, excepting a banner, on

which the actions of the goddess were represented in embroidery, executed by maids, with the names of those who had distinguished themselves in the service of the republic. This only was borne at the greater. Prizes were established for three different kinds of combat. The first consisted of foot and horse races; the second, of athletic exercises; and the third, of poetical and musical contests. These last are said to have been instituted by Pericles. Singers of the first class, accompanied by performers on the flute and the cithara, exercised their talents upon subjects prescribed by the directors of these exhibitions. (See Meursius, *Panath.*, Lugd. Bat. 1619; H. A. Muller, *Panath.*, Bonn, 1837; K. O. Muller, in *Phil. Museum*, vol. ii., p. 227, &c.)

PANAULON, an enlarged German-flute, with sixteen finger-keys, and descending as low as G in the treble clef, with two ledger lines under the stave. It was invented some years ago by Trexler of Vienna. To remedy its inconvenient length, the lower end was curved. The quality of its tone is not so good as that of the common German-flute; but still the panaulon may be effectively used in orchestra music as a bass to the other flutes.

PANAY, the central island of the Philippines, lies between N. Lat. 10. 25. and 11. 50., E. Long. 122. and 123. 10., having Mindoro on the N.W., Masbate on the N.E., and Negros on the S.E. Its form is triangular; its length, 110 miles; breadth, 100 miles; area, about 4579 square miles. The surface is mountainous, especially in the N.E. and S.W.; but it is well watered, and has a fertile soil. Along the western coast there is a low, well-cultivated tract of ground, containing several villages and a large population. Rice, maize, sugar, tobacco, coffee, and other crops are raised on the island; and in the interior there are extensive forests of valuable timber. Buffaloes, wild oxen, stags, &c., abound, as well as birds of great beauty. Turtle and fish are obtained on the shores and in the rivers. The women are chiefly employed in weaving; while the men work at agriculture, fishing, cutting wood, making oil and sugar, &c. The island is divided into the provinces of Iloilo, Capiz, and Antique. Iloilo, the chief town, has a harbour capable of affording safe anchorage to a large number of vessels. Many coasting ships frequent it, and some commerce is carried on. The resources of the island are such as to lead to the expectation of its making rapid progress and attaining great prosperity. Pop. 559,861.

PANCRAS, St., a parish of England, in the county of Middlesex, forming a part of London towards the north. The church of St Pancras in the Fields contains many interesting monuments. There is also a new church, which is a fine specimen of the Athenian-Ionic style of architecture. Area of the parish, 2716 acres. Pop. (1851) 166,956.

PANCRATIUM (compounded of πᾶν, *all*, and κρατος, *strength*) signifies properly an athletic game in which all the powers of the athlete were brought into play. It consisted of wrestling and boxing; but the athletes were not permitted to seize the body, and their hands were not armed with gauntlets. The *pancratium* was the third and the most severe of all the gymnastic exercises of Greece, and was not introduced till long after the others. The people who were engaged in these exercises were called *pancratiastæ*,—a name which was also given to such as did not confine themselves to one exercise, but succeeded in several different ones. (See J. H. Krause, *Die Gym. und Agon. der Hellenen*, vol. i.)

PANCSOVA, a town of the Austrian empire, in the Banat Military Frontier, stands on the Temes near its junction with the Danube, 8 miles E.N.E. of Belgrade. It contains a Roman Catholic and a Greek church, and two schools. Many of the houses are well built, and inhabited by Germans and Greek merchants. Manufactures of beet-root sugar and of silk are carried on; and there is an active trade in corn, timber, and cattle. Pop. (1851), exclusive of the military, 11,043.

PANDECTS. See CIVIL LAW.

PANDORA (from πᾶν, *every*, and δῶρον, *a gift*), a personage who is represented in classical mythology as the first mortal woman. The following account is her history, as given by Hesiod:—Jupiter, enraged at Prometheus for having stolen fire from heaven, resolved to send upon the earth some great evil under a lovely and bewitching disguise Vulcan was accordingly commanded to create out of clay a female possessing the form and features of an immortal goddess. The divinities of Olympus were then summoned to adorn the new being with their gifts. Venus breathed upon her grace and beauty, Mercury instilled into her mind insinuating and impudent artifices, Minerva taught her domestic accomplishments and clothed her with becoming garments, and the Hours and Graces decked her with golden necklaces and crowned her with flowering chaplets. Thus adorned, as the name then given to her implied, with *all the gifts* of the gods, Pandora was sent by the hand of Mercury to Epimetheus, the brother of Prometheus. That infatuated individual, although warned beforehand, accepted the fascinating present, and entailed perpetual misery upon the human race. In a short time, a peculiar vase came under the inquisitive eye of the woman; her hand was tempted to open it; a swarm of plagues, privations, and miseries hitherto kept imprisoned, immediately flew forth to haunt the world for ever; and Hope alone remained at the bottom.

PANEEPUT, a town of British India, capital of a district of the same name in the territorial division of Delhi, N.W. Provinces, stands in a fertile country, 78 miles N. of Delhi, and 965 N.W. of Calcutta. The numerous white spires and domes of the various temples render Paneeput a beautiful object when seen from a distance. Most of the houses are built of brick, and are provided with balconies. The walls and ramparts, with which the town is surrounded, are of an irregular kind, having been built at several different periods. There are here two caravanserais, which contribute greatly to the importance of the town. In the vicinity there are a great number of tombs in ruins, and many of these are remarkable for size and splendour. The neighbourhood of Paneeput, lying in the great military highway between Eastern India and Afghanistan, has been more than once the field of great battles. Here, in 1526, Baber gained the victory over the Patan King of Delhi, which overthrew that dynasty; and here, in 1761, the Mahrattas were conquered by the Afghans under Ahmed Shah. Pop. (1853) 22,612.

PANEEPUT, a district of British India, in the division of Delhi, bounded on the N. and W. by the division of Sirhind, S. by the district of Delhi, and E. by those of Meerut and Mozuffurnuggur. It lies between N. Lat. 28. 50. and 29. 48., E. Long. 76. 40. and 77. 16., having a length of 65 miles from N. to S., a breadth of 30 miles, and an area of 1279 square miles. The surface is flat, and well watered by natural streams and by artificial canals; but in many parts it is quite barren, and covered with a saline incrustation resembling snow in its appearance. The principal river is the Jumna, which flows along the eastern boundary of the district. Pop. (1853) 389,085.

PANEGYRIC (πανήγυρις), an oration in praise of some extraordinary person or thing. The name is composed of πᾶν, *all*, and ἀγειρω, *I assemble*; because anciently in public and solemn assemblies of the Greeks, either at their games, feasts, fairs, or religious meetings, panegyrics were pronounced. To render these the more solemn, the Greeks used to begin with the praises of the deity in whose honour the games were celebrated; next they descended to the praise of the people or country where they were celebrated; then they

Panel || Pannonia.

lauded the princes or magistrates who presided at them; and, lastly, they bestowed eulogies on the champions, especially the conquerors, who had gained the prizes in them.

PANEL, according to Sir Edward Coke, is derived from *pane*, a part, and denotes "a little part;" but the learned Spelman says that it signifies *schedula vel pagina*, a schedule or roll, as a panel of parchment, or a counterpane of an indenture; whilst others derive it from the French *panne*, a skin. It is used more particularly for a schedule or roll, containing the names of such jurors as the sheriff returns to pass upon any trial. Hence the *impanelling* a jury is the entering their names in a panel or little schedule of parchment.

PANIONIA, a great national festival of all the Ionians, celebrated on Mount Mycale, in honour of Poseidon, their national deity. In this festival, if the bull offered in sacrifice happened to bellow, it was accounted an omen of divine favour, because that sound was thought to be acceptable to the god. These national gatherings were frequently political as well as religious.

PANMELODICON, an instrument invented by Leppich at Vienna in 1810. By means of a conical barrel moved by a wheel, rods of metal, bent to a right angle, were made to sound when the finger-keys were pressed down.

PANNINI, GIOVANNI PAOLO, an eminent Italian painter, was born at Piacenza in 1691. At Rome, where he completed his preparatory studies, he devoted his attention chiefly to the painting of architecture, and acquired great excellence in that branch of art. Although prone to make his figures too large in proportion to the buildings, and to fall into the mannerism of mixing a reddish hue in his shadows, he was unsurpassed in his management of perspective. His groups of figures were also admirable for their grace, variety, and vivacity. All these qualities were displayed with especial advantage in his picture of the "Money-Changers driven from the Temple." Pannini died in 1764.

PANNONIA, a Roman province, was bounded on the W. by Noricum and Italy, on the S. by Illyricum and Mœsia, and on the E. and N. by the Danube, and corresponded to that track including Croatia, Slavonia, and portions of Austria, Hungary, and Bosnia. The early history of the country is involved in obscurity. Some suppose that its original inhabitants were Pæonians, who gradually came to call themselves Pannonians. A more probable opinion is, that it was colonized by Celtic tribes. At any rate, in 35 B.C. the Romans found the district in a low state of civilization. The extensive forests which cumbered the soil prevented the pursuits of agriculture; and the natives, divided into several tribes, which seem to have acknowledged separate chiefs, were addicted to war and rapine. From that date, however, a change slowly began to come over the social state and government of Pannonia. In 8 A.D., after an obstinate resistance, it was ultimately subjugated and reduced to the form of a Roman province by Tiberius. In the second century it was divided into two parts, Upper Pannonia, on the W., and Lower Pannonia, on the E. In the third and fourth centuries the emperors Probus and Galerius cleared the soil of much of the wood, and made room for the operations of agriculture. Meanwhile roads had been made, colonies had been planted, and Roman legions in the various fortresses, and a Roman fleet on the Danube, protected the government of the country. Pannonia retained this social organization until the middle of the fifth century, when it was ceded to the Huns.

The most important towns in Lower Pannonia were—Vindobona (*Vienna*), Carnuntum, Sabaria (*Sarwar*), Æmona (*Laybach*), and Siscia (*Siszeg*). Those in Upper Pannonia were Acincum (*Alt-Buda*), Mursa (*Erzek*), and Sirmium. The principal rivers were the Arrabo (*Raab*), the Dravus (*Drave*), and the Savus (*Save*), all flowing into the Danube.

Panorama.

PANORAMA (from πᾶν, *all*, and ὅραμα, *a view*) is a picture drawn on the interior surface of a large cylinder, representing the objects that can be seen from one station, when the observer directs his eye successively to every point of the horizon. A picture drawn on a vertical plane in the usual way includes only that portion of the sphere of vision that can be seen from one point opposite to the picture, without turning the eye; this portion may comprehend about thirty degrees of the horizon, because the field of distinct vision when the eye remains unmoved is concluded in a cone, the angle at the apex of which does not exceed thirty degrees. There are compositions comprehending the visible hemisphere, and sometimes nearly the whole sphere of vision; and in these, one connected scene is represented on the interior surfaces of a polyhedron or of a curved solid, the point of sight being in the centre of the polyhedron, and the eye being turned round on its centre to each of its surfaces, in order to view the whole scene. Of this kind are the gnomonic projection of the sphere on the interior surfaces of a cube, and several pictures, in which one connected subject is represented on the ceiling and the sides of a room; such as the picture of "Jupiter Fulminating the Giants," by Giulio Romano, on the walls and hemispherical ceiling of a round room in the Palazzo del T at Mantua; and the architectural representations and ornaments in Raphael's Loggie in the Vatican. Objects are also sometimes projected on the interior surface of a sphere, the eye being placed in the centre; as in a large hollow sphere with the constellations, which was constructed at Pembroke College, Cambridge. These projections, where the eye, remaining in the point of sight, is turned round on its centre to view the different parts of the picture, are formed on the same principle as the panorama.

The cylindrical surface is the most convenient for panoramas of landscapes; and the specific employment of a large cylindrical surface for representing the landscape of the whole circle of the horizon is the invention of Robert Barker, who brought the panorama into use about the year 1794. The cylinder on which the panorama is painted is commonly about sixty feet in diameter. The projection or perspective of a panorama is formed by imaginary lines drawn from different points of the surrounding objects to the point of sight in the axis of the cylinder. The intersections of these lines with the cylindrical surface form the corresponding points in the panoramic picture. Where the picture is projected on a plane, as in common perspective, and in the gnomonic projection of the sphere, the cones formed by imaginary lines or rays passing from the point of sight to the different objects are cut by the plane of the picture; consequently the sections, being formed by a plane, are curves of which the curvature is always simple. In the perspective of the panorama, where the picture consists of the intersection of the cones of rays by a cylinder, these intersections are, in many of the cases, doubly curved curves. When the picture of a straight line which is neither parallel to the horizon nor to the axis of the cylinder is drawn on the cylinder of the panorama, the picture of the line is part of an ellipse, because the oblique section of a right cylinder, by a plane passing through the axis, is an ellipse; when the cylinder is developed and unrolled on a plane surface, this ellipse becomes the curve called the sinical curve. The projection of lines on the interior surface of a cylinder is also employed in drawing Mercator's charts. But in the projection of the panorama, the field extends only a few degrees above and below the horizon, whereas in the projections of the sphere, the field extends many degrees on each side of the plane, which is at right

Panormus || Pantheism.

angles to the axis of the cylinder. In drawing a panorama, as well as in drawing a picture on a plane, the horizontal angles between different objects may be observed by a plane table or theodolite; and the elevation of the objects above the horizon, or their depression, may also be observed by the theodolite. The horizontal angles are to be laid down by setting off on the graduated horizon of the cylindrical picture the number of the degrees observed; the vertical angles on the cylinder are the tangents of the angles observed, the radius being the semidiameter of the cylinder.

PANORMUS. See PALERMO.

PANTALONE, an instrument invented about the end of the seventeenth century by Hebenstreit, a German. It resembled the German psaltery, was of an oblong shape, and had two sound-boards, the one furnished with metal wires, the other with gut-strings. Its compass was the same as that of the harpsichord.

Pantellaria || Pantheism.

PANTELLARIA (anciently *Cossyra*), an island belonging to Sicily, in the Mediterranean, 50 miles E.S.E. of Cape Bon, and 80 miles S.W. of the coast of Sicily. The coasts are steep and rocky, affording a landing-place only in one harbour; and the surface is mountainous, and of volcanic origin. It contains mineral springs, and a lake of great depth. The soil is fertile, producing vines, figs, &c. The principal town, which is called Pantellaria, and sometimes also Oppidolo, is built in the form of a semicircle round the harbour, which has a narrow entrance. It contains several churches; and is defended by a castle occupied by a Sicilian garrison. Pop. of the island, 7000.

PANTHEISM.

Description of Pantheism.

PANTHEISM (πᾶν, *all*, Θεός, *God*), is that speculative system which, by absolutely identifying the Subject and Object of thought, reduces all existence, mental and material, to phenomenal modifications of one eternal, self-existent Substance, which is called by the name of God.

The rational solutions of the problem of existence hitherto proposed reduce themselves to the two great classes of Dualism and Unitarianism. The former divides being or substance between two original principles, the latter limits it to one. Three possible ontological theories emerge from Unitarianism, according as we identify absolute reality with Self, with the World, or with Deity:—1. Are all things educed from, and identified with, Self? *Egoism* emerges, of which the corollary is properly Atheism. 2. Are all things educed from, and identified with, Matter? *Materialism* emerges, of which the corollary is also properly Atheism. 3. Are all things educed from, and identified with, Deity? *Pantheism* emerges, which is subject to two grand subdivisions, according as He is conceived of as exhausted or as unexhausted in the act of producing the universe. 1°. Is he regarded as exhausted in the act? Material, physical, real Pantheism is the result, which is subject to further modifications, and of which the proper formula is, *All things are God, and God is all things.* 2°. Is he regarded as unexhausted in the act? Spiritual, ideal, intellectual Pantheism is the result, admitting also of further modifications, and of which the proper formula is, *All things are God, but God is not all things.* According to the former scheme, the one necessary eternal being is identified with the universe, the progressive evolution of material nature being regarded as the development and adequate expression of the entire Divine existence; by the latter scheme, the universe is regarded as a necessary yet inexhaustive evolution of Infinite Being, of which it forms an essential part.

Speculative origin of Pantheism.

As pantheistic speculation finds its origin in that intellectual ambition which would aspire to universal knowledge, and would rest satisfied only with the personal subjugation of the empire of being, it is not to be supposed that it should be limited in its development to any particular time, age, or country. The peculiar class of thinkers likely to be determined towards pantheism are found to rise up in almost all times and in nearly all places.[1] The humble walks of sober induction are discarded as beneath the notice of a lofty and daring genius bent upon the achievement of all knowledge and the conquest of all existence; a position of the highest abstraction is assumed, properly indeterminate and absolutely general, from which, without any regard to what knowledge or existence really is, it becomes the task of the formal ontologist to *deduce* the particular and determinate of knowledge and existence. But neither boldness of design nor brilliancy of execution can atone either to philosophy or to humanity for the essential error and dangerous results which are invariably attendant upon all such attempts to transgress the fixed boundaries which One wiser than we has assigned to our intellectual operations. Such frequent attempts, however, and such conspicuous failures, bring with them their lesson of wisdom. And this lesson may surely be read in the history of pantheistic speculation.

Historical origin of Pantheism.

The origin of pantheistic philosophy can be traced back to near the dawn of reflection in the remote East; and among no class of thinkers has this speculative system found more favour, or a more constant advocacy, than among the dreamy and subtle Orientals. In the front rank stands India, that great centre of speculative activity in the East, which has given birth to pantheistic systems as vast and various as the country on whose soil they grew. Not that speculative systems of rigid scientific strictness, or of an exclusively philosophical character, are to be found among the schools of the Hindus, so far as they are yet known to Europeans. For, with all that has been admiringly said regarding the scientific grandeur and completeness of the Hindu systems of philosophy, we always find, on coming into actual contact with them, that, pervaded as they are by marvellous acuteness, they nevertheless, from their semi-religious, semi-poetical character and colouring, fail to satisfy the demands of rigid scientific speculation both in connected severity of thought and in clear accuracy of expression. This may no doubt in some measure arise from our imperfect acquaintance with their systems; but it is beyond a doubt, that those who fling the pantheistic speculations of the Hindus as a triumphant taunt in the face of Spinozism, as if all that the subtle Jew had accomplished had been often and better done before, do so either in ignorance or through sheer wantonness. For there can be no question whatever, that, so far as history informs us, no pantheistic theory has ever been forged by the brain of man so complete in conception and masterly in execution as that elaborated by Spinoza. In point of fact, however, Spinoza, with all his iron logic and severity of system, never rises to heights more purely pantheistic than are to be found among the mystical speculations of the Hindus. The main distinction is, that the Orientals vivify their philosophy with a spirit of religion, and clothe it with a garniture of poetry; while, with the western pantheist, speculation is a matter almost entirely of the intellect, and no extraneous consideration whatever, apart

[1] "Pantheistic tendencies are found," says H. Ritter, "wherever religion and philosophy are to be found, even among the islanders of the South Sea." (*Hist. of Anc. Philosophy*, vol. i., "Origin of Greek Philosophy.")

from the direct, undeviating path of a rigorous logic, finds any place in the system of this stern thinker.

Hindu Pantheism.

The Hindus themselves reckon six different schools of Indian philosophy, all regarded as offshoots from the primordial doctrines of the Brahmans or sacerdotal caste, viz.,—1. The *Sankhya*, attributed to Kapila; 2. The *Yoga* schools of Pantanjali and the *Bhagavad-Gítá;* 3. The *Púrva-Mimansa*, attributed to Jaimini; 4. The *Vedánta*, or *Uttara-Mimansa*, by the Vyása[1] Krishna Dwaipayana; 5. *Nyaya*, of Gautama; 6. The *Vaisheshika*, of Kanâda.[2] The doctrines of these six schools, however, may be conveniently included under the three general systems denominated the *Sankhya* (including Nos. 1 and 2), the *Nyaya* (including 5 and 6), and the *Vedic* system (including 3 and 4). Curious to say, the only one of these schools considered by the Hindus to be orthodox or conformable to the doctrine of the Vedas, or sacred books, is the Púrva-Mimansa, which is more a Brahmanical essay on the Vedas, of very indifferent merit, than a regular treatise on philosophy.[3] The Sankhya system exhibits a twofold development,—the one atheistic, by Kapila; the other theistic, by Pantanjali. Both agree, however, in being dualistic, admitting, as they do, two real and substantial principles,—Material Nature and the Human Soul,—and are thus excluded from present consideration. The system termed the Nyaya is properly a scheme of logic, at once complicated and elaborate, followed up by a complemental theory of the physical world. It is to the system termed Vedic, accordingly, that we have to direct our attention.[4]

The Vedanta philosophy is the very incarnation of pantheism; and there can be no conceivable ramification of that system which does not find a place among the complicated subtleties of this singular body of doctrines. The great end of man's life, according to this philosophy, is to free himself from all vicissitude, and to attain to perfect repose. This can only be achieved by disengaging himself from that which is transient, and by attaching himself to that which is fixed, eternal, and absolute. Only two paths are open to such a deliverance,—science and good works; and but one of them leads to the golden gates of silence and rest. Good works, as transient in their nature, can only produce a corresponding degree of satisfaction; but science, as devoted to the contemplation of the supreme unity, which is subject to no change, can elevate man above all vicissitude, and secure for him enduring satisfaction.[5] But how is such a consummation to be achieved? Sense cannot attain this science, for it has to do with the transitory; reasoning is likewise insufficient, for the discursive faculty, as essentially relative, can never become the measure of the absolute. To attain to immutable being, accordingly, it is necessary to approach it through that revelation which has been preserved in all ages by the divinely initiated. Sense must be ignored, and all desire for the temporal and earthly must be completely foregone. The aspirant to science must become absorbed in pious meditation, must forget his own individuality, and make the object of his contemplation the Supreme Existence,—the great end of life being not "the union of Self with Supreme Spirit," but to know that all is unity. "Best of all is the *identification* of Soul with the Supreme Spirit."[6] The novice can then have the mysteries of science disclosed to him; and the sum of the revelation is contained in the formula—*All is soul; Brahma* (or Deity) *alone exists; everything else is an illusion.*[7] "Listen to the complete compendium of the Purânas, according to its tenor. The world was produced from Vishnu:[8] it exists in him: he is the cause of its continuance and cessation: *he is the world.*"[9] Having reached this sublime abstraction, the Vedantists labour to give validity to it by considerations drawn from the very idea of Brahma. If there existed out of Brahma, who is the one eternal, absolute, unlimited being, existences, limited, manifold, complex, they must have been produced by him. But as they are repugnant to his very essence, it would be impossible for Brahma to produce them, unless he possessed within himself the real source of limitation, multiplicity, and imperfection. It accordingly follows, continue these speculators, that the mind of man stands in a twofold relation to the universe,—the one resembling a state of sleep or dreaming, the other that of being awake. In the former state man realizes phantasms only, and hence regards the multiplicity of beings in the universe as distinct from Brahma; but when he rises to the waking state, these phantoms of the brain vanish before the coming light of science, and he at once recognises Brahma as everything, and addresses him as "Thou All!"[10] Mind and Matter, in their mutual antithesis and reality, are here of course destroyed. All particular beings, whether spiritual or material, are not even simple modifications of the Divine substance in the same sense in which they are regarded in some systems of pantheism; the universe, material and mental, is nothing but the spectacle of the thoughts of Deity, which he represents to himself by contemplating their possible combinations if realized out of himself. For the law of Causality, which exists in every mind, the refining Hindu substitutes the doctrine of Emanation; and thus discovers, by quite irrefragable logic, that what we call Matter is a mere illusion, and Mind but an empty dream. Corresponding with these two conditions of human thought and life, there exists in the Vedantist philosophy two separate languages,—the one, that of illusion; the other, that of science. The one language is expressive of the relative and the apparent, the other of the absolute and the real. Parallel series of propositions are thus to be found in this philosophy which are apparently contradictory and mutu-

[1] This Vyása (compiler) is generally written and spoken of in most books of philosophy as if it were a proper name, whereas it is used here emphatically to distinguish the last of the 28 vyásas or compilers, who are generally regarded as the redactors of the Vedas. (See *The Bhagavad-Gítá, a Sanskrit philosophical poem*, translated by J. C. Thomson, 1855, p. 69, note.)

[2] See Weber's *Vorlesungen ueber die Indische Literatur-Geschichte*, Berlin, 1852.

[3] For an account of the numerous philosophical sects among the Hindus, see Colebrooke's *Miscellaneous Essays*, vol. i., "Indian Sectaries;" also H. H. Wilson's Essays in the *Asiatic Researches*, vols. xvi. and xvii.

[4] The compilation of the Vedas remounts, according to Colebrooke, to the fourteenth century B.C., and according to Sir Wm. Jones, to the sixteenth B.C.; while Ritter is emphatic in his rejection of the pretensions of the Hindu philosophy to a high antiquity. But on this whole matter critical philosophers and oriental scholars seem alike at sea.

[5] "The great end of life (or truth) is considered by the wise to be eternal; but it would be transient if it were accomplished through transitory things. If you imagine that this great truth is the performance of religious acts, from which no recompense is sought, it is not so; for such acts are the means of obtaining liberation, and truth is (the end) not the means." (See Wilson's *Vishnu-Purânas*, p. 252.)

[6] *Vishnu-Purânas*, chap. xiv.

[7] "The knowledge that this spirit, which is essentially one, is one's own, and in all other bodies is the great end or true wisdom of one who knows the unity and true principles of things. As one diffusive air, passing through the perforations of a flute, is distinguished as the notes of the scale, so the nature of the great spirit is single, though its forms be manifold, arising from the consequence of acts." (*Vishnu-Purânas*, c. xiv., p. 253.)

[8] The Supreme Being of the Hindus is regarded under the three relations of Brahma, Vishnu, and Shiva. Of this Trinity, Brahma is the creator, Vishnu the preserver, and Shiva the destroyer and renovator of material forms.

[9] *Vishnu-Purânas*, c. i., p. 6.

[10] See Cockburn Thomson's *Bhagavad-Gítá*, c. xi.

Pantheism.

ally destructive of each other. But the Vedantist reminds us that there are radically two orders of things,—the real and the illusory. He omits, however, to tell us how this asserted illusion can arise out of the pure and absolute essence of the unconditioned Brahma. To any intelligence but that of a Vedantist it is no doubt palpably contradictory and absurd. Real or imaginary, contradictory or otherwise, this alleged state of illusion is a state of bondage, suffering, and error; but once free from it, the emancipated thinker is no longer perplexed with distinctions, and forms, and names; there is for him then no distinction, no name, no form; there is but one absolute substance, in which the subject and object of thought are absolutely identical.

The Vedantist neophyte having passed through this speculative novitiate, begins to reap the fruit of his vigils. The practical tendencies of the system here emerge, and in them we find, boldly and consistently conceived, and no less boldly and consistently advocated, the normal tendencies of pantheism in their relation to human duty. When man has attained to this superior knowledge of the Vedantist, he is emancipated from all ignorance, and can know no error: from ignorance, for in affirming Brahma, he affirms everything; and from error, since he has annihilated the possibility of error, which implies a particular affirmation, in annihilating the distinction of beings. He is not responsible, and can commit no sin; for such conceptions, as implying a right and a wrong, suppose distinction, which belongs to the state of illusion, but can find no place in Brahma, where all diversity ceases. He is freed, besides, from all activity, which supposes a duality,—a subject and object of action,—the very negation of that absolute unity and identity of all things which his science has taught him. He feels no emotion and is prompted by no desire, for he knows that, in being Brahma, he possesses everything. During life, the soul of the wise man continues, despite his knowledge of Brahma, to be haunted by recollections of the phantoms which flit through the realms of illusion, just as the awakened sleeper remembers the incidents of his dreams; but when death comes, the emancipation is complete,—the sage is stripped of every vestige of individuality,—he can show no longer any trace of limitation,—in form and in name he is mingled with and lost in Brahma, as rivers lose their forms and names when they meet the ocean. Such, in brief, is the pantheism of the Vedic schools of the Hindus.[1]

Other forms of speculative error, frequently spoken of as pantheistic, exist among the Buddhists, the great opposing sect of the Brahmans in the religion and philosophy of the Hindus. But while these systems are heterodox and unitarian, they are nevertheless not properly pantheistic. They oscillate between materialism and idealism, and one of the schemes is so refined as to end in sheer *egoism*, such as that of Fichte in Germany, admitting of no real existence but that of Self or the Ego, which is alleged to be eternal, and to draw from its own depths all phenomena.[2] Such a system is properly atheistic.

Greek Pantheism.

In further tracing the historical evolutions of pantheistic speculation, we find ourselves at once transplanted from India to Greece; for while the philosophical systems developed in China, in Persia, in Egypt, in Chaldæa, and in Phœnicia, were as false as they were various, they nevertheless exhibit no instances of speculative theories legitimately pantheistic. And without waiting to consider the vexed question of how much Greece owed to the philosophical ideas of the East, it is sufficient here briefly to ascertain the precise character of Greek speculation in itself, irrespective of its peculiar genesis, which is at best extremely problematical.[3] It is but a shallow view of the history of human development in matters of speculation that would ascribe every similarity of doctrine or coincidence of thought to direct filiation; for a comparatively limited knowledge of the struggles of individual minds towards scientific insight will not only warrant the possibility of something more than even a general resemblance in the speculative efforts of independent thinkers, but will positively lead the inquirer to anticipate the independent recurrence of the same methods, ideas, and sympathies, in places the most distant and in times the most remote. It is not necessary, therefore, apart from direct evidence, to ascribe to a Hindu source, as is often done, every possible vestige of the pantheistic theory recorded in the annals of philosophy. Pantheism, if a great speculative error, is at least not an unnatural one for erring men, as both history and observation can attest; not unnatural either for Brahman or Greek, Jew or German.

Anaximander.

Passing over as dualistic the earliest speculative evolution of the Ionic school, with which began properly the history of Greek thought, and the adherents of which followed what has been called the "physical" method of investigation, we approach the second development of Ionian philosophy in the class called "mathematicians," which originated with Anaximander[4] of Miletus (611–547 B.C.), the father of the pantheistic tendencies of Grecian speculation. With him began the purely *deductive* method of philosophizing afterwards employed by the Pythagoreans and Eleatics; and consequently, also, with him began the disposition to develop the universe from one grand indeterminate abstraction. The beginning of things (ἡ ἀρχή), according to this geometrician, was not Water, as Thales had supposed, but the Infinite (τὸ ἄπειρον). This Infinite or primary existence is One, yet All. Finite things, of whatever kind, are but the manifestations of this eternal unlimited All. Creation takes place by an eternal motion of the Infinite. It does not seem, however, that Anaximander identified this Infinite Existence with Infinite Mind, much less that he called it by the name of Deity. To all intents and purposes, however, his grand error was identical with that of Hegel and his school in modern times, who maintain that "creation is the mundane existence of God." The direct pantheistic conception of Deity was posterior to the time of Anaximander.

Pythagoras.

Pythagoras (584–489 B.C.), the first among scientific thinkers who called himself by the humble yet exalted title of "philosopher," took up the method of Anaximander, and endeavoured to improve upon his notion of the ἀρχή. Like his predecessor, Pythagoras held the principle of things to be absolute unity, from which multiplicity origi-

[1] See *De Theologumenis Vedanticorum*, by K. J. H. Windischmann, Bonn, 1833; also Windischmann's *Die Philosophie im Fortgange der Weltgeschichte*; and Ritter's *History of Ancient Philosophy*, vol. iv, London, 1846.

[2] The author of the *Précis de l'Histoire de la Philosophie* (known to English readers as Henry's *History of Philosophy*) falls into the mistake of reckoning Egoism a species of Pantheism. In the *Essai sur l'Pantheisme dans les Sociétés Modernes*, par H. L. C. Maret, troisième edition, Paris, 1845, p. 176, the rhetorical Abbé falls into a similar mistake respecting Fichte, who is erroneously ranked by him among the pantheists. This is a blunder, however, which is by no means peculiar to this churchman, for numerous writers,—and especially English ones,—have committed the same error.

[3] The Greeks themselves admitted their obligations to the oriental philosophers. Among others, Ritter (*Hist. of Anc Phil.*, vol. i.) and Lewes (*Biographical Hist. of Philosophy*, Introd. to the library edition; also *Edinburgh Review*, April, 1847), are tolerably decided,—the former particularly so,—as to the independent origin of Greek speculation; while the modern orientalists, Roth (*Geschichte unserer abendländischen Philosophie*, vol. i.) and Gladisch (*Die Relig. u. die Phil. in ihrer weltgesch. Entwickelung.*) find nothing in the early Greek teachers but reproductions of eastern thought.

[4] Let it be noted here, once for all, that biographies of the philosophers alluded to in this article will be found under the name of each throughout the work.

Pantheism.

nated, and of which it was but the manifestation. This original principle was Number, and the absolute unity was One. As One is the basis of all numerical calculation, so also it is the last expression of our attempt to analyse the Infinite. Therefore the Infinite must be One; and Numbers are the ultimate nature of things. The Pythagoreans did not separate Numbers from things. "They held Numbers," says Aristotle, "to be the first principle, and, as it were, the material cause (ὕλη) of entities, as well as of their peculiar manifestations." (*Metaph.*, b. i., c. 5.) As to the precise significance which Numbers bore in the theory of Pythagoras critics are not agreed. Some are inclined to a literal, some to a symbolical interpretation of the term.[1] However this may be, suffice it to say, that by reducing mind and matter to phenomenal manifestations of the infinite and absolute One, he thereby constructed a scheme essentially pantheistic. It remains doubtful, however, as in the case of his predecessor, whether or not he made mind an attribute of his Infinite One. To reason from the spurious and notoriously pantheistic works ascribed to his followers, Timæus of Locrum, and Ocellus Lucanus, and thus convict the master of a pantheism which he did not in terms avow, would be at once futile and foolish. Suffice it to say, pantheism was there in substance, if not in name.

Xenophanes.

Not content with the solution which the great problem of existence had received at the hands of the "mathematicians," Xenophanes the Eleatic (born 620 B.C.) came forward with what was in form a new theory, yet in substance not widely different from that of his predecessors. According to Pythagoras, the Infinite Unity contains and produces everything. Xenophanes denied the possibility of such a production. If aught was made, he alleged it must have been either from that which was, or from that which was not: not the former, for if it already was, it could not be made; not the latter, for out of nothing nothing can come (*ex nihilo nihil fit*). Creation being therefore impossible, it necessarily follows that there is but *one* Being in the universe, eternal, absolute, infinite. Of this unconditioned being all finite existences, whether material or mental, are merely modifications. But had not his predecessors reached this unity of being before? Wherein, then, did Xenophanes differ from them in his doctrine of the One? In this, that, as Aristotle phrases it, "he cast his eyes wistfully upon the whole heaven, and pronounced that unity to be God." (*Metaph.* i. 5, § 7.) This Deity he endowed with self-existence and intelligence; but, denying him personality, he converted monotheism into pantheism.[2] Parmenides, Melissus, and Zeno, the other noted disciples of this school, while identifying thought and existence, and continuing the unitarian tendencies of the Eleatics generally, seem to have stopped short of an articulate avowal of pantheism. They all agreed, however, in the essential unity of being, and in the illusory character of sensible phenomena.

Heracleitus.

The next pantheist among the Greek ontologists was Heracleitus, "the weeping philosopher" (born 503 B.C.). The Eleatics founded their philosophy upon the certitude of the Reason; this thinker upon that of Sense. The former were rational pantheists; the latter was a material pantheist. For while Heracleitus held that we became conscious through the senses, he besides maintained that it was not we that became conscious, but the universal intelligence which became conscious in us. "Inhaling," he says, "through the breath the Universal Ether, which is Divine Reason, we become conscious."[3] With this philosopher, Fire was the first principle of things; it was ever kindling, ever dying out, and was identical with God. In this "perpetual flux and reflux" of things Hegel finds an anticipation of his doctrine, that "Being and non-Being is the same" (*Seyn und Nichtseyn ist dasselbe*). Hegel accordingly claims kindred with the melancholy old Greek, and alleges that he has developed every position of the Heracleitic system in his logic.

With Heracleitus the history of Greek pantheism properly closes. The only result of the unitarian systems of Elea, which were mainly pantheistic, was, as in the case of all erroneous forms of speculation, to shake the foundations of the human reason, and drive men to scepticism. This determination of human thought is actually to be found in the succeeding epoch among the Sophists. Socrates arose to put down the Sophists: Plato carried out the method of Socrates; and Aristotle brought this movement to a close. Philosophy in the hands of the Stagirite was once more reduced to a system; but it was not long till the sceptics of the succeeding epoch arose to demolish it. Doubt had its day; and no long time had elapsed when a new power arose in Christianity, taking hold upon the minds and hearts of men such as no system of belief had ever done before. This divine light broke forth in a region intermediate to the philosophical speculations of both the East and the West. Its influence was accordingly felt ere long both by sceptical Greek and mystical oriental; and out of this clash of opposing doctrines arose in the early centuries of the Christian era the sect called the Gnostics, and the philosophical movement known as the "Alexandrian schools." From both of these speculative movements arose evolutions of pantheism as thorough-going as any that had preceded them. Among the Gnostics, who attempted to harmonize orientalism and Christianity by torturing the latter to suit their eastern predilections, faith was subordinated to philosophy, rather than philosophy to faith. Their ontology was in general of a dualistic cast, but it not unfrequently took a turn towards pantheism. The most notorious of the latter class was Valentinus, who, so far as his precise doctrines can be ascertained, held all finite existences to be emanations from the "Universal" and "Unknown Father" (Βυθός), a sort of indeterminate Brahma, who was the sole being in the universe, and of which all else were but the modes.

Gnostics.

Neo-Platonic Pantheism.

On turning to the Alexandrian schools, we witness the collision of oriental ideas and Greek thought with Christianity. The first of the "Neo-Platonists" was Philo the Jew, born 27 B.C. at Alexandria. This eminent thinker had been long familiar with all the three modes of thought peculiar to the Platonist, the oriental, and the Jew. By distrusting the Senses, discarding the Reason, and taking refuge in Faith, he gave philosophy a determination towards mysticism, and united it once more to religion. (See MYSTICISM.) The material being thus gathered, it remained for Plotinus to give this speculative evolution a solid metaphysical basis. Farther attempts were made to perfect this eclectic system by his followers; but it continued to present a strange agglomeration of doctrines, all swallowed up by the all-embracing one of pantheism.

Plotinus.

The object of philosophy, these thinkers held with Plato,

[1] A novel and ingenious, if a somewhat arbitrary, explanation of the Pythagorean doctrine of Number, is given by Professor Ferrier in his *Institutes of Metaphysic* (prop i., § 16, p 88). He holds that Pythagoras made Number the ground of all conceivability. "In nature, *per se*," he says, "there is nothing but absolute inconceivability. If she can place before us things, she cannot place before us *a* or *one* thing. So said Pythagoras. According to him, it is intelligence alone which contributes *a* to a 'thing,' gives unity," &c. This exposition of the doctrine has at least the merit of being intelligible. Aristotle, however, who was not deficient, we presume, either in acuteness or in general information respecting such matters, seems to have held a different view from the Professor. (See *Metaph.*, i. 5.)

[2] See Karsten's *Xenophanis Carminum Reliquiæ*, 3 vols. 8vo, Brussels, 1830–38; also C. A. Brandis *Commentationum Eleaticarum*, &c., Alton. 1813; and Cousin's *Nouveaux Fragmens Philosophiques*.

[3] See Lewes' *Biographical History of Philosophy*, library edition, p. 57.

Pantheism.

Plotinus.

to be Universals, of which all phenomena were but the modes. This ideal world, again, of Universals was but the mode of God's existence. But how can I, a finite being, comprehend God, who is infinite? It is obviously impossible so long as I remain finite. Since, then, I *do* possess a knowledge of the Infinite, it cannot be through my reason, which can only deal with finite things, but through some *higher* faculty, altogether impersonal, by which I become for the time being infinite, and am identified with the object of my contemplation. "The faculty," says Plotinus, "by which the mind divests itself of its personality is *Ecstasy*. In this ecstasy the soul becomes loosened from its material prison, separated from individual consciousness, and becomes absorbed in the Infinite Intelligence from which it emanated. In this Ecstasy it contemplates real existence; it identifies itself with that which it contemplates."[1] Here, then, is the doctrine of Absolute Identity in all its fullness, of which pantheism is but the corollary. Thought and thing are identical, and this is the only possible ground of knowledge. We know the Infinite, according to Plotinus, by an immediate intuition (παρουσία), out of and beyond reason; we know it, according to Schelling, through an "intellectual intuition." Thus the fundamental position of both systems is the same.[2] By a process of subtle dialectics the Alexandrians came to the conclusion that the Deity consisted of a Trinity in Unity. This Trinity consisted of the *hypostases*, of which the first is *Unity* simply, not properly Being; the second, *Intelligence*, which is identical with Being, Mind, absolute and eternal (νους): third, the *Universal Soul*, the Soul of the world (ψυχή τοῦ πάντος or τῶν ὅλων), the source of all activity and life, mental and material. In his highest state, Deity is neither thought nor existence, but simple *Unity*, reminding one of Hegel's Absolute Nothing. The next peculiarity of this system—the corollary indeed of what has gone before—is the law of Emanation, or the mode in which the world of mind and matter is produced by the Universal Soul. It is at this point the pantheism of the "Neo-Platonists" becomes palpable. If God made the universe, he did so, says the human reason, so far as it can give a deliverance on the matter, either from his own substance or from something else already existent. If the former, Deity and the universe are in fact identical,—hence pantheism; if the latter, Deity and the universe are radically and eternally distinct, which is the assertion of dualism, but no satisfactory explanation of the origin of the world. The Christians affirmed that God made the world out of nothing by the energy of his own omnipotence; the Alexandrians maintained that he made it out of his own substance, but that, while not distinct from him in *essence*, it was nevertheless distinct from him in *act*. The pantheism thus reached is of the most refined and subtle character. Instead of confounding God with the world, after the manner of the material pantheists, the Alexandrians held that the nature of Deity was not exhausted in the act of creation, although the matter created was identical in essence with himself. Thus, while the ordinary pantheistic formula, "All things are God," holds true for this system, its converse, "God is all things," is directly opposed to its express development of the law of Emanation. Proclus, with whom ancient philosophy properly ends, terminated the speculative evolution of the "Neo-Platonists." He endeavoured to work up into methodical connection the labours of his predecessors in that school; and brought as subtle a scientific faculty to the task as any that had yet been known among the Alexandrians. (See especially his *Institutio Theologica*.)

Pantheism.

Middle Age Pantheism.

Scotus Erigena.

On descending to the philosophy of the middle age, we come in contact with a man of great learning and original genius in the person of John Scotus Erigena, who flourished during the seventh century. This eminent thinker stands alone as an original advocate of pantheism during that entire epoch. So far as Erigena was indebted to previous speculators, Neo-Platonism, combined with eastern thought, seems to indicate the direction of his philosophy. The traditionary account of his travels in the East seems to be confirmed by the striking and almost literal coincidences which Colebrooke detected between parts of his writings and certain portions of the Sankhya philosophy. He begins with Absolute Unity as the origin and essence of all things, and endeavours, in his *De Divisione Naturæ*, to explain how this radical unity, or Deity, has produced the universe of multiplicities with which he is emphatically identical. From the plenitude of the Divine Intelligence first causes (*primordiales causæ*) are derived, which give birth in turn to the world of nature, destined ultimately to return to the bosom of the Absolute. Like Proclus among the Alexandrians, and like Hegel in more modern days, Scotus Erigena seems to have maintained the strict analogy and correspondence of the world of ideas and the world of realities; so that the relations of human thought are properly expressions of the real relations of the universe.[3] "If," he says, "the knowledge of all things is the reality of all things, this cause [viz., Deity] which knows all is all." He again winds up his theory of human knowledge in these words:—"Everything is God; God is everything; God is the only real substantial existence." The pantheism of Erigena again reappears towards the end of the twelfth century, in the speculations of Amaury de Chartres, and, with modifications, in those of his pupil David de Dinant, who was a material pantheist.

Modern Pantheism.

Bruno.

The brilliant and unfortunate Giordano Bruno, who was burnt as a heretic in the streets of Rome in 1600, stands prominently forward in the records of philosophy as the precursor of Benedict Spinoza. Bruno's pantheistic system, which is little more than a purification and development of the speculations of the Eleatics and of Plotinus, is set forth with singular eloquence and richness of poetic colouring. With him, Deity, the Infinite Intelligence, is the principle and essence of all things (*natura naturans*): he is the cause of the universe (*natura naturata*), yet he did not create it; he simply informed it with life, for he is the universe, although not limited by it. He is self-existent, absolute, and simple. He is incessantly active as a cause; and all his energies are determined by his nature. His activity is necessary; and yet he is perfectly free. The universe is the infinite activity of his mind; and hence it is infinite, eternal, and imperishable. To hold the contrary were to limit his power. But while Deity is thus the essential substance of the universe, he is nevertheless separated from nature: he is *superessentialis*, just as a mind is conceivable apart from any one of its thoughts. The universe is properly a living being, an immense infinite animal; and Deity, as the soul of the universe, modifies and influences it throughout all its parts. There exists but one sole intelligence which dwells in God in perfection, but in inferior spirits in imperfection, varying according to the capacity of their natures down to the lowest level of created beings. These differences of endowment are not generic, however; they are simply differences of degree. Man occupies a middle place in the scale of intelligence; and his noblest function, according to Giordano, is to discover the harmony that exists between the order of the

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[1] See the *Enneades* of Plotinus; also Lewes' *Biog. Hist. of Philosophy*, library edition, p. 264.

[2] See *Disputatio de differentia quæ inter Plotini et Schellingii doctrinam de numine summo intercedit*, G. W. Gerlach, Viteb. 1811.

[3] See Lib. iii., § 4, of his *De Divisione Naturæ*, Libri v., ed. T. Gale, Oxon., 1681; Fr. Ant. Staudenmaier's *Johannes Scotus Erigena u. d. Wissensch. sr. Zeit*, &c., 1834; and the Abbé Gerbert's *Troisième Conference de Philosophie Catholique*.

Pantheism. external universe and the internal ideas of the soul; to perceive the identity of his intelligence and that of the Deity, of the Subject and Object of thought.[1] There is no real distinction between good and evil, between happiness and misery, between beauty and deformity; all are essentially good, proceeding as they do from good, and intended as they are for the best. Such distinctions are therefore merely relative and illusory; they are not absolute and real.

Spinoza. In 1632, just thirty-two years after the burning of Bruno, was born in Amsterdam, Benedict Spinoza, who was destined to give a method and shape to the heretical theory for which the Italian suffered, such as it had never received before at the hands of man. No speculator is more frequently abused than the subtle Jew, and no one is less understood. The legitimate and even avowed consequences of his system induce the belief—perhaps a natural one—in thoughtless minds, that the author of them must have been a very bad man. Yet such was not the case. He lived a thoughtful, industrious, and strictly moral life, grinding optical glasses for his livelihood, and spending the remainder of his time in calm, speculative seclusion. He seems to have been a man of a naturally reverential and earnest disposition. This appears frequently from certain attitudes of mind and turns of thought in his writings, as well as from the fact that, in his great work, the *Ethica*, in which his pantheistic system is elaborated, it was his design to deduce mathematically from the knowledge of God the fundamental laws of morality, and the principles that should regulate human life.

Philosophical critics have got up a polemic as to whether or not Spinozism was a legitimate development of Cartesianism; whether or not the philosophy of Descartes contained in embryo that of Spinoza, and only required the speculative courage and strong logic of the Jew to convert it into pantheism.[2] Considered in itself, and especially in relation to the philosophers in question, the dispute,—as indeed all such usually are,—is rather an idle one than otherwise. Suffice it to say, that Spinoza studied the works of Descartes with intense interest and admiration, as is abundantly evinced by his unrivalled abridgment of the doctrines of that philosopher, and, in particular, that he agreed with the Cartesians in holding that what was true in thought was true also in things. The latter principle formed the basis of Descartes' main argument for the existence of Deity; and Spinoza resolved, if possible, to put it to a more extensive and solid use. He accordingly set to work to develop by strict mathematical demonstration an ontological system embracing Deity and the universe. His scheme is developed in the work, published posthumously in 1677, entitled *Ethica, Ordine Geometrico Demonstrata; et in quinque partes distincta; in quibus agitur*—I. *De Deo;* II. *De Natura et Origine Mentis;* III. *De Origine et Natura Affectuum;* IV. *De Servitute Humana seu de Affectuum Viribus;* V. *De Potentia Intellectus seu de Libertate Humana.* Such is the plan and range of this celebrated work. First God, then man, the laws of his nature, and the character of his activity. With Spinoza, as with all pantheists, the main point to be attended to, in order to a comprehension of his system, is the method which he employs. The only "refutation of Spinoza" (and how many such have there been!) consists in rejecting his method as false and illegitimate. Other pantheists may be overthrown by their pursuing the suicidal course of inconclusiveness. But it is not so with Spinoza; for no single opponent, nor any combination of hostile criticism, has yet succeeded in convicting this arch-pantheist of tripping in his logic, or of wandering far from the method with which he set out. Once grant the all-sufficiency of logic, the essential harmony of thought and existence, and the infallibility of the *deductive* method, and the chances are, that in the hands of an able and daring thinker the ontology of the universe will be pantheistic. So at least was it with Spinoza. His method deceived him; and in proving true to it, he became a pantheist. Spinoza opens the first book of the *Ethica*, which is entitled *De Deo*, in genuine geometrical fashion, by laying down a series of definitions and axioms, from which he proceeds to evolve demonstratively, in a set of theorems each dependent on what has gone before, his entire scheme of God and the world. This he does with uncommon accuracy and clearness of language; so that if it is difficult to understand him, the defect does not lie in the author. Before entering upon a brief analysis of his system, it is necessary to exhibit his definitions and axioms.

Pantheism. Spinoza.

DEFINITIONS.[3]

1. By a thing which is its *own cause* (*causa sui*) I understand a thing of which the essence involves existence, or a thing which cannot be conceived of except as existent.

2. A thing is said to be *finite, in suo genere*, which can be limited by another thing of the same nature; *e.g.*, body is called finite because we can always conceive another body as larger. So one thought is limited by another thought. But body is not limited by thought, nor thought by body.

3. By *substance* I mean that which exists in itself *(in se)*, and is conceived by itself *(per se)*; the conception of which, in other words, does not involve the conception of anything else as the cause of it *(a quo formari debeat)*.

4. By *attribute* I understand that which the intellect perceives as constituting the very essence of substance.

5. By *mode* I mean an affection (*affectio*) of substance, or that which is in something else, through which also it is conceived.

6. By *God* I understand a being absolutely infinite, that is, a substance consisting of infinite attributes, each of which expresses an eternal and infinite essence.

Explanation.—I say absolutely infinite, but not infinite *suo genere;* for whatever is infinite *suo genere* only, does not possess infinite attributes, whereas that which is absolutely infinite contains in its essence whatever implies essence, and involves no negation.

7. A thing is said to be *free* which exists by the sole necessity of its own nature, and by itself alone is determined to action; but that thing is *necessary* (*necessaria*), or rather constrained (*coacta*), which owes its existence to something else, and is determined to action according to a fixed and definite method.

8. By *eternity* I mean existence itself, in so far as it is conceived to follow necessarily from the sole definition of an eternal thing.

Explanation.—For this kind of existence is conceived as an eternal verity, and cannot therefore be explained by duration or time, even though this duration should be conceived as without beginning and without end.

AXIOMS.

1. All things which exist, exist either of themselves or through something else.

2. That which cannot be conceived [as existing] through something else (*per aliud*) must be conceived [as existing] through itself (*per se*).

3. From a given determinate cause an effect necessarily follows; and if there be no given determinate cause, no effect can follow.

4. The knowledge (*cognitio*) of an effect depends upon and implies the knowledge of its cause.

5. Things that have nothing in common with each other cannot be understood through each other; in other words, the conception of the one does not involve the conception of the other.

6. A true idea (*idea vera*) must correspond with its object (*suo ideato*).

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[1] See a passage from the *De l'Infinito*, quoted by Lewes in his *Biog. Hist. of Philosophy*, library edition, p. 330, which contains a vigorous sketch of the life and works of this unhappy thinker. See also *Opere di Giordano Bruno*, by Adolfo Wagner, 2 vols., Leips. 1830; and the *Jordano Bruno* of C. Bartholmess, 2 vols., Paris, 1848.

[2] See, for example, among recent books of the kind, H. C. W. Sigwart, *Ueber den Zusammenh. d. Spinozism, m. d. Cartesian, Philos.; e philos. Versuch;* also, *Welchen Einfluss hat d. Philos. d. Cartesius auf. d. Ausbildung der des Spinoza gehabt, u, welche Berührungspuncte haben beide Philosophieen m. einand. gemein?* von H. Ritter.

[3] These extracts are translated from the *Benedicti de Spinoza Opera quæ supersunt omnia* of C. H. Bruder, 3 vols., Leipsic, 1843.

Pantheism. Spinoza.

7. Whatever can be conceived as non-existent, the essence of that thing does not involve existence. (*Ethica*, pars. i., pp. 187–8.)

Such is the foundation on which Spinoza commences to rear the vast edifice of his ontology. It will be perceived that, alike in definition and in axiom, he adheres strictly to the method which he has resolved to pursue, and which has been already alluded to. This he continues to do throughout proposition, corollary, and scholium with an accuracy and rigour which Euclid himself has not surpassed. Without taking up in detail the successive evolutions of his system, a rapid outline of it may here be given.

There are two classes of existences, according to Spinoza, which appear to be real, but whose reality lies merely in appearance. These are the phenomena of Mind and Matter, on the one hand, and what are called the substances Mind and Matter, on the other. Existence is but accidental and transient in these objects; and hence there must be somewhere a being or beings endowed with the characteristic of self-existence: there must be a substance underlying all these accidents and changes, and that substance must be self-existent. This follows from the very definition of substance, the essence of which implies existence as part of the idea. It is obvious there can be but one substance possessed of self-existence, and that one substance is God. But to see how this position is established, and also to witness a specimen of Spinoza's logic, we may turn to

Proposition XIV.—*There is no substance but God, nor can any other be conceived.*

Demonstration.—Since God is a Being absolutely infinite, possessed of every attribute (by defin. 6) which expresses the essence of substance, he necessarily exists (by prop. xi.). If there is any other substance besides God, it must be explained by some attribute of God; and thus two substances would exist possessed of the same attribute, which (by prop. v.) is absurd. There is therefore no substance but God, and hence no other can be conceived. For, if such could be conceived, it must be conceived as existent, which, by the first part of this demonstration, is absurd. Wherefore, there is no substance but God, nor can any other be conceived. Q.E.D.

Corollary 1. Hence, it very clearly follows, in the first place, that God is one; *i.e.* (by defin. 6), there is only one substance in nature, and that substance is absolutely infinite, as already hinted in the scholium to prop. x.

Corollary 2. It follows, in the second place, that an extended object and a thinking object are either attributes of God, or (by ax. 1) affections of those attributes. (*Ethica*, part i., p. 197.)

There is, accordingly, but one substance, infinite, self-existent, eternal, necessary, simple, and indivisible, of which all else are but the modes. God, as the infinite substance, with its infinity of attributes, is the *natura naturans*. As the infinity of modes under which his attributes are manifested, he is the *natura naturata*. God is the immanent, but not the transient, cause of all things. The universe is not God, but simply the necessary modes of being of his attributes. According to Descartes, there were two substances, Spirit and Matter, of which the essences were respectively Thought and Extension. But as Thought and Extension are only modes of existence, and as there can be only one substance, it follows, according to Spinoza, that Thought and Extension are two infinite attributes, and the only two known to us of the one infinite substance.[1] Now, as the attributes of Deity are only different manifestations of one nature, infinitely absolute, it follows that there must be a complete harmony and correspondence between the successive modes of one attribute and the successive modes of every other. Thus, a mode of thought[2] must correspond with a mode of extension; every idea must harmonize with its ideate or object, being only the same phenomenon under a different aspect. Extension is Thought objectified, and Thought is Extension subjectified. What God does as an extended substance, he thinks as an intelligent substance; for thought and thing, subject and object, are in him absolutely identical. All things are modes of his attributes of Extension, and all thoughts are modes of his attribute of Thought. The circle is a mode of God under his attribute of Extension: the idea of a circle is the corresponding mode under his attribute of Thought.[3]

Again, as Deity is necessarily existent, he can only act through and by the necessary laws of his being. Freedom, in the ordinary sense of that term, is accordingly incompatible with the only legitimate idea of such a being; but freedom, in the proper sense of the word, as applicable to a being whose acts are determined solely by the laws of his essential nature, can not only be predicated of Deity, but can be predicated of him and of him alone of all beings in the universe. And as good men are free when most a law to themselves, so we magnify God's freedom when we affirm he *must* have acted as he has done. His acts are therefore at once free and necessary: necessary, from the very essence of his nature; and free, from the very nature of their necessity. The nature of man being limited, and his existence derived, he cannot act as a free cause, in the proper sense of that term. What we ordinarily call "will" (*voluntas*) is simply a mode of thought, is simply a link in the causal nexus which binds all phenomena to the one *causa causarum*. "Will" cannot therefore be applied to Deity (*voluntas non potest vocari causa libera, sed tantum necessaria*, prop. xxxii.), nor does he possess any proper personality. It follows, again, that in God there can be no such distinction as good and evil, and in ascribing moral qualities either to his actions or to those of ourselves, we simply indulge in baseless fancies (*entia imaginationis*) which have no real existence, and which are derogatory to the true dignity of God. For our convenience, we form these abstractions of human excellence; but in the eye of God, everything is just what it has the means of being; and there is properly no resistance of his will.[4]

But to pass to a more special consideration of man. Man is composed of *Body* and *Spirit*. But Body and Spirit, as has been already shown, are not two independent realities. Body is but a mode of Extension, and Spirit is but a

[1] That Spinoza makes this infinite substance *material*, as some have alleged, is entirely erroneous; for body with him is but a mode of Extension, while Extension itself is an attribute of the one Substance—Deity. There is therefore equal warrant for making the Deity of Spinoza *spiritual* as there is for making him *material*; for in point of fact He is properly neither, being the identity, as Spinoza expressly states, of the *natura naturans* and the *natura naturata*. Materialism and spiritualism are equally indifferent to Spinoza, and he accepts of the extremes of both systems with like equanimity.

[2] It is scarcely necessary to observe that "Thought" (*cogitatio*) is used by Spinoza in the Cartesian sense, as equivalent to any mental mode, whether cognition, feeling, or volition.

[3] It will be perceived that the celebrated "pre-established Harmony" of Leibnitz is little more than an adaptation of the singularly ingenious theory of the great pantheist. With Leibnitz, mind and body are adapted to each other by a pre-ordinating power; with Spinoza their movements coincide, because they are *essentially the same*,—idea and ideate being the same modification of the one absolute being, but manifested through different attributes. (For further illustration on this point, see an able article on Spinoza in the *Westminster Review* for July 1, 1855, attributed to Mr Froude.)

[4] Such is the extraordinary manner in which Spinoza explains the mystery of evil. It might be supposed at first sight that his system makes God the real cause of all the error and crime that is in the world; but such a conclusion he avoids by leading a proof of the positive non-existence of what is called evil. When Blyenbergh presses him with this difficulty, Spinoza replies calmly, as is his wont, "God is really and absolutely the cause of all things which have real existence (*essentia*), whatever they may be. If you can demonstrate that evil, error, crime, &c., have any real existence, I entirely admit that God is the cause of those evils, errors, crimes, &c. It appears to me, however, that I have sufficiently shown that what constitutes the real essence of evil, error, crime, is no real thing at all, and therefore that God cannot be regarded as the cause of it." (*Epistola* xxxvi., § 4, vol. ii., p. 255.)

Pantheism. Spinoza.

mode of Thought. Thought and Extension are attributes of the one absolute substance, God, evolving themselves in two parallel streams, so to speak, of which each separate body and spirit are but the waves. What I call my mind is only a succession of certain modes of Thought: what I call my body is only a succession of certain modes of Extension. The sum of my ideas, at any moment, constitute my soul: the sum of my material qualities, at any moment, constitute my body. Body and soul are apparently two, but really one: they have no independent existence: they are parts of God. The human mind is percipient of bodily affections, —not directly, but by coincidence; and as it belongs to the nature of thought to cognise its own modifications, as well as those of the other attributes of Deity, the human mind, being a portion of that thought, is likewise cognisant of the ideas of corporeal affection. In other words, the mind is self-conscious; or, as Spinoza expresses it, "Mens se ipsam non cognoscit, nisi quatenus corporis affectionum ideas percipit." (*Eth.*, pars. ii., prop. xxiii.) Perception is of two kinds—adequate and clear, inadequate and obscure. An idea is adequate and clear when it conforms to its object; inadequate and obscure when it imperfectly represents it. The former class is positively true, the latter negatively false. Inadequate and false ideas are either the ideas of bodily affections or the perception of those ideas. Adequate and clear ideas are those abstracted from the former class, and elaborated by a process of reflection. This reflective process is regarded as being within the direction and control of the mind itself; and here, in his theory of knowledge, as well as afterwards in his theory of morals, Spinoza, in the judgment of some, departs from the absolute necessitarianism which his system induces, and which he himself had already avowed.[1] It may be noted, however, that Spinoza was perfectly well aware that the theoretical aspect of man's relation to the all-embracing nexus of causation seldom influences very materially the ordinary practical bearings of any question involving self-control; nor did he forget, at the same time, that a certain measure of self-direction may be not inconsistent with a scheme of the most thorough-going necessitarianism. But it is not to be forgotten that such considerations, as resulting from psychological observation, and not from the application of the method of formal demonstration which Spinoza professes throughout to employ, cannot be regarded as falling in harmoniously with the other evolutions of his system. Nor do they; for at bottom, and on such a scheme, personality is only phenomenal, and human liberty an illusion. The better we know, according to him, the better we act; and upon this hypothesis he passes on from the sphere of knowledge proper, to a consideration of the passions and affections of human nature. There is a necessary desire in all being, says Spinoza, to remain in existence. God, whose essence is existence, is possessed of this desire; but as his being is under no limitation, he is absolutely perfect and perfectly happy. But the human soul, while participating in this desire of Deity, is necessarily limited, and hence necessarily unhappy. This desire for a continuance of being becomes in man a desire to remain intelligent, and, if possible, since limited, to enlarge the sphere of his knowledge, seeing that knowledge is the constituent element of the mind. But this simple and fundamental activity of our nature is frequently impeded in its development by the obstruction of external causes consequent upon our inadequate and confused knowledge. Hence emerges from the bosom of this primary desire a new class of emotions termed *passions*, such as joy and sorrow, hope and fear, love and hatred, &c. To increase the sum of our being is accordingly the great end of life: the pursuit of this end is virtue, and the attainment of it happiness. To perfect happiness, therefore, it is necessary to diminish the number of our inadequate ideas; for it is owing to these that passion and pain have any existence. Phenomenal knowledge of sense and internal perception, such as occupies the attention of the great mass of mankind, is the fertile source of the ills to which they are exposed. Now, to escape from these evils incidental to obscure knowledge, it is necessary to get behind phenomena, and to inquire into the relations, causes, and essences of things, until we have grasped the attributes of God. This is the first stage of clear and adequate knowledge; but it is not the only one. To sages and men of devout meditation a third and highest degree of adequate knowledge is attainable in rising to the universal and absolute idea of God. As here is the highest light, so here is the most perfect peace. Were our knowledge of God capable of present completeness, we might attain to perfect happiness; but such is not possible. Out of the infinity of his attributes, two only—Thought and Extension—are accessible to us; while the modes of those attributes being essentially infinite, escape our grasp. Universal science is thus possible for God alone, and he is the only being absolutely happy. We may nevertheless, by prosecuting arduously and courageously our real good, enlarge the boundaries of positive knowledge, and thus emancipate ourselves from the tyranny of ignorance and the slavery of passion. To know God and to love him is thus the true source of self-mastery, peace, and blessedness.

It follows from the unequal distribution of clear and adequate knowledge, that men possess real being in very unequal degrees. And it is from this fact that Spinoza deduced his ingenious and startling theory of the immortality of the soul. Such a doctrine is at first sight impossible in Spinoza's philosophy; for, as the soul is only the collection of our ideas, and as our ideas have their origin in the affections of body, it necessarily follows that the destruction of the body at death is the destruction of our ideas, and the consequent annihilation of the soul. But Spinoza, while granting the validity of this conclusion, qualifies it in a very important manner. He reminds us that all knowledge is not necessarily phenomenal; that there are adequate as well as inadequate ideas; and that while the latter perish with the body, whence they arose, the former are absolutely indestructible. For, as occupied with the essences of things, with the attributes of God, or with God himself, the human soul, even although the body were destroyed, would find objects of thought, time without end, in what is essentially permanent and enduring. For men who are destitute of this higher knowledge and being there is on this system no positive hereafter. And this Spinoza calmly admits. The man who has been the slave of passion; who has had no love or knowledge of God as the source of all goodness; who has possessed no proper personality while living; who has, in short, been wholly occupied with the body, will lose everything in losing the body. Our immortality, then, rests with ourselves. It is the reward of a life of virtue and of high noble endeavour.

Such, then, are the main features of a pantheistic system of philosophy which has never been surpassed in bold ingenuity, and never equalled in scientific rigour. However we may be disposed to regard the moral consequences of its general reception, it must not be denied that, in the hands of the author, it was by no means an immoral system. To try Spinoza by a Christian standard may be instructive, but it is hardly just, for he never was, nor professed to be, a Christian.[2] Monstrous as his philosophy is when viewed in

[1] Even so acute a thinker and fair a critic as Theodore Jouffroy, on reviewing this development of Spinozism, affirms, "Here is the radical contradiction lurking through his whole system." (*Introduction to Ethics*, 2d Lecture on "Spinoza.")

[2] Yet the school of Herder and Schleiermacher in Germany have claimed him as such.

Pantheism.

many of its ramifications, and pernicious as must be the result of its practical adoption, it is beyond a doubt that the author does not seem to have so regarded it. The system is profoundly false, and the heart of man rises up in wrath against it; yet it is not fair, as is often done, to denounce Spinoza as an atheist, or to regard him as essentially a bad man. Novalis called him a god-intoxicated man (*Gott trunkner Mann*), an epithet which, if we may judge from the frequency of its quotation, seems to have been regarded by many as a happy one. Pantheism and atheism are not in strictness identical; yet it is true they are not far separated in their practical tendencies. It is no new remark, however, that men are frequently better than their doctrines; and (so inconsequent and self-deceiving is man) while soundness of doctrine is no absolute guarantee for purity of life, so erroneous opinion is not necessarily accompanied by habits of vice. Exceptional cases, however, should not be made the bases of laws, any more than imperfect moral inductions should be elevated into absolute standards of moral life.

Schelling and Hegel.

In following the progress of pantheistic speculation, as traceable in the annals of philosophy, the ontological systems of modern Germany should next demand attention. As, however, the speculative systems of Schelling and Hegel—the most celebrated pantheists of modern times—have been treated of in the article METAPHYSICS, under the section devoted to "Ontology," no special notice of these philosophers is required here; and the reader is referred once for all to that article for further information respecting the most recent evolutions of pantheism.

Estimate of Pantheism.

Such, in conclusion, is an outline of the numerous attempts at constructing a science of Being which have ended in pantheism, which is but another name for failure. And in this we have an epitome of the history of all such attempts. Did the results of pantheistic speculation, as of many other fantastic follies of the human brain, terminate merely when the ingenious fabricator had placed the last cope-stone upon his imposing edifice, they might excite a smile, as the harmless amusements of misdirected genius, but would awaken no serious alarm in the breasts of earnest men who are interested in the advancement of truth and the triumph of goodness. But such speculations have a more intimate practical bearing, both directly and indirectly, than might at first sight be supposed. For, apart from the opprobrium which they bring upon philosophy for its speculative variation and egregious absurdity, such doctrines exert a more subtle and dangerous influence in determining men to scepticism, and to a disregard of the ordinary obligations of morality and religion. For if philosophers, by sheer dint of a reckless logic, wring conclusions from the human reason abhorrent to the common sense and shocking to the conscience,—thus bringing into hostile collision the primary elements of our nature,—what escape is there from the most complete intellectual doubt, from the most absolute moral indifference? Thoughtless men may smile or sneer at all such speculations as equally foolish and harmless; but there is assuredly a Nemesis in all erroneous speculation, as there is in all wrong-doing. And this retribution comes not unfrequently nearer the ordinary business and bosoms of men than they are well aware of. A word, then, on the *method* pursued by the pantheistic philosophers, for it is here the vice of their system lies.

The total falsehood of all pantheistic systems may be established both directly and indirectly:—directly,—1. From its misapplication of the laws of thought; and, 2. From its violating, *in limine*, the original data of consciousness: indirectly,—3. From its virtually contradicting the intellectual and moral consciousness of mankind; and, 4. From its rendering religion impossible.

Pantheism.

1. The one invariable method employed by pantheists is the formally deductive. Now, this method, in order to be thorough-going, in order to transport the thinker into the sphere of absolute existence, would, first of all, require to vindicate the possibility of such existence; would next need to establish the fact of its existence in general; and would, lastly, be constrained to demonstrate its special existence as determinate and individual reality. Now, are all, or is any, of these tasks possible for the logical method of sciencing Being? The laws of formal thinking are those of Identity, Contradiction, and Excluded Middle.[1] These laws, as admitted on all hands to be merely regulative and analytical, cannot, of course, *add* to what already is,—cannot, in point of fact, furnish any existent reality at all. They can neither say *that* a thing is, nor *what* a thing is; they can merely say what it is not. Being merely explicative, and perpetually employed on the evolution of identical propositions, they are limited in strictness to the sphere of what is already fixed upon as determinately existent, and as clearly defined. A single *fact* the laws of logic cannot afford; and when once a fact is postulated, they can never in any degree amplify its positive contents.[2] Before it is possible to apply the laws of formal thinking in the pursuit of determinate existence, we would require to define existence in general. But do we know anything of existence in general? Is existence *per se* aught more than a mere abstraction? And if only a mere abstraction, no application to it of the laws of formal thinking can ever succeed, as has just been shown, in clearing the boundaries of abstraction and gaining the territories of real existence. In short, all such demonstrations begin with abstractions and end with abstractions. This brings us to consider—

2. Wherein does the pantheist violate the original data of consciousness? In this, eminently, that he ignores the essential condition of knowledge in arrogating to himself a capacity for defining existence *per se*, which involves a violation of the limitation of all human knowledge. Spinoza demonstrates that Substance exists because the essence of it implies existence as part of the idea, according to his definition of Substance. Here he makes two erroneous assumptions. In the first place, he identifies thought and existence in assuming that his *idea* of Substance and the *thing* Substance are convertible; and, in the second place, he assumes that we have a knowledge of absolute Substance, of Substance irrespective of all qualities, which contradicts the articulate and unequivocal deliverance of consciousness respecting the essential relativity of all our knowledge. In short, Spinoza, and all metaphysicians with him who employ the deductive method of philosophizing, virtually maintain with the sophist Protagoras, that "man is the measure of the universe, both of that which is, and of that which is not." Everything is and must be as we conceive it; an assumption which is not only destitute of a shadow of foundation, but is directly opposed to positive evidence to the contrary.

3. But not only may pantheism be redargued in its premises,—it can also be proved false from the consequences to which it consistently leads. These consequences are both intellectual and moral: intellectual, in contradicting the primary deliverances of consciousness, which assert the real antithetic existence of Self and not-Self; and moral, in giving the lie to the conscience, and denying the possibility of moral obligation. The pantheist maintains that, as man's personality is merely phenomenal, and his power of self-control at bottom but a chimera, every one's actions, whether external or internal, are determined by causes over which

[1] For further information respecting those laws, see LOGIC; also Appendix I to Sir W. Hamilton's *Discussions on Philosophy*, &c.

[2] The reader will find this admirably put by Mr John Veitch in Appendix C, iii., to his *Memoir of Dugald Stewart.*

he has no influence, and which utterly deprive him of any power of moral choice, or of any control over his conduct. His actions, as properly those of Deity, are all equally divine. Responsibility is thus but an illusion,—an *ens imaginationis*, as Spinoza would say,—and moral obligation naught but a plausible fiction. Conscience may be, perhaps, of a little practical use; for, as Spinoza allows, we are obliged occasionally to regard the future as contingent; but, however convenient such a supposition may be, it is wholly destitute of foundation, and contrary to the truth. Fortunately for humanity, their moral judgments are not to be silenced by such reasoning; and morality or truth has nothing ultimately to fear from any conclusions which rest upon false premises, or do violence at the outset to the universal consciousness of mankind.

4. But not only is pantheistic speculation, when carried into practice, destructive of moral activity, it likewise cuts off the possibility of religion and of religious worship. For, in the first place, the God of the pantheist is not the Deity before whom human nature feels constrained to bow. The One abstraction which gathers up into its alleged sole reality all the other existences of the universe—the identity of the *natura naturans*, and the *natura naturata*—is not that God in whose presence the human heart is filled with humble reverence and holy adoration. In the second place, if all things, and myself among the rest, are properly God, what room is there for worship? How can God be said to worship himself? In short, there is hardly any conceivable limit to the wild extravagances and pernicious consequences which legitimately spring from a consistent adherence to pantheistic doctrines.

Beside the bane, however, grows up the antidote. If we will only rest content with the small portion of truth which is legitimately within our reach, and eschew the ambitious and blind folly of aspiring to the sum of knowledge, we may still experience the happiness of conscious, if humble, security, while safe from the fatal delusions of those who unduly lust after intellectual power. Philosophy is not to be despaired of although a philosophy of the Absolute is impossible; and truth has not necessarily come to an end because man is not "the measure of the universe."[1] Pantheism, like all error, is unquestionably doomed; and as soon as the world can afford to do without it, we shall doubtless cease to hear any more of it. Meanwhile, it is the duty of the earnest speculator to adhere to what is legitimately placed within his reach. Observation and experiment, the judicious use of a rational induction, is the only method vouchsafed to man whereby truth is to be attained—if attainable at all—in such high matters. This method may appear vulgar and pedestrian to the proud eye of ambition; it may prove comparatively barren—nay occasionally unsatisfactory—in its results; but no method of inquiry can ever become contemptible which alone conducts man to the possession of truth. Philosophies without number have been tried and found wanting; but there remains still for the wise thinker as much truth as is necessary for the conduct of human life, if not sufficient to disclose to mortal gaze the hidden mysteries of the universe. (J. D—S.)

PANTHEON. See ARCHITECTURE.

PANTICAPÆUM. See KERTCH.

PANTOGRAPH, an instrument contrived for reducing, enlarging, or copying plans. It has been constructed in

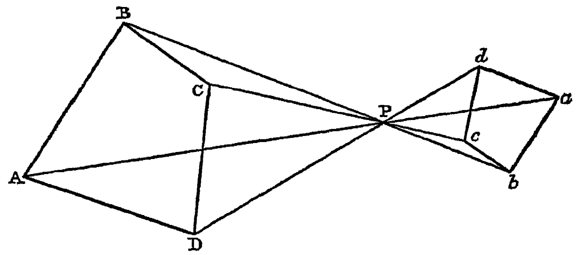

Fig. 1.

a variety of forms, all of them depending on the same geometrical proposition. If from the corners A, B, C, D (fig. 1) of any polygon, lines be drawn to a fixed point P, and be continued to distances Pa, Pb, Pc, Pd, proportional to PA, PB, PC, PD, the figure *abcd* is similiar to ABCD.

In order to utilize this property, a bar EPe (fig. 2) is made to turn freely upon the point P; on E and e are jointed two

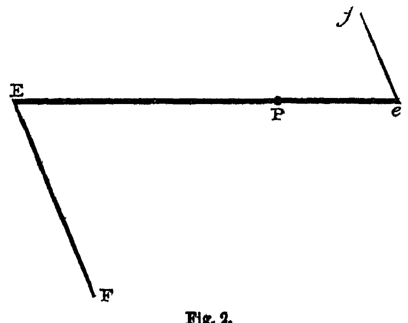

Fig. 2.

other bars EF, *ef*, having their lengths in the ratio PE to Pe, and being kept constantly parallel to each other by some mechanical contrivance. In this way the points F, P, and f are maintained in a straight line, and the ratio of FP to fP is preserved constant; so that if the point F be led along the contour of any figure, f must mark out a similar figure.

In the old form of the pantograph the parallelism of the bars EF, *ef* was secured by a thin rhomboidal frame like the common parallel ruler, the several joints being supported on small ivory castors. Hence the whole apparatus moved by jerks, and it was impossible to follow with precision any delicate outline. In the eidograph of Professor Wallace, the parallelism is maintained by means of two light wheels, round which a chain is passed, and the machine is supported by long axes; while in Dunn's pantograph, the rhomboidal frame is used with long axles. With these improved forms a free and smooth motion is obtained, so that very minute work can be gone over.

At one of the points F, f there is placed a tracing-style of steel, delicately pointed, but not sharp, to be led along the outline of the plan, and at the other a tracing-pencil, kept pressing on the copy-paper by a small weight which can be pulled up when required. There are also arrangements for altering the lengths of the arms to suit the ratio in which the plan is to be diminished or enlarged.

The pantograph is extensively used in the arts; thus, the machine-embroiderer leads the longer arm over a magnified copy of the figure to be produced, and guides with ease and precision the successive strokes of the needles. To this simple contrivance we owe much of the beauty and cheapness of flowered muslins and embroidered silks. (E. S.)

PANTOMIME (πᾶν, *all*, μῖμος, *an imitator*), is one who imitates all sorts of actions and characters by means of gesticulation alone. This species of actor was common to the civilized nations of antiquity, and especially to Greece. The pantomimes proper, however, who resembled very nearly the modern ballet-dancers, were peculiar to Rome, where the art was carried to great perfection during the reign of Augustus. This art was discountenanced by Ti-

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[1] Lewes, true to the spirit of his philosophical creed, confidently asserts that one can only escape Spinozism "by denying the possibility of all philosophy."—(See *Biog. Hist. of Phil.* "On Spinoza's Doctrine.")

berius, but it revived again under Caligula and particularly Nero. Lewd, mythological love stories were the favourite subjects chosen for pantomimic-acting; and the pernicious effect of such spectacles is vehemently satirized by Juvenal (vi. 63, &c.) These representations were founded on a text mostly written in Greek: the movements of the actors were rhythmical; and hence the entire art got the name of *musica muta*. In Sicily such dances were called Βαλλισμοί, whence some have derived the words *ball* and *ballet*.

In the modern drama, the term *pantomime* is applied to a mimic representation by gestures, actions, and amusing tricks, performed by certain fantastic characters known as Harlequin and Columbine, Pantaloon and his Clown, &c. The *pantomime* is sometimes also a sort of dramatic entertainment appended to the Italian opera.

PANUCO, a town of Mexico, in the state of Vera Cruz, on the banks of a river of the same name, 18 miles W. of Tampico. The situation is extremely beautiful; and in the neighbourhood of the town there are many remains of antiquity, extending over a rich tract of ground. Pop. about 4000.

PANVINIO, ONUFRIO, a voluminous Italian antiquary and historian, was born at Verona in 1529. A love for the records of former times early became his master-passion and gave the bent to his entire career. That he might enjoy both time and opportunities for study, he became a monk of the order of St Augustine, and in that capacity went to receive his education at Rome. The appointment to a theological chair at Florence did not divert him from his favourite pursuits, for he soon obtained from his superiors leave to resign. He then made an antiquarian tour through Italy, rummaging the archives in the principal cities, and collecting information touching the dates of events and the customs of nations from the inscriptions on medals, monuments, and other relics of antiquity. This course of preparatory study was followed by a period which was spent in the midst of literary quiet, and under the smile of liberal patrons. In 1555 Pope Marcellus II. encouraged him in his studies, and gave him a situation in the library of the Vatican. On the death of that pontiff immediately afterwards, he was received into the family of Cardinal Farnese. He was daily obtaining other marks of his patron's esteem, when he was cut off in 1568, at the age of thirty-nine. Panvinio left many erudite works behind him. Among the most important are the following:—

Epitome Pontificum Romanorum usque ad Paulum IV., fol., Venice, 1557; *Viginti-Septem Pontificum Romanorum Elogia et Imagines*, fol., Rome, 1568; *Fasti et Triumphi Romanorum a Romulo usque ad Carolum V.*, Venice, 1557; *De Ludis Secularibus et Antiquis Romanorum Nominibus*, fol., Heidelberg, 1588; *De Baptismate, Pascali Origine, et Ritu Consecrandi Agnos Dei*, 4to, Rome 1560; *De Sybillis et Carminibus Sybillinis*, 8vo, Venice, 1567; *De Triumpho Commentarius*, fol., Rome, 1573, and 4to, Helmstadt, 1676; *De Ritu Sepeliendi Mortuos apud Veteres Christianos et Eorum Cœmeteriis*, 8vo, Louvain, 1572, and 8vo, Rome, 1581; *De Republica Romana*, 8vo, Venice, 1581; *De Bibliotheca Pontificis Vaticana*, 4to, Tarragona, 1587; *De Ludis Circensibus Libri Duo et De Triumphis Liber Unus*, fol., Venice, 1600; *Amplissimi Ornatissimique Triumphi ex Antiquissimis Lapidum Nummorum Monumentis, &c, Descriptio*, fol., Rome, 1618; and *De Antiquitate et Viris Illustribus Veronæ Libri Octo*, fol., Padua, 1648.

PAOLA, or PAULA, a town of Naples, province of Calabria Citra, stands on a height at the edge of a deep ravine not far from the sea, 13 miles W.N.W. of Cosenza. Many of the houses are well built; and there are a castle and two forts. It contains several convents, hospitals, silk factories, and a pottery. The fisheries are extensive. Pop. 5500.

PAOLI, PASQUALE, a great patriot and legislator, was the younger son of Giacinto Paoli, and was born at the village of Rostino in Corsica in 1726. His training was such as became one who was destined to be a great benefactor to his country. Born in a family of patriots, and at a time when the Corsicans were struggling for independence, the young boy imbibed with his opening faculties a strong love of freedom. Then removing at the age of fourteen with his exiled father to Naples, he received the most thorough discipline which that city could give. In the school of Genovesi, the eminent political economist, he learned humanistic philosophy; in the Neapolitan army he became acquainted with military tactics; and in the pages of his favourite classical authors he caught the spirit which animated the great citizens of antiquity. Thus prepared with the high accomplishments of a ruler, Paoli, in 1755, was summoned by his fellow-countrymen to be their general, and he immediately entered upon the great work of his life. It now became his task to reform a people, rude, unlettered, torn by hereditary feuds, living under wild sword-law, and exasperated by a long-continued struggle for liberty. His first measure was to reconcile them to authority. For this purpose, wandering forth among them, he brought all the qualities of his noble nature into play. His graceful and princely bearing won their hearts, his gentle eloquence captivated their understandings, and his calm energy of character awed them into submission. Paoli's next endeavour was to organize a government. Accordingly, he brought into operation a democratic administration at once simple and self-sufficient. The citizens above the age of twenty-five elected a legislative assembly called the *Consulta;* the *Consulta* nominated out of its members an executive body called the Supreme Council; and the Supreme Council acknowledged the general of the nation as its president. Any contested judicial sentence was referred to a censorship of five; and any abuse of power was punished by a decree of the people. Having established law and order, Paoli next employed the influence of the government to bring the nation under the agencies of civilization. Agriculture was promoted; manufactories were put in motion; a national printing-press was instituted; and on the 3d January 1765 a Corsican university was opened. Paoli now began to see the results of his legislation. As the Corsicans grew wealthier and more enlightened, they became stronger and more inspirited. A militia which they organized beat back the Genoese from the interior of the island, and hemmed them in within a few seaport-towns. A fleet which they built took up the offensive against their foes, and captured in 1767 the island of Capraja. At the same time, they were becoming devotedly attached to the civil administration. Their general was regarded as the saviour of his country. As he walked out among his people, old men blessed him, and women held up their children to see the man who had made the nation happy. This fair fabric of prosperity which Paoli was rearing was not, however, destined to be completed. On the 15th of May 1768 the Genoese, having lost all hope of ever re-conquering Corsica, sold their right over the island to the French. The small nation of the Corsicans, just emerging from barbarism, was thus involved in a losing struggle with one of the great powers of the earth. In vain did the natives for some time with desperate valour check the advance of the forces under Marbœuf and Chauvelin: in vain did they rout the invaders at the bridge of Golo and at Borgo. A reinforced army, under a new general, De Vaux, advanced against them in the beginning of 1769. After a struggle of three days, they were driven from their camp at Murati; and on the 9th May of that year their cause was irretrievably ruined by the decisive battle of Ponte Nuovo. The wise magnanimity of Pasquale Paoli now appeared in greater prominence than ever. Unlike the old tragic heroes, he thought it better, in a contest with destiny, to give way for a little, and remain upon guard, than to offer an unyielding resistance, and be crushed beneath her inevitable blow. His first step, therefore, was to leave the island and retire to Leghorn. Then, finding refuge in England, he lived for twenty years in London, taking no

part in the political intrigues of the day, keeping a thoughtful silence, and waiting for an opportunity to benefit his enslaved country. At length the events of the French Revolution restored Paoli to Corsica, and to an important place in its administration. At first he acted as lieutenant-general and military commandant of the island under the government of France. Then, becoming shocked with the lawless and sanguinary procedure of the Convention in Paris, he organized an anti-French party, and called in the assistance of the English. His cause was victorious; the garrisons of France were driven out of the island; and in 1794 Corsica, with the consent of the natives, was united to Great Britain. The reward which Paoli received for these services was little more than neglect. The office of viceroy of the country, which should have been conferred on him, was conferred upon Sir Gilbert Eliot. He was even prevented, for reasons of state, from passing the closing years of his life in the fatherland he had loved so well. He was called to England in 1795, and died there on the 5th February 1807.

Paoli, *Clemens*, the elder brother of the preceding, was born in 1715, and, like the rest of his family, began at an early age to take an active part in the struggles of his country. His character was that of a saintly hero of the old Hebrew type,—fervent in prayer and mighty in battle. Although he was one of the Corsican generals, and although he might have held a high office in the government of his brother, he preferred to assume the garb of a monk and the uniform of a common soldier. To fight and to pray became the sole desires of his heart. At the sound of the coming battle he rose from his knees to rush into the field; in the thick of the conflict he fought like a lion, grimly muttering prayers for the souls whom he sent in rapid succession into another world; and when his bloody work was done, he returned to his cell with a pious countenance to resume his interrupted devotions. Thus did this praying soldier in the wars of the Corsicans become the champion of the national cause, the chief hero in an army of heroes. It was he who drove the Genoese from the district of Orezza; who carried San Pellegrino and San Fiorenzo; who kept Furiani for fifty-six days, until the village became a heap of ashes around him; who routed the disciplined troops of France at the famous battle of Borgo. Nor, after his country's independence had been lost on the fatal day of Ponte Nuovo, did his holy valour suffer abatement. Retiring to a solitary cloister near "the brooks of Vallombrosa," he continued for twenty years to pray and wait for the hour when he might draw his sword once more in Corsica's behalf. He had returned to the island an aged man, yet anxious to play a part in the restoration of national freedom, when he died in 1793 in the convent of his native Rostino. (*Wanderings in Corsica*, translated from the German of Gregorovius by Alexander Muir, in 2 vols., Edinburgh, 1855; and Boswell's *Account of Corsica*.)

PAOLO VERONESE. See Cagliari.

PAOU, Tacanova, or Sandalwood, one of the Feejee Islands, in the Pacific Ocean, S. Lat. 17., W. Long. 179.; length, 96 miles; average breadth, 25. Its outline is irregular, and its surface hilly, containing several peaks, one of which, called Corobato, has a height of 2000 feet. Many of the hills are volcanic; and the island is well wooded. The principal product is sandal-wood. Pop. about 15,000.

PAPA, a market-town of Hungary, circle of Veszprim, and 27 miles N.W. of that town. It contains a splendid castle and garden of Count Esterhazy, a fine cathedral, a court-house, convent, and schools. The chief manufactures are china and cloth. Pop. (1851) 12,397.

PAPAL STATES. Under Italy the origin and growth of the temporal power of the Roman pontiffs is taken up. In the article Rome there is sketched a view of the rise and progress of that great state. The present article will be limited to a view of the actual condition of the temporal dominions of the sovereign pontiff.

The *Stato Pontificio*, as the Papal States are called in Italian, is situated in the centre of Italy, being bounded by the Adriatic Sea on the eastern, and the Mediterranean on the western side. It extends in N. Lat. from 41. 9. 8. to 44. 49. 54., and in E. Long. from 10. 26. 2. to 12. 49. 30.; and has an area of 12,041 geographical, or 16,155 English square miles, with a population of 3,124,758 inhabitants. The whole is connected together, with the exception only of the delegation of Benevento, which is surrounded by the Neapolitan province of Principato Ulteriore, and the small state of Pontecorvo, inclosed within the province of Terra di Lavoro, belonging to the same state. The Papal States are bounded on the N.W. by the Lombardo-Venetian kingdom, on the N.E. by the Adriatic Sea, on the S.E. by the kingdom of Naples, on the S.W. by the Mediterranean Sea, and on the W. by the grand-duchy of Tuscany and the duchy of Modena.

The western coast of the States is by far the shortest. It commences a little to the S.E. of Orbitello, in the Tuscan territory, and proceeds by a bay, not deep, to Civitavecchia. It has no towns on the shore; but about 3 miles inland, and visible from the sea, is the small town of Corneto. Civitavecchia is well fortified with good walls and ditches, several half-moon batteries, and various other works; and upon a peninsula is a fine castle, from which a mole is projected, whilst another mole about 180 fathoms in length is carried into the sea. Between these two is the harbour, having 17 feet of water at one of the entrances, and 12 feet at the other. Ships are safe everywhere within the harbour, and have 20 feet of water. Though the principal seaport on this side, Civitavecchia has no great commercial importance, its trade being chiefly confined to the supplies of Rome. In 1856 it was declared a free port. Proceeding to the S.E. of this port, and passing Cape Linaro, a view is obtained of the church of St Peter's at Rome. The miserable villages of Marinella, Palo, and Monterone, about 2 miles from the sea, are visible. The river Tiber has two outlets to the sea, which are divided by the Isola Sacra, a tract of land about 2 miles in breadth and 9 miles in circumference. Of these, the first or northernmost is called the Fiumicino, and the second the Fiumara. All the land near and about the mouths of the Tiber is low and marshy, and not easily distinguished from the sea, which renders the approach dangerous, especially when, as is often the case, it is covered with dense fogs. The Fiumara was the old channel of the Tiber; the Fiumicino, which is now the only navigable mouth, was excavated by Trajan from Porto to the sea, and from him called *Fossa Trajani*. It has a bar at its mouth, with 7 or 8 feet of water, and within it from 2 to 4 fathoms. The Fiumara has only 2 feet of water on its bar, and consequently can be entered by nothing larger than boats. There is good anchorage at from 3 to 6 miles from the shore, where there is a depth of water of from 6 to 13 fathoms, with good holding ground of stiff mud.

From the mouths of the Tiber the land continues low and marshy, and it has no town, but a few houses and towers at intervals; and, like the rest of the Campagna di Roma, of which it forms a part, is frequently so obscured by haze and fog, that the objects on the shore are not easily distinguishable. At the distance of about 30 miles from the Tiber, and 37 miles from Rome, under a projecting headland called Capo d'Anzio, is Porto d'Anzio, the ancient *Antium*, the birthplace of Nero, and one of the most important seaports of imperial Rome. The two moles constructed by Nero, about 30 feet in thickness, one 2700, and the other 1600 feet long, still exist, but the extensive basins they inclosed are now useless except for vessels of

small burthen, owing to the accumulation of sand caused by the filling up in the seventeenth century of the open arches on which the moles were originally built. The papal government has sundry projects for restoring this port, and converting it into a refuge harbour. Two miles E. of Porto d'Anzio is the small dilapidated town of Nettuno, supposed to have derived its name from an ancient temple to Neptune. The whole coast between Porto d'Anzio and Nettuno is covered with vaults, grottoes, baths, pillars, and other remains of Roman villas. At 20 miles from Nettuno is Monte Circello, the *Promontorium Circæum* of the ancients, an isolated perpendicular mass of limestone at the south extremity of the Pontine Marshes. On the S. side of the promontory is the village of San Felice, near to which good anchorage, in 6 or 7 fathoms water, is found; but there is no shelter against winds from the S.E. At 10 miles from thence is Terracina, the ancient *Anxur* of the Volscians, and the last town of the Papal States on the Neapolitan frontier. The harbour, once of celebrity, is now choked up; and the town, though fortified, is inconsiderable. The country around is fruitful, but marshy and unwholesome.

The E. sea-coast of the Papal States, bordering on the Adriatic Sea, extends about 120 miles in length. It commences to the south at the river Tronto (the ancient *Truentus*), by which it is divided from the kingdom of Naples, and extends to the S. mouth of the river Po, where the Lombardo-Venetian kingdom commences. From the Tronto towards the N. there are along the shore a number of small towns and villages, defended by towers, but no harbour or place of shelter, and the coast generally is low and sandy. At a short distance inland, on a hilly range, there are several small flourishing towns, such as Ripatransone, Fermo, Macerata, Recanati, Loreto, and Osimo. About 45 miles from the Tronto, the land trending N. by W. half W., is the city of Ancona, beautifully situated, and spreading like an amphitheatre between the two promontories of Monte Ciriaco and Monte Comero. Its famous port, constructed by the emperor Trajan, and enlarged by Clement XII., who made it a free port to encourage its commerce, is protected by two moles, of which the one erected by Trajan is 2000 feet in length, 100 feet in breadth, and 68 feet in height. On its point there are a battery and a lighthouse, and near it a triumphal arch of white marble, erected in honour of Trajan, and considered as one of the most perfect and imposing monuments of Roman magnificence still existing. The port has a lazaretto, where the quarantine regulations are very strict. The city is defended by several forts and strong fortifications near the harbour and on the heights of Monte Pelago and Monte Cardeto. The harbour of Ancona is the best on the Italian coast of the Adriatic, and vessels may lie in it secure from all winds, as the mole towards its termination has a turn to the west, forming a hook; it is, however, too full of shoals ever to be of consequence as a naval port. Three or four frigates may be well sheltered within the lighthouse, moored by the head and the stern; but in no part of the harbour could ships of that class swing to their anchors. The city is walled, has the best arsenal in the Roman dominions, and carries on considerable trade, arising chiefly from the exportation of corn, wool, and silk. The most appropriate merchant ships for Ancona are those not drawing more than 16 feet of water.

From Ancona to Rimini, a distance of about 50 miles, the coast is of moderate height, and the shore is sandy. The chief towns are Sinigaglia, Fano, Pesaro, and Rimini; but at none of these is there a harbour for shipping. Sinigaglia has only a mole to protect small craft. A great fair is held here, to which many of the Greeks resort, and exchange honey, wax, tar, and other articles, for hemp, wheat, and silk. Fano and Pesaro possess little or no trade, but are ancient places, each furnished with a great number of churches. Rimini is a decayed, but still elegant town, situated in a rich plain between the Rivers Ausa and Marecchia. Near the mouth of the latter river there is good anchorage on muddy ground, in 7 fathoms water; but there is no shelter from the sea-winds. At 4 leagues farther to the north there is good anchorage opposite the town of Cesenatico, a place inhabited for the most part by fishermen. It is connected by a canal with the episcopal town of Cervia, near which there is an extensive plain, used in summer for the production of salt by natural evaporation. On the river Montone, about 5 miles distant from the sea, stands the city of Ravenna, once an important place, and the seat of government, but now fallen into decay, though still possessing several silk manufactories and some commerce. Its port, which is still frequented by the coasting crafts of the Adriatic, is connected with the sea by the Canale Naviglio, 7 miles long, opened in 1737; its entrance is denoted by a beacon or moat, on which a light is hoisted at night. At the tower of Volano is the little port of Goro, the westernmost branch of the river Po, within which ships may enter and be secure in 6 fathoms water; and at that point the Roman territory is terminated by the S. stream of the Po. The alluvial matter of the different branches of that powerful stream has formed numerous shoals, which extend to a considerable distance from the shore, and the bank extends outwards to the distance of 2 leagues. Within the shoals vessels may haul up, and do so occasionally, in from 6 to 10 fathoms water. The mouths of the Po present a figure much resembling those formed by the Mississippi in America. The river, from its source in the Alps, has a course of nearly 380 miles to the sea, and is augmented by many smaller rivers which fall into it, most of its branches being navigable by small vessels. The current is very strong, and its bed having become so elevated that the level of its waters, in the lower part of its course, is several feet above that of the neighbouring lands, great injury has often been done by inundations. To prevent this, strong dykes have been gradually raised on its banks.

On the whole of the eastern coast, which has been here surveyed, there are a great number of small streams running to the sea. They have their source in the range of the Apennines at no great distance, and are consequently of short but rapid course. Many of them are dry, or nearly so, in the summer, at which season the whole district suffers very severely from the want of fresh water.

The surface of the Roman territory, with the exception of those parts on the N. which form part of the valley of Po, and the portion to the S. on the banks of the Tiber, is hilly, and much of it mountainous. The chain of the Apennines, after forming the boundary between the Bolognese and Tuscany, enters the S. part of the Papal States near Borgo San Sepolcro, and runs through them in the direction of N.W. and S.E. much nearer the Adriatic than the Mediterranean Sea, and then is continued through the Neapolitan provinces of the Abruzzi, leaving on their W. slope the Campagna di Roma, in the centre of which the city of Rome stands. From this range of mountains spurs project on both sides, some of them extending to the Mediterranean Sea, and others to the Adriatic; and between these projections are to be found valleys of much beauty, and of the highest degree of fertility. Without any visible communication with this ridge of mountains stand the lofty volcanic range of Monte Cimino, near Viterbo; Monte Santo Oreste (the ancient *Soracte*), a mass of secondary limestone projecting to a height of 2250 feet from the midst of the volcanic tufa of the Campagna; and the volcanic group of Albano, of which Monte Cavo, the highest peak, is 3130, and Rocca di Papa 2648 feet above the level of the sea. The Apennines here are nearly as naked and as

desolate as those in Tuscany and in the vicinity of Genoa, but much more lofty. The Velino, to the N.W. of Rome, rises 8180 feet above the level of the sea; Monte Sibilla, on the border of the Abruzzi, is 7200 feet; and Monte Terminillo is 6998 feet. The great northern plain, which is bounded by the Apennines, the river Po, and the Adriatic Sea, has the same character as the plains of Austrian Lombardy. It is covered with a rich marshy soil, which, near Comacchio, terminates in an almost useless, and always insalubrious swamp. Along the south-western coast extend vast swamps, which are occasionally flooded by the sea. They are scarcely habitable, though sometimes shepherds resort to them. The pestilential air causes them to be avoided. These districts, from the mouth of the river Astura to Terracina, contain the Pontine Marshes, which neither the emperors of ancient, nor the popes of modern Rome have been able to render of any real value. What Pope Pius VI. performed has been of no great avail, though it has produced a certain improvement, and has enabled some tracts of them to be changed into rich pastures.

The Mediterranean Sea receives the water of but one considerable river in the Papal States. The celebrated Tiber rises in the Apennines, under Monte Coronaro, below the village of Le Balze, in the duchy of Tuscany, enters the Roman territory at the town of Borgo San Sepolcro, and taking a south-westerly direction, and passing through Rome, after a course of nearly 250 miles, during which it receives forty tributary streams, falls into the sea at Ostia. It is only navigable for the last 15 miles between the metropolis and its mouth. The principal river of the Roman States is that which forms one of its boundaries, the Po. From the Roman States its water is augmented by the streams of the Panaro, the Reno, the Riolo, the Porotto, the Idice, the Santerno, the Senio, and the Lamone. These various streams are for the most part united by canals, and rendered navigable; and they also greatly contribute to cultivation by affording easy means of irrigating the fields near them. Besides the Po, the other principal streams which empty themselves into the Adriatic from the Papal Territory are,—the Montone, which runs into the sea near Ravenna; the Savio, which empties itself S. of it; the Uso, a small stream near Forli, which Benedict XIV., by a papal bull, decided, in 1756, was the Rubicon, though the arguments preponderate in favour of the Fiumicino or Pisatello, a small stream near it, as that at which Julius Cæsar hesitated; the Metauro, which runs by Fano; the Foglio, near Pesaro; the Musone, the Leta, the Asone, and the Tronto, which last forms the boundary between the Roman States and the territory of Naples.

There are several lakes in the Papal States. The largest of these is that of Perugia (the ancient *Thrasimenus*), celebrated for the victory obtained upon its banks by Hannibal over the Romans. It is nearly 30 miles in circumference, is surrounded by gentle eminences covered with oak and pines, and contains three small islands. Its greatest depth is 21 feet. It is well stored with fish, and the outlet is into the Tiber. The Lake of Bolsena (the ancient *Vulsiniensis*), near the town of that name, is about 26 miles in circumference, and has two small islands. Its shores are deserted in consequence of the most fatal malaria. The Lake of Bracciano (the ancient *Sabatinus*), near the town of that name, is 20 miles in circumference. Besides these lakes, there are many smaller, such as the Lake of Vico (the *Ciminus* of the ancients), 3 miles in circumference; the charming lakes of Albano and of Nemi, in the vicinity of Rome; the Lake of Piè di Luco, near Rieti; &c.

The mountainous parts of this territory abound in mineral springs of various degrees of medicinal celebrity. Those most frequented are,—the acid springs near Rome; the baths of Bracciano; the baths of Stigliano, near Tolfa; the baths of Palazzi, near Civitavecchia; the warm baths and acid springs of the Bulicame, between Montefiascone and Viterbo; the baths of La Porretta, 32 miles from Bologna, on the road to Florence by Pistoia, &c.

The climate of the Ecclesiastical States varies much according to the local position of the several parts. Some of those produce the orange in perfection, whilst others are covered with snow during great part of the year. The tops of the Apennines are clothed with snow in October, and it generally remains till May. The northern part, in the valley of the Po, has the climate of Lombardy, and the environs of Rome that of Naples. At Terracina the gardens are inclosed with fences formed by the aloe. The heat is tempered by breezes from the sea. The air upon and between the Apennines is generally favourable to health; but on the Pontine Marshes, and near the mouths of the Po, as well as near to Rimini, the marshes are gradually extending, and their pestiferous influence is observable in the increase of dense fogs, and the diminution of the population.

The description of the agriculture of Lombardy, given under that head in the present work, will apply to the portion of the territory of the Church near the Po, in the four legations of Bologna, Ferrara, Ravenna, and Forli. In the other parts the art is most negligently exercised, as well in the Apennines as in the plains of Rome itself. The Roman States produce a sufficiency of corn for their own consumption; and, in ordinary years, even for exportation. Wheat, maize, and barley, are the chief grain; but the great mass of the poorer people eat but little bread, and, especially in the Apennines, substitute for it chesnuts, onions, and beans. A great part of their food consists of fruits, culinary vegetables, and salads. They rarely taste animal food, except a little bacon or sausages. Flax and hemp are raised in great quantities to supply the inhabitants, and for exportation. Saffron is also produced to a considerable extent, and is an article of export. Some cotton is raised, and the growth of it is rapidly extending. In some parts many plants are raised that are applied by the perfumers to their preparations, such as spikenard, anise, and others. The olive grows everywhere, but is almost exclusively reserved for home consumption.

Vines are generally cultivated, but their management is careless, and the selection of the kinds of them very negligent and injudicious. The best wine is made about Montefiascone, Orvieto, and Albano; but the greater part of the common wine is very indifferent. Some little of a moderate quality is made about Bologna and Ravenna, part of which finds a market in Venice. The land produces a great variety of fruits. In the plain of Rome oranges, citrons, pomegranates, and figs ripen; and amongst the Apennines there is an abundance of almonds, walnuts, and chesnuts. The forests produce wood for fuel, and some little is sent to the Isle of Elba to supply the iron-works. On several parts of the coast much soda is prepared. The woods of Terracina have many cork-trees, the bark of which forms an article of foreign commerce.

Formerly the breeding of horses was carefully attended to, but of late it has been negligently pursued; and the celebrated race known by the name of Borghese has deteriorated, and nearly disappeared. On the Apennines asses and mules are used as beasts of burden and for riding; and for the plough, oxen are almost universally employed. The breed of cows is very fine; and they roam about the Campagna di Roma almost without attendance. The milk is not converted into cheese or butter, but the profit they yield to the proprietors, some of whom have herds of nearly two thousand, arises from the sale of the calves, and of the mothers when fattened. Sheep are very numerous, especially on the shores of the Mediterranean. There are two distinct races. One of these, called *negretti*, are small, with very strong and very white wool, as fine as that of Aragon, whence the race, as well as the name they bear, has been

derived. They give abundance of milk, from which much cheese is made. These flocks, like their ancestors in Spain, are migratory. In the month of May they march from the plains near Rome to the mountains of Norcia and the Abruzzi, and return again in October. The other race of sheep, called *puglia*, are inferior in their wool, and are stationary on the Apennines and the lands situated on the Adriatic shore. Goats are very numerous, both on the plains and on the Apennines. They yield abundance of milk, which is converted into cheese; but much of it serves to sustain the swine, of which large herds are bred and fattened upon some of the most extensive farms. The production of silk is one of the most important objects in Roman agriculture, and gives occupation to almost every member of certain families for the season. The soil is favourable to the growth of the white mulberry, the leaves of which yield the finest silk; that of the best quality, collected near Fossombrone, is chiefly exported to England and Germany.

The manufacturing operations of the Ecclesiastical States are very limited, and chiefly adapted to domestic consumption. The chief seat of the silk manufactory is Bologna, which formerly had the monopoly of the trade in crapes, but now divides it with the fabrics of other parts of Europe. Linen and woollen cloths are made, some good paper is produced, and leather is made in several parts; also glass, pottery, rosaries from Loretto, artificial flowers, tallow, and wax candles, with a variety of small articles.

There are no mines worked within the Roman territory, but considerable quantities of excellent alum and of sulphur are furnished, and some saltpetre; and on the coast there are lagunes, from which culinary salt is made by the natural evaporation of the sun's rays.

The Papal States are divided into twenty provinces, the first of which is the Comarca of Rome, which includes within its jurisdiction the Capital and the Agro Romano, and is governed by a president, who is always a cardinal. The other nineteen provinces are divided into *Legations*, which are governed by cardinals, though of late years this rule has not been strictly adhered to, and *Delegations*, governed by prelates, who are styled *Monsignori*. Each legation or delegation is divided into districts, each district into governorships, and these into communes. The following table will show the extent and population of each province, as well as of its capital, according to the official returns of the last census, completed in 1853:—

Provinces.		Area in geographical square miles.	Population of each Province. In 1816.	In 1833.	In 1844.	In 1853. In Towns.	In Country.	Total.	Average per sq mile.	Number of Houses.	Population of the capital of the province.
	Comarca di Roma	1319 2	245,203	283,456	314,274	313,230	13,279	326,509	503	39,728	(1856) 178,500
Legations.	Bologna	1023	280,701	322,228	350,588	113,682	261,949	375,631	367	45,904	74,421
	Ferrara	823 4	170,727	210,883	219,109	101,366	143,158	244,524	297	31,098	32,000
	Forli	541	150,933	194,399	202,546	70,919	147,514	218,433	404	32,875	16,643
	Ravenna	528	123,767	156,552	172,595	69,449	106,545	175,994	333	21,542	21,056
	Urbino with Pesaro	1064·7	198,145	225,806	235,386	91,658	166,093	257,751	242	40,709	U. 5,555 P. 11,568
	Velletri	430	48,098	56,530	58,313	59,197	2,816	62,013	144	11,097	12,400
Delegations.	Ancona	332 5	147,355	158,159	167,119	79 533	96,986	176,519	531	24,833	28,804
	Macerata	673 6	197,313	220,130	233,004	88,152	154,952	243,104	361	40,899	10,956
	Camerino	240 9	31,136	36,592	37,705	13,880	29,111	42,991	178	7,219	4,558
	Fermo	252 7	77,089	89,404	104,003	40,431	69,890	110,321	437	19,333	14,000
	Ascoli	358 5	69,058	78,946	83,980	46,952	44,964	91,916	256	15,490	12,000
	Perugia	1170 7	181,542	202,660	216,587	84,028	150,505	234,533	200	38,358	18,240
	Spoleto	885	102,053	116,759	126,360	78,598	56,431	135,029	152	24,988	11,170
	Rieti	400 2	55,861	59,394	69,755	53,486	20,197	73,683	184	13,289	11,000
	Viterbo	872 2	101,164	113,041	123,874	112,976	15,348	128,324	147	23,477	14,226
	Orvieto	238·3	21,736	24,877	25,253	12,650	16,397	29,047	122	4,747	6,943
	Civitavecchia	286·1	15,886	19,601	24,700	19,117	1,584	20,701	72	2,546	7,823
	Frosinone with Pontecorvo	555 4	116,770	139,979	143,234	115,021	39,538	154,559	278	25,259	F. 8,000 P. 7,500
	Benevento	46·2	20,184	23,046	22,422	21,480	1,696	23,176	502	5,066	16,000
		12,041·6	2,354,721	2,732,442	2,920,807	1,585,805	1,538,953	3,124,758	285	468,457	...

The annexed table, showing the sex and the various ages of the population, will give an idea of the comparative longevity in the Papal States:—

Ages.	Males.	Females.	Total.
Under 5 years	184,175	171,986	356,161
From 5 to 10 years	181,028	168,819	349,847
„ 10 to 20 „	308,057	285,396	593,453
„ 20 to 30 „	281,786	265,901	547,687
„ 30 to 40 „	219,726	208,871	428,597
„ 40 to 50 „	173,352	170,137	343,489
„ 50 to 60 „	120,287	122,571	242,858
„ 60 to 70 „	86,417	89,519	175,936
„ 70 to 80 „	37,127	35,173	72,300
„ 80 to 90 „	6,679	6,031	12,710
„ 90 to 95 „	287	296	583
„ 95 to 100 „	56	62	118
Upwards of 100 „	11	8	19
Total	1,599,988	1,524,770	3,123,758

The population was grouped in 608,280 families, each of an average number of 5·14 members, nearly one-half of them living in towns, and the other half in the country; but commerce and manufactures are so insignificant that many of the inhabitants of the towns also are more or less dependent upon agriculture. The subjoined table, showing the value of the total yearly imports and exports, as well as of some of the principal articles, from 1850 to 1853, will give an idea of the chief produce of agriculture, as well as of the state of the manufactures of the country.

The foreign trade of the States, which is not considerable as compared with their extent of coast both on the Adriatic and the Mediterranean, is chiefly carried on at Ancona, but varies much in different years. Thus, the number of vessels of various nations which entered that port in 1854 was 1421, of 80,612 tons; in 1855 it was 941, of 76,002 tons; in 1856, 1296, of 121,691 tons; and in 1857, 684, of 110,704 tons. The vessels that cleared it were,—1274 in 1854, 919 in 1855, 1259 in 1856, and 652, of 104,786 tons, in 1857.

Value of Principal Articles, and Total of each Year.

Exports.

	1850.	1851.	1852.	1853
	L	L	L.	L.
Hemp, raw	254,337	422,537	471,434	314,498
„ combed	148,130	137,486	153,607	11,755
„ prepared	39,114	41,145	44,287	39,553
Wheat and buckwheat . .	254,816	216,088	288,448	146,075
Thread, silk	177 444	196,718	269,678	219,204
Maize...	99,179	133,319	41,767	9,435
Rice	49,726	39,573	64,647	23,325
Oxen, cows, swine, and other animals	177,228	195,133	166,450	176,014
Works of modern art, sculpture, &c.	42,083	96,688	18,133	67,077
Sheep's wool	85,669	38,069	93,984	81,415
Manufact. of linen and hemp...	68,356	65,857	74,946	66,745
Cordage of hemp	35,877	29,748	27,356	27,021
Salted fish	22.022	15,335	19,143	14,323
Skins and furs	35,916	33,608	30,121	37,170
Books	20,570	36,313	27,826	31,635
Stone and building materials...	20,286	26,780	33,885	32,427
Mercery	12,405	11,333	23,897	11,704
Other articles........	313,473	302,353	344,348	350,574
Total exports......	1,956,630	2,048,083	2,203,907	1,659,950

Imports.

	1850.	1851.	1852.	1853.
	L.	L	L.	L.
Manufactures, cotton	211,619	233,290	252,803	228,192
Do. woollen ..	169,515	182,292	182,918	168,033
Do. silk	133,721	153,567	135,223	135,588
Do. linen & hemp	42,343	46,725	29,518	24,908
Thread—hemp, linen, and cotton...	142,145	158,513	151,099	147,197
Thread—silk and woollen	9,846	11,031	9,441	11,814
Wheat, buckwheat, and maize	...	...	..	389,838
Coffee, raw, &c....... .	66,044	60,306	35,087	35,049
Animals......	69,419	71,077	50.500	62,383
Sugar..	138,956	136,276	143,663	157,419
Salted fish..	127,456	119,610	116,143	103,977
Skins and furs	57,272	55,639	61,365	42,624
Mercery	88,140	79,944	68,934	67,187
Stone, wood, &c., for building... ..	46,942	45,112	45,172	38,727
Stone, wood, &c., for works of art	14,942	12,771	14,431	13,785
Coffee	45,348	54,064	56,437	53,185
Tobacco	59,622	45,909	41,295	40,390
Iron of various kinds	69,871	69,380	62,692	56,259
Other articles	591,799	694,545	693,406	752,142
Total imports . ..	2,085,000	2,230,051	2,150,127	2,528,697

The government of the Papal States is an unlimited elective hierarchy, presided over by the Pope, and administered by a Council of Ministers, of whom the Cardinal secretary of state and of foreign affairs is the chief and most influential member. The other ministers,—interior, grace and justice, finance, war, police and commerce, public works and fine arts,—though they may be laymen, are generally ecclesiastics or prelates. The latter are a class peculiar to the Papal States. Any one who has passed the degree of Doctor of Laws, and enjoys a small independent income, may be admitted into the *Prelatura*, which entitles to employment in the Pope's household, and in the various departments of the state, and is the stepping-stone to preferment to most of the highest offices,—such as nuncio, delegate, governor of Rome, &c., and possibly even cardinal. The *prelate* wears a peculiar costume, is styled *Monsignore*, though he is neither a bishop nor necessarily an ecclesiastic, and is bound by celibacy as long as he retains office. If not in holy orders, on retiring from office, he becomes a layman, and may marry. The election of the Pope originally rested with all the clergy and the people of Rome; it was made, as Anastasius Bibliothecarius tells us, "*A cunctis sacerdotibus seu proceribus, et omni clero nec non et optimatibus, vel populo cuncto Romano.*" Before his consecration the new Pope had to receive the imperial sanction, and, by a decree of the Emperor Otho I., had to swear to respect the rights of the clergy, of the people, and of the emperor. In the year 1059 a great change was introduced by Pope Nicholas II., who vested the College of Cardinals with the exclusive right of electing the Pope out of their own body. Eventually, and after a long contest, not only the Popes emancipated themselves from any imperial sanction to their election, but, under Gregory VII., the church asserted its pre-eminence over the empire.

On the death of a Pope, and till his funeral on the ninth day, the supreme power of the state is in the hands of the Cardinal *Camerlengo*, who, during that time, has even the privilege of coining money bearing his own name and arms. On the tenth day the cardinals are to meet in secret Conclave, and by secret voting, and a majority of two-thirds of their number, appoint a successor

The number of cardinals, who at first were the parish priests of Rome (*parochi cardinales*), was limited to seventy by Sixtus V. in 1586, in allusion to the number of disciples commissioned by our Lord to preach the Gospel. They constitute the Sacred College, are appointed for their lifetime by the Pope, and are designated as Princes of the Church. They rank in six classes,—*1st*, Six cardinal bishops of the suburban dioceses of Ostia (Velletri), Porto (Civitavecchia), Sabina, Palestrina, Albano, and Frascati; *2d*, Fifty cardinal priests; *3d*, Fourteen cardinal deacons. Their part in the government and in decisions alike on spiritual and temporal affairs, and their share in the revenues of the church, were agreed upon in the conclave that was held after the death of Martin V., and were framed in nine articles ratified after his election by Eugene IV. in 1431, which may be called the *Magna Charta* of the Sacred College.

In the Papal States, exclusive of Rome, there are nine archbishoprics and fifty-two bishoprics. The archiepiscopal sees are Bologna, Ravenna, Ferrara, Spoleto, Fermo, Camerino, Bevagna, Urbino, and Benevento. The inhabitants all adhere to the Roman Catholic religion, with the exception of about 12,500 Jews, who reside at Rome, Ancona, and Ferrara, and have eight synagogues. At Rome they are compelled to live in a separate confined quarter, called the *Ghetto.* The clergy is very numerous—21,415 monks and friars, occupying 1800 monasteries; and 16,905 priests; forming a total of 38,200, or more than one for every 82 inhabitants. There are, besides, about 8000 nuns, with 600 nunneries. In Rome alone there are nearly 4500 priests, monks, and friars, and 1800 nuns.

The education of the people is very little attended to, and, with the exception of the kingdom of the Two Sicilies, the instruction of the lower classes in reading and writing is less spread than in any other part of Italy. In all the communes that can afford it there are schools for primary education, under the superintendence of the parish priest: the teachers, always ecclesiastics, are appointed by the communal council. In the episcopal towns there are the bishops' schools, for the education of persons intended for the church. For the higher branches of knowledge there

Papenburg.

are eight universities, two primary and six secondary ones. The primary are,—the Sapienza at Rome, founded in 1244; and the university of Bologna, which dates from 1119. The secondary universities are those of Ferrara (1264), Perugia (1307), Macerata (1548), Fermo (1589), Camerino (1727), and the Gregoriana, or Collegio Romano, at Rome itself. The number of young men who receive in them an academical education is reckoned at about 3400. The education of women is greatly neglected, and the little education they receive is almost entirely acquired in convents.

The *Corpus Juris* and the *Jus Canonicum*, or the civil law and the canon law, and a *Motu Proprio* of July 10, 1831, by Gregory XVI., are the texts by which justice is imparted in the Papal States. The judges are appointed by the Pope, and are removeable. There are tribunals of first instance in the capital of every province, and courts of appeal at Bologna, Macerata, and Rome. Over the latter is the Corte della Segnatura, sitting at Rome, which resembles the French Cour de Cassation. It revises the judgments of the courts of appeal, and in case of any violation of the law, annuls them, and sends the parties before another court for a new trial. At Ancona, and in the other principal towns, there are tribunals of commerce, to decide commercial cases. When an ecclesiastic, however, is concerned in a lawsuit, the jurisdiction belongs to the bishop's court, from whose judgment an appeal may be interposed to the court of the metropolitan. In all the courts the proceedings are public, except in state trials, which are brought before the *Consulta*, a secret tribunal, in which the prisoner is allowed neither to see the witnesses nor to have communicated to him the nature of the evidence to be adduced; and he can only be defended by the official advocate of the Consulta. The Vicario's court at Rome, and the bishop's courts in the provinces, have arbitrary powers summarily to imprison any person of either sex on the grounds of immorality; a power which often leads to acts of great injustice.

The whole military force of the Papal States in 1857 amounted to 16,900 infantry, and 1315 cavalry. It consisted of two Swiss regiments, two regiments of Italian infantry, a battalion of chasseurs de Vincennes, one regiment of dragoons, one of artillery, a corps of military engineers, the Pope's noble guard of 80 noblemen, the Swiss body-guard (126 in number), 4540 gend'armes, and 1760 custom-house guards. The principal fortresses are, Ancona, Ferrara, Civitavecchia, and Castel St Angelo, in Rome, of which the two former are now held by the Austrians, and the two latter by the French. A gun-brig, two steamboats, and some small craft, form all the Papal navy.

The finances of the country have long been in an embarrassed state. Since 1828 there has been a yearly deficit, which has occasionally been met by an additional loan. According to the official returns lately published by the minister of finance, the revenue of the state, which in 1851 was L.2,269,445, in 1857 had increased to L.3,009,524; but the expenditure, which in 1851 was L.2,621,504, had also swelled to L.3,104,692. From the table we give below of the estimated amount of each branch of the public revenue and expenditure from 1853 to 1857, it will be seen that the expense of collecting the revenue amounts to nearly 25 per cent. on the gross receipts; and that the lotteries, which have a most demoralizing influence, and check the benefit of savings-banks among the lower classes, give the state a net yearly income of only about L.63,000, nearly 75 per cent. of the gross receipts being swallowed up by the machinery of collecting it. It also will be seen that in 1857, 5,076,018 scudi, or more than one-half of the net revenue of 9,716,638 scudi, went to pay the interest on the public debt. The yearly deficit, it must be observed, is greater than that given in the subjoined table, as for the last four years no returns are given of the expenses of the ministry of the interior and the ministry of police.

Estimated Amount of the Public Revenue and Expenditure from 1853 to 1857.

Branches.	Revenue.					Expenditure.				
	1853.	1854.	1855.	1856.	1857.	1853.	1854.	1855.	1856.	1857.
	L.	L.	L.	L.	L.	L.	L.	L.	L.	L.
Direct taxes and domains	570,906	603,791	677,388	679,041	672,423	82,278	109,060	109,832	102,912	103,394
Customs and excise	1,157,2[illegible]3	1,13[illegible]	[illegible]	1,[illegible]9,040	1,634,354	126,055	131,046	148,357	412,664	450,627
Stamps and registration	193,7[illegible]	18[illegible]2	19[illegible]	[illegible]2,339	222,348	22,923	24,057	23,560	24,610	24,527
Post-office	72,032	72,135	72,322	72,395	74,018	46,945	47,555	50,317	49,095	50,721
Lotteries	177,634	172,594	179,117	189,680	217,340	118,946	115,567	118,814	120,473	143,721
Mint	111,534	144,292	157,548	3,662	3,745	105,967	145,567	166,980	6,275	6,692
Public debt	44,577	44,128	65,623	50,183	51,065	950,750	966,133	1,057,575	1,070,415	1,068,079
Fund retained for the use of the minister of finance	44,187	22,094	28,616	21,041	31,562	286,058	278,526	286,765	287,244	287,570
Ministry of the interior	6,708	8,509	5,910	7,404	8,420	188,548	311,430	311,712	313,976	322,535
Ministry of police	130	...	...	...	...	39,103	...	...	...	...
Ministry of commerce, fine arts, agriculture, and industry	1,272	1,749	17,656	13,053	15,313	17,853	20,425	102,730	106,240	111,203
Ministry of public works	4,882	5,238				97,915	78,084			
Army	1,623	1,529	1,390	1,519	1,925	359,194	379,477	378,985	406,280	424,247
Ministry of grace and justice	...	...	..	...	...	88,103	...	...	...	...
Census	...	...	...	...	..	8,747	8,696	8,759	8,759	8,755
Extraordinary	2,602	9,015	79,217	77,538	77,011	104,275	112,065	118,500	100,550	102,621
Total	2,389,076	2,405,574	2,672,141	2,866,895	3,009,524	2,643,660	2,727,688	2,882,886	3,009,493	3,104,692
Deficit						254,584	322,114	210,745	142,598	95,168

The only railway as yet constructed in the Roman States is the short line of 10 miles from Rome to Frascati, which was opened in 1856. Another line from Rome to Civitavecchia is not yet (1858) completed. (* * *)

PAPENBURG, a town of Hanover, in the government of Osnabrück, near the left bank of the Ems, 23 miles S.S.E. of Emden. It contains distilleries, saw-mills, and manufactories of sail-cloth. Many ships are built here; and an active trade is carried on. Pop. (1852), including the village of Drostensyhl, 5641.

PAPER.

Paper. PAPER is a word derived from the Greek πάπυρος, *papyrus*, the name applied to the celebrated Egyptian plant which was so much used by the ancients in all kinds of writing. It is unnecessary to describe the different expedients which men have, in every age and country, employed for giving permanence to their ideas, and handing them down to posterity. When the art of writing was once discovered, stones, bricks, leather, stuccoed cloth, potsherds, leaves of trees, the outer and inner bark, plates of lead, wood, wax, and ivory, were all employed. Among the curious miscellaneous relics of ancient Egypt which have come down to us, are fragments of pottery inscribed with various documents, as soldiers' furloughs, orders of admission, memoranda, accounts, &c. In the progress of society men have tried other more permanent devices for this purpose, and have successively invented the Egyptian paper, paper made of cotton, paper manufactured from the bark of trees, and in our times paper prepared from old rags.

The only kinds of paper which merit particular attention are,—*first*, the Egyptian; *secondly*, that made from cotton; *thirdly*, paper made from the interior bark of trees; *fourthly*, Chinese paper; *fifthly*, Japanese paper; *sixthly*, paper made from asbestos; and, *lastly*, paper prepared from linen and cotton rags.

Egyptian paper.

Egyptian paper, so called from its having been used by the ancient Egyptians, was made from a species of reed called *papyrus*, which grew on the banks of the Nile. The ancient botanists placed the papyrus amongst the gramineous plants, or dog-grass. Ignorant of the particular kind to which it belonged, they were contented to specify it under the name of *papyrus*, of which there were two kinds, namely, that of Egypt, and that of Sicily. The papyrus (*Papyrus Niloticus; Papyrus Ægyptiacus; Papyrus antiquorum; Papyrus antiquorum Niloticus*) is of the order *Triandria Digynia*, and is one of the many varieties of the genus *Cyperus*. The stem is naked, and reaches a height of ten and even fifteen feet. It is surmounted by a plume of leaves and flowers. Besides its well-known seat in Egypt, the papyrus, in several varieties, has been observed in Syria, Sicily, Calabria, India, and Madagascar. The name *papyrus* was probably but the Greek transcript of the native name of the plant, *babeer;* but the same plant was also known to the Greeks under several other names, as βύβλος, βίβλος, and, more rarely, δέλτος, from the chief seat of its cultivation, the delta of the Nile. Considerable uncertainty has prevailed, nevertheless, among modern botanists, as to the exact identification of the plant formerly used in Egypt for the manufacture of paper. Many have supposed that some alteration of the soil of Egypt, or in the system of cultivating the plant, may have induced such modifications of its appearance as to render it difficult of recognition; and it has even been suggested that it may have disappeared altogether in the long series of ages, and the many social and political revolutions through which Egypt has passed since the classic times.

Whatever doubts may have formerly existed on this point are now at an end. Bruce not only saw the papyrus growing both in Egypt and Abyssinia, but actually made paper of it, in the same manner as that in which it was made by the ancients. He tells us, likewise, that, so far from any part of it being useless, the papyrus is at this day used in Abyssinia for making boats; a piece of the acacia tree being put into the bottom to serve as a keel. That the boats of ancient Egypt were made of a species of papyrus, probably of the very same construction described by Bruce, we know from the testimony of Pliny, who informs us that the plants were first sewed together, and then gathered up at stem and stern, and tied fast to the keel: *Conseritur bibula Memphitis cymba papyro.* It is not by any means clear, however, that the plant which Bruce found in use for the manufacture of boats is the same which he made into paper; and perhaps, indeed, a good deal of the difficulty among modern botanists has arisen from their not observing that more than one variety of the Cyperus appears to have been turned to different uses by the Egyptians; to some of which uses—as the making of baskets, mats, sandals, sails, and even punts or boats—the Cyperus used in paper-making appears but little suited, or rather, in which it could not be so profitably employed. Now, Sir Gardner Wilkinson mentions two varieties which are still common in Egypt—the *Cyperus dives* and the *Cyperus papyrus.* The former, which is even yet cultivated for many of the uses specified above, he thinks to have been that used by the ancients for boats and for all the other coarse manufactures. The *Cyperus papyrus* (the *Papyrus hieraticus* of Strabo, and the *berd* of modern Egypt) was reserved chiefly for the manufacture of paper.

Another question has arisen among modern botanists, whether the papyrus of Sicily is the same with that of Egypt, and whether the Romans used the former plant for the purpose of paper-making, or for any other of the uses of the Egyptian papyrus. The Sicilian plant is called in Italy *papero*, or *pipero.* A careful examination of it was made by the celebrated naturalist, Cesalpino, for the purpose of resolving this question. His opinion was, that the two plants, although bearing a strong resemblance to each other, were in reality different. The papyrus of Sicily, says he, which is there commonly called *pipero*, has a longer and thicker stem than the plant cyperus. It rises sometimes to the height of four cubits; the angles are obtuse, and the stem at the base is surrounded with leaves growing from the root; and there are no leaves on the stem, even when the plant is at its greatest perfection, but it carries at the top a large plume, which resembles a great tuft of dishevelled hairs. This is composed of a great number of triangular pedicles, in the form of reeds, at the extremity of which are placed the flowers, between two small leaves of a reddish colour like the cyperus. The roots are woody, about the thickness of reeds, jointed, and throw out a great number of branches, which extend themselves in an oblique direction. These are scented somewhat like the cyperus, but their colour is a lighter brown. From the lower part issue many small fibres, and from the higher a number of stems shoot up, which, in proportion as they are tender, contain a sweet juice.

An interesting description of the Sicilian plant, accompanied by elaborate drawings, was written by Doctor Domenico Cirillo, and published at the celebrated Bodoni press at Parma, in which the habitat, form, and characteristics of the Sicilian plant are minutely described, and contrasted with those of the Egyptian papyrus, as detailed by Pliny, Prosper Alpinus, Bauhin, and others. Cirillo's own conclusion from the comparison is, that the Sicilian is exceedingly like (*simillimam*) the Egyptian plant, as described by Theophrastus and Pliny. (*Domenici Cyrilli, Medicinæ Doctoris, Cyperus Papyrus*, folio, Parma, 1796, p. x.)

The accuracy of this judgment was impugned by some of the botanists of the last century. But later researches have tended to confirm the authority of the older naturalist. It is certain that the ancients themselves recognised the same character of resemblance between two varieties of the plant which they regarded as distinct. Theophrastus (*Histor. Plantarum*, iv. 8.) distinguishes the *sari* (σάρι) and the *papyrus* (πάπυρος); observing that, although

they have a decided character of resemblance, they differ in this, that the papyrus sends forth thick and tall stems, which being divided into slender plates, are fit for the fabrication of paper, whilst the sari has small stems, considerably shorter, and altogether useless for any kind of paper.

The papyrus, therefore, which anciently served to make paper, must not be confounded with the papyrus of Sicily, which is also found in Calabria. According to Strabo, the former was not to be found anywhere except in Egypt and in India. The greater part of botanists have believed that the Sicilian plant is the same with the sari of Theophrastus; but others have alleged that the papyrus of Egypt and the sari were the same plant in two different stages of its existence, or considered with respect to the greater or less height; which, according to them, might depend upon the qualities of the soil, the difference of the climate, or other accidental causes. In proof of this, it is maintained, that there is an essential difference between the papyrus growing in the waters and the same plant growing on the banks of rivers and in marshes. The first of these has thick and tall stems, and a plume in the form of a tuft of hair, very long and slender, and without any seed. The second differs from the first in all these particulars; it has a shorter and more slender stem, its plume is loaded with flowers, and consequently it produces seed. In whatever way we consider these facts, it is sufficient for us to know, that the difference between the papyrus and the sari neither depends on climate, nor soil, nor situation. The plants, whose difference depended on these circumstances, both grew in Egypt, and were both employed in the manufacture of paper. We should add, nevertheless, that, whatever may be the specific differences between the Egyptian and the Sicilian papyrus, the latter may also, absolutely speaking, be converted into paper. Cavaliere Landolina Nava of Syracuse, and others, have actually made paper of it, and sheets of the paper are still offered to travellers as specimens of the manufacture; but they are decidedly inferior in every respect to the ancient Egyptian fabric. (Wilkinson's *Egyptians* iii. 148.) Indeed, not only for the manufacture of paper according to the ancient plan, but in every other industrial point of view, the Sicilian plant appears to be entirely inferior to the kindred one of Egypt.

The *Cyperus papyrus* of the ancients was chiefly cultivated in Lower Egypt, especially in the Sebennitic Nome; and the right of growing and selling it was one of the government monopolies. The date of the origin of the manufacture of paper from this plant has been the subject of much discussion. Pliny, on the authority of Varro, states, that it was unknown in Egypt till the time of Alexander the Great; but there is no doubt that this is a grievous error; and, although it is impossible to fix the precise time at which the use of the papyrus began, modern antiquarians have clearly shown that it dates back as far as the most remote Pharaonic period, to which period many extant papyri are believed to belong. Perhaps, however, the authority of Pliny may at least show that the use of papyrus, especially outside of Egypt, as an article of commerce, became more general after the conquest of Alexander; and on this point Pliny is confirmed by other ancient authors, especially Herodotus (v. 58, ii. 100), Athenæus (xiv. 644), and Theophrastus (*Historia Plantarum*, iv. 8, 4).

The manufacture of the papyrus is minutely described by Pliny (xiii. 23); and, although his account contains some obvious inaccuracies, and has been strangely misunderstood by the commentators in one important point, it is on the whole very interesting. He tells us that "paper is made from the papyrus by splitting it with a needle into very thin leaves, due care being taken that they be as broad as possible." Some of the commentators, and even of the eminent Egyptian antiquarians (among the rest, Sir J. Gardner Wilkinson, iii. 148), understand this to mean that "the interior of the stalks of the plant, after *the rind had been removed*, was *cut into thin slices* in the direction of their length, and these being laid on a flat board in succession, similar slices were placed over them at right angles." Another equally eminent Egyptian scholar, Seyffarth (*Beitrage zur Kenntniss des alten Ægyptiens*, ii. 201), supposes that it was the *stem* of the papyrus which was *cut into slices*. The true explanation of the process, however, is that given by Becker (in his *Charikles*, ii. 220), and indeed follows naturally from the words of Pliny. Neither the pith of the plant, nor the entire stem, if cut into slices, would have furnished a suitable material. But under the coarse exterior rind of the plant lie a number of successive layers of the inner cuticle (*philuræ*), about twenty in number. These several integuments, instead of being sliced, were separated from each other by the point of a needle, and the portions so removed are the "thin leaves" of which Pliny speaks. The best and finest philuræ were those which lay nearest to the centre of the plant, the quality of the others declining as they receded from it. The outer rind or bark was only used for making ropes, and especially for ropes which were to be submerged in water, for which they possessed a remarkable power of resistance. The leaves thus separated were rendered adhesive, not as Pliny states, by the muddy Nile water (which he erroneously supposes to have had certain glutinous qualities), but by the use of a paste made of very fine flour, and mixed with size or glue (for the preparation of which Pliny also furnishes a prescription, ch. 26), and then placed upon a flat board or table, slightly inclined. The leaves were placed down lengthwise, as long as the papyrus would admit of,—forming, as it were, the woof of the fabric,—and their jagged edges were duly cut off at both ends; a second layer of leaves, which may be called the warp, was then laid down transversely upon these at right angles, in the same way, in fact, says Pliny, "that hurdles are made." The leaves were then pressed close, dried in the sun, beaten smooth with a mallet, and polished with ivory, or some similar substance; after which they were all united to each other, the best sheets being always taken first, and the inferior ones afterwards. The sheets were rolled for use upon a cylinder (scapus). The breadth (or depth) of the roll of course was limited by the length of the strips of the papyrus; its length could be indefinitely extended; but Pliny says that they never placed more than twenty sheets on the roll.

The frail specimens of Egyptian paper which have come down to us have created the impression that the ancient papyrus must, like the modern rice-paper, have had the grave defect of exceeding brittleness. But it may be doubted whether this impression is well founded; and very possibly a great deal of this apparent defect of the ancient papyri is rather to be ascribed to the excessive dryness of the climate in which these rolls have been preserved for so many ages, than to their own inherent brittleness. Sir Gardner Wilkinson states, that the best English drawing-paper, after a few years in Egypt, becomes too brittle to fold up without breaking; and that on the contrary, when the papyrus is gradually exposed to steam or to the damp of this climate, it acquires a considerable degree of pliability. He himself mentions one ancient papyrus of Memphis, still extant, which is as pliable as common paper.

The finest quality of the Egyptian paper, that made of the inner leaves, was called *Hieratica*. It was made, as the name implies, by or for the priests, and was not suffered to be sold, lest it should be desecrated by profane writings. But it is curious that, although some writers have denied the existence of palimpsest papyri (see PALIMPSEST), there was a regular trade at Alexandria in Hieratic papyri which had been already written upon, for the purpose of their being washed and re-prepared for a second use. It was only, or at least principally, in this way that, during the time of the Re-

public and in the early days of the Empire, the best papyrus could be obtained in Rome. In later times the manufacture was much improved, and especially after the paper began to be manufactured in Rome. In the reign of Augustus, a very fine quality was produced, which was called *Augusta*, in honour of that emperor. The second quality was called *Liviana*, from his wife Livia, the name *Hieratica* being degraded to the third quality. A still coarser quality was called *Amphitheatrica*, probably from its being made near the amphitheatre of Alexandria; but this kind of paper eventually became a very important article of commerce, from its being used as the basis of a much finer quality, which was manufactured at Rome by a new process. The inventor of this process, who gave his name to the paper (*Fanniana*), was a grammarian of Rome—Q. Remmius Fannius Palæmon—who is supposed to have been Quintilian's preceptor. His process is not described in detail, but it consisted in carefully inserting finer slips into the coarse paper, and probably re-laying or re-adjusting the slips into a closer and smoother fabric. A fifth variety of paper was the *Saitica*, so-called from the city of that name in Lower Egypt, where it was manufactured in large quantities. A sixth kind, *Tæniotic*, called from a place in the vicinity of Alexandria, was made entirely from the coarse exterior layers of the plant, and was sold by weight and not by quality; and a further kind, used only as wrapping-paper, and called *Emporetica* (from ἔμπορος, a merchant), was so coarse as to be quite unfit for writing upon.

The breadth of the paper, which, as we saw, was limited by the length of the strips of the papyrus, was an important element in the value of the different qualities. The *Augustan* paper, according to Pliny, was thirteen fingers in breadth, the *Hieratic*, eleven; the *Fannian*, ten; the *Amphitheatric*, nine; the *Saitic*, still narrower; and the *Emporetic*, only six fingers broad. Pliny adds that the Emperor Claudius made a great improvement in the quality of paper, as to smoothness, colour, and strength. The Augustan paper had been so fine as not to resist sufficiently the action of the sharp point of the pen; and even when it escaped being torn or perforated, the writing, from the extreme thinness of the paper, could be read from the opposite side of the page. To obviate these inconveniences, a sheet of coarser paper was taken as a groundwork, "over which was laid a woof, as it were, formed of leaves of the first quality." In consequence of these improvements, the *Claudian* paper (for so this paper was called) came to be preferred to all others, though the *Augustan* was still used in Pliny's time for all the purposes of correspondence.

Papyrus paper formed an important branch of the commerce of Egypt, which continued to increase towards the end of the Roman republic, and became still more extensive under Augustus. The demand from foreign nations was often so great as to cause a scarcity at Rome; and, in the reign of Tiberius, a tumult occurred amongst the people in consequence of this scarcity. In a letter of the Emperor Hadrian, the preparing of papyrus is mentioned as one of the principal occupations at Alexandria. "In this rich and opulent city," says the emperor, "nobody is seen idle. Some are employed in the manufacture of cloth, some in that of writing paper." During the time of the Antonines, this commerce continued to flourish; and Apuleius says that he wrote upon the paper of Egypt with a reed of the Nile prepared at Memphis.

Towards the end of the third century, the demand for papyrus became so great, that when the tyrant Firmus conquered Egypt, he boasted that he had seized as much paper and size as would support his whole army. St Jerome informs us that it was much in use in the fifth century, when he flourished. The duty on its importation had become excessive towards the end of the fifth or the beginning of the sixth century; and on its being abolished by Theodoric, the Gothic king of Italy, Cassiodorus congratulated the whole world on the cessation of an impost on a merchandise which was so essentially necessary to mankind.

Down to what period papyrus continued to be used, and still more to what date its manufacture continued, it is very hard to determine. Montfaucon and Mabillon mention several fragments written on this paper in the sixth century. One of these was a charter of the Emperor Justinian, entitled *Charta Plenariæ Securitatis*. In 1698, Montfaucon saw, in the library of Giuglio Giustiniani, three or four fragments of Egyptian paper of the same antiquity; and Mabillon mentions a manuscript of the Jewish antiquities of Josephus translated into Latin, which seems to have been written in the same century, and which was preserved in the Ambrosian Library at Milan; but he had not himself seen the manuscripts. The same antiquary mentions his having seen in the library of St Martin of Tours the remains of an old Greek manuscript of Egyptian paper, which appeared to him to be of the seventh century. He also believes that the copy of St Mark's gospel preserved in the Register-house of Venice is written upon the same paper; that it is the most ancient of any of the evangelical manuscripts; and that it may be supposed to have been written, at the latest, in the fourth century. According to the same antiquary, the Egyptian paper was used in France, Italy, and other European countries, both for books of learning and for public records; and there still remain, he adds, a great number of these in the archives of the church at St Denis, at Corbey, in the Abbey de Grasse, and in other convents. That it was also used by the Syrians, Arabians, and other Orientals, is clear from the circumstance that papyri in these languages are still extant. Silvestre, in his *Palæographie Universelle*, gives specimens of more than one.

It is probable that the invention of paper made of cotton, of which we shall afterwards treat, insensibly destroyed the reputation and manufacture of the Egyptian paper; but it is still a question at what particular period the fabrication of the latter totally ceased. Eustathius, the learned commentator on Homer (*Ad. Hom. Odyss.* xxi., p. 1913), assures us that in his time it was no longer in use; but Mabillon maintains that many of the papal bulls were written on papyrus in the eleventh century. Count Maffei, however (*Histor. Diplomat.* lib. ii.; *Biblioth. Ital.* tom. ii., p. 251), is decidedly of opinion that Egyptian paper was not in use in the fifth century. He considers all records written upon this paper, and dated subsequently to this period, as not authentic; and the papal bulls mentioned by Mabillon, as well as the copy of St Mark's gospel, were, according to him, written upon paper manufactured from cotton. On the contrary, Pauly (*Real. Encyclopädie der Klassischen Wissenschaft*, v. 1156) states that a copy of St Augustine's Letters, which Montfaucon saw in the library of St Germain des Prês, partly of papyrus, partly of parchment, is not earlier than the sixth century. To reconcile in some measure these contradictory accounts, it may be observed, that on some particular occasions, and by some particular persons, the Egyptian paper might have been employed for several hundred years after it ceased to be in general use.

Before we pass from the ancient manufacture of the papyrus paper, we may observe, that the plant has been proposed as one of the most promising of the vegetable materials for the manufacture of paper by the modern process. Chevalier Claussen in a paper on "Plants which can furnish Fibre for Paper Pulp," appears to place it higher in the scale, both as regards the per-centage of fibre and the facility of bleaching, than most of the substances hitherto experimented upon. He found it to contain 40 per cent. of strong fibre, excellent for paper, and very easily bleached. He appears to think, however, that the common indigenous rush (*Juncus effusus* and other varieties) will supply an

equally, if not more, available pulp for paper-manufacture.

Paper made from cotton.

It is generally supposed that the invention of the paper called *Charta bombycina* supplanted the Egyptian paper in Greece. This paper is incomparably more lasting, and better calculated for all the purposes of writing. It is not precisely known at what period this art, which supposes a great variety of previous experiments, was first reduced to practice. The application of cotton to the purposes of paper-making requires as much labour and ingenuity as the use of linen rags; and for this reason, if we would determine the precise time when paper was made from cotton, we should also be able to fix the invention of the art of paper-making as it is presently practised in Europe. Montfaucon proves, by incontestible authorities, that paper made from cotton was in use in 1100. This paper in the Greek language is called χαρτη βομβυκινος, or βαμβακινος; for although βομβυξ is the Greek word for silk, yet in those times it was applied, as well as βαμβαξ, to cotton; and hence the Italians call cotton *bambaccio*.

The most ancient manuscript of this paper which Montfaucon saw with a date, was that in the French king's library, written in the year 1050; but as the manuscripts without date are infinitely more numerous than those which are dated, and as some conjecture can be formed concerning them from the manner of the writing, the same antiquary believes that some of these were written in the tenth century. The researches of the same learned person serve to show that this paper was discovered towards the end of the ninth or beginning of the tenth century; for before the twelfth century it was commonly used throughout the eastern empire, and even in Sicily. Roger, King of Sicily, says, in a diploma written in 1145, that he had renewed on parchment a charter which had been written upon cotton paper in the year 1100, and another which was dated in the year 1112. About the same time the Empress Irene, in the statutes for regulating some religious houses at Constantinople, states that she had left three copies of these statutes, two on parchment, and one on cotton paper. From that period paper of this sort became still more in use throughout all the eastern empire; and innumerable Greek manuscripts are found written upon it, in all the great libraries.

This discovery happened at a time when there seems to have been a great scarcity of parchment; for it was about the same period that the Greeks erased the writings of Polybius, Diodorus of Sicily, and many valuable ancient authors, for the sake of the parchment. It was the invention of this cotton paper which destroyed the manufacture of the Egyptian article; for, if we may believe Eustathius, who wrote towards the end of the twelfth century, the latter had gone into disuse but a little before his time. We may easily believe, however, that this new invention, although of great advantage to mankind, was only introduced by degrees.

Paper from the bark of trees.

Paper of the interior bark of trees was made from the white pellicle or inner coat which is found in many trees between the bark and the wood. The trees commonly in use were the maple, the plane-tree, the elm, the beech, the mulberry, and most commonly the linden-tree. The ancients wrote upon this inner coat after they had separated it from the bark, and beaten and dried it. Mabillon and Montfaucon speaks frequently of manuscripts and diplomas written upon paper made from bark; and positively distinguish it from the Egyptian paper, because it was thicker, and composed of parts less adhesive.

There are many palm trees in India and America to which botanists have given the name *papyraceous*, because the natives have written with bodkins either on the leaves or on the bark. Such is the American palm, called *tal* by the Indians; and also the *guajaraba* of New Spain. Every palm, the bark of which is smooth, and the leaves large and thick, may be used for this purpose.

Chinese paper.

The art of making paper from vegetable matter reduced to pulp was known in China long before it was practised in Europe; and the Chinese have carried it to a high degree of perfection. The fine paper of China is much softer and smoother than that of Europe; and these qualities are admirably adapted to the pencil, which the Chinese use in writing. Several kinds of their paper discover the greatest art and ingenuity, and are applied with much advantage to many purposes. These are capable of receiving the impression of types; and Chinese paper is celebrated for affording the most clear and delicate proof-impressions from copperplates.

The different sorts of paper vary in China according to the materials of which they are composed, and the various modes of manufacturing these materials. Every province has its peculiar paper. That of Sechuen is made of linen rags, as in Europe; that of Fo-kien, of young bamboo; that of the northern provinces, of the interior bark of the mulberry; that of the province of Kiang-nan, of the skin which is found in the webs of the silk-worm; and in the province of Houquang, the tree chu or ko-chu furnishes the materials of which paper is made.

The method of fabricating paper from the bark of different trees is nearly the same with that which is followed in the bamboo. To give an idea, therefore, of the manner of manufacturing the interior barks of the mulberry, the elm, and the cotton tree, it will be sufficient to confine our observations to the bamboo.

The bamboo is a kind of cane or hollow reed, divided by knots, but larger, more elastic, and more durable, than any other reed. The whole substance of the bamboo, composed of filaments, and a great abundance of fibrous materials, are employed in this operation. The shoots of one or two years, nearly as thick as a man's leg, are preferred. They strip the leaves from the stem, cut them into pieces of four or five feet in length, make them into parcels, and put them into water to macerate. As soon as they are softened, which generally happens in five days, they are washed in pure water, put into a dry ditch, and covered for some days with lime watered for the purpose of slacking. They are then washed carefully a second time, and every one of the pieces is cut into filaments, which are exposed to the rays of the sun to dry and to bleach. After this they are boiled in large kettles, and then reduced to pulp in mortars of wood, by means of a hammer with a long handle, which the workman moves with his foot.

The pulp being so far prepared, some shoots of a plant named *koteng* are taken, and being steeped in water four or five days, are reduced to an unctuous or glutinous substance; and when the workmen proceed to make the paper, this is mixed with the pulp in certain fixed quantities, because upon this mixture depends the quality of the paper. When the extract from the koteng is mixed with pulp of the bamboo, the whole mixture is beaten together in mortars till it become a thick and viscous liquor; when it is poured into large tubs or reservoirs, so exactly framed as that no part of the liquor can escape. After this the workmen plunge their forms into the liquor, and take out what is sufficient for a sheet of paper, which, when formed and consolidated, is at once dried and detached from the mould, by being held a moment or two against a heated hollow wall, the two fronts of which are smooth and extremely white. At the extremity of this wall is placed a stove, the pipes of which are carried in a circular manner throughout the whole empty space. The sheets of paper are laid on the surface, to which they adhere till a soft brush is applied to them; and after they become dry, it is easy to distinguish the side which received impressions from the brush from that which adhered to the wall. By means of this stove the Chinese dry their paper as fast as they make it; but it is only in cold seasons, or in certain provinces, that they find this expedient necessary.

The Chinese paper must be dipped in a solution of alum before it can take either ink or colour. They call this operation *faner*, from the Chinese word *fan*, which signifies alum. The manner of preparing this solution is extremely simple. Six ounces of isinglass cut very small are put into boiling water, and constantly stirred, that it may dissolve equally. When the isinglass is wholly dissolved in the water, twelve ounces of calcined alum are thrown in, and also stirred till it is completely dissolved and mixed with the isinglass. This composition is afterwards poured into a large deep basin, at the mouth of which there is a little round piece of wood; and the extremity of every sheet of paper is then fixed in another piece of wood, with a slit made to receive it. By means of this apparatus the sheet of paper is plunged into the composition of alum and isinglass; and when it has been fully penetrated by the mixture, it is drawn out, and made to glide over a little round piece of wood. The long piece of wood which holds the sheet by one end, and keeps it from tearing, is afterwards suspended with it on a wall till it becomes sufficiently dry.

The Chinese give to the paper intended for different purposes different colours; but we shall confine our observations to the silver colour, which they impart to some kinds. They take two scruples of paste made of cow's hide, one scruple of alum, and a pint of water, and boil the whole on a slow fire till the water be evaporated. The sheets of paper are then stretched on a smooth table, and covered over with two or three layers of this paste. They afterwards take a certain quantity of talc, washed and boiled in water, with a proportion of one third of alum. The whole is then dried, reduced to a powder, passed through a sieve, boiled a second time in water, dried in the sun, and again passed through the sieve. This powder is then spread equally over the sheets of paper, prepared as above mentioned; and these are afterwards dried slowly in the shade. The sheets of paper, covered in this manner with talc, are laid upon a table, and rubbed with a little cotton, which fixes a certain quantity of talc in the paper, and carries off the surplus to be used on another occasion. By means of this composition the Chinese draw all manner of figures on their paper.

The paper made from the bamboo is sufficiently white, soft, and closely united, without the least inequality on the surface to interrupt the motion of the pencil, or to occasion the rising of the materials which compose it. But every kind of paper made from the bamboo or the bark of trees is more liable to crack than that made in Europe; besides, it is more susceptible of moisture, and is sooner destroyed with dust and worms. To obviate this last inconvenience, people are obliged frequently to beat their books in China, and to expose them to the sun. It may be observed, however, that the Chinese paper, employed for various purposes in Europe, has been preserved for a long time without receiving damage either from moisture or from insects.

Japanese paper.

According to Kæmpfer, the bark of the *Morus papifera sativa*, or true paper-tree, is chiefly employed for making paper in Japan. Every year, after the fall of the leaves, which happens in the tenth month, corresponding to our December, the Japanese cut the young shoots of this tree into pieces of about three feet, and collect them into parcels, which they boil in water containing a certain quantity of ashes. If the wood be dry, they take care to steep it twenty-three hours in water before it is boiled. The parcels are kept in a close copper till the bark at the extremity of the shoots is separated from the stem about half an inch; they are then cooled, and the bark alone is fit for making paper. They begin by a preparation, which consists of cleaning the bark, and separating the good from what is bad. For this purpose they steep it in water three or four hours; and as soon as it is softened they scrape off with a knife whatever is blackish or green, and at the same time separate the strong bark of a year's growth from the slender kind which cover the young shoots. The first of these gives the whitest and best paper. If there be any of the bark of more than a year's growth, it is laid aside for the coarsest kind.

After the bark has been culled and cleaned in this manner, it is boiled in a clear ley till the matter is of such consistency, that, being gently touched with the finger, it draws off in the form of hairs, or like a collection of fibres. During the time of boiling it is constantly stirred with a strong reed, and the waste by evaporation is supplied from time to time with additional quantities of the clear ley. To make this ley, they put two pieces of wood across the mouth of a tub, and cover them with straw, upon which is laid a bed of ashes a little moistened; and when boiling water is poured on the ashes, the salts contained in them are carried down to the tub. This is what is called a *clear ley*. After the bark is in the condition which we have just stated, it is washed with great care; for on this washing depends in a great measure the quality of the paper. It is put into a kind of sieve through which the water can flow freely; and great care is taken to turn it with the hand till it be sufficiently diluted, and reduced to soft and tender fibres. For the finest paper a second washing is requisite, and a piece of cloth is used instead of a sieve.

When the bark is washed, it is laid upon a strong and smooth table, and beaten with a kind of baton of hard wood till it is reduced to a proper consistency. Indeed it becomes so soft that it resembles paper steeped in water. The bark prepared in this manner is put into a narrow tub, with a glutinous extract from rice and the root *oreni*, which is very viscous. These three substances are mixed together, and stirred with the reed till they form a liquor of uniform consistency. The composition is then poured into vats similar to those used for filling the forms or moulds in our paper-mills.

As soon as the sheets are made and detached from the form, they are laid in a heap upon a table covered with a double mat. A small chip of cane is placed between every sheet, and this jutting out serves to distinguish the sheets, and afterwards to raise them. Every one of the heaps is covered with a plate or thin board of the exact size of the paper. In proportion as the paper dries, or is able to bear it without danger of being compressed into one mass, they lay on additional weights. This pressure, being intended to carry off any unnecessary moisture, is continued during twenty-four hours, when the sheets are, by means of the little pieces of reed, suspended to long plants in the open air, till they are completely dried.

The extract from rice is made in an unvarnished earthen pot, which is at first agitated gently, and then more briskly; new water is next poured in, and the whole is filtered through a linen cloth. The finishing of the process is determined by the viscosity of the substance. The infusion of the root *oreni* is prepared in this manner:—The root, peeled and cut into small pieces, is infused in water for one night, during which time it communicates a viscosity sufficient for the purpose to which it is applied.

The Japanese paper is of such prodigious strength, that the materials of which it is composed might be manufactured into ropes. There is sold at Serige, the capital city of the province of that name, a kind of paper which is fit for bed-hangings and wearing apparel, and so much resembles stuffs of wool and silk that it is often taken for them. There are four trees used in Japan for the manufactory of paper:—1. The true paper-tree, called in the Japanese language *kaadsi*, and characterized by Kæmpfer as *papyrus fructu mori celsæ, sive morus sativa foliis urticæ mortuæ cortice papifero*; 2. The false paper-tree, called by the

Japanese *katsi* or *kadsire*, and by Kæmpfer *papyrus procumbens lactescens folio longo lanceata cortice chartaceo*; 3. The plant which the Japanese call *oreni*, and which is named by Kæmpfer *malva radice viscosa flore ephemero magno punico*; 4. The *futokadsura*, named by Kæmpfer *frutex viscosus procumbens folio telephii vulgaris emulo fructu racemoso.* The description of these trees, as given by Kæmpfer, may be of service in leading botanists to discover the European plants and shrubs adapted, like the Japanese, for the fabrication of paper.

Before concluding this part of the subject, it may be proper to given an idea of the attempts which have been made to increase the original materials of paper in Europe. A slight attention to the Chinese process in reducing the bamboo to a paste, by a careful and ingenious analysis, and to the method employed by the Japanese in separating the principal fibres of the bark of the mulberry, will show the absurdity not only of taking plants without any kind of choice, but of giving them no preparation, except that of pounding them with mallets. With a proper selection and right treatment, it appears probable that many of the European plants might be used with great advantage in fabricating several kinds of paper. It is evident that the materials used by the Chinese require less labour and preparation than the stuff of linen rags. The sheets of the Chinese paper are easily detached from the form; they are laid in heaps, without the interposition of pieces of woollen cloth; the superfluous water is immediately discharged; and they require not, as in Europe, the vigorous action of presses to unite the parts more closely together.

Paper made from asbestos.

Asbestos is a fibrous substance of little strength, and the threads of which are easily broken. This substance has the peculiar property of supporting the action of fire without receiving any damage; and hence pieces of cloth and garters made of it are incombustible. From the knowledge of this property, paper has been made of asbestos. The manner of fabricating this paper is described in the *Philosophical Transactions* (No. 166). A certain quantity of asbestos is pounded in a stone mortar till it be reduced to a substance like cotton. All the parts of earth or stone remaining in the asbestos are then taken off by means of a fine sieve, and it is formed into sheets of paper by an ordinary paper-mill. Mixing it with water reduces it to stuff; but as it is heavier than that made from linen rags, it requires to be continually stirred when it is taken up with the frames. The only excellence of this paper is, that the writing disappears when cast into the fire. But as it is of a slender consistency, and easily torn, it is rather an object of curiosity than of use.

Paper made from rags.

This paper is manufactured throughout all Europe, in the East Indies, and in America, from linen and cotton rags collected in the cities and in the country. Paper made of linen rags was utterly unknown to the ancients. The *libri lintei* mentioned by Livy (i. lib. iv.), Pliny (lib. xiii., c. xi.), and other Roman writers, are demonstrated by Guilandin, in his Commentary on Pliny, to have been written on pieces of linen cloth, or canvas prepared in the manner of painters. But it is not sufficient to be certain that paper made from linen is a modern invention; it is necessary to know by what nation, and at what period, it was discovered. Polydore Virgil (*De Inventoribus Rerum*, c. ii., c. viii.) confesses his ignorance of this circumstance. Scaliger, without any kind of proof, gives the credit of the invention to the Germans; and Maffei claims it for the Italians. Other writers ascribe this honour to some Greek refugees at Basil, to whom the manner of making paper from cotton in their own country had suggested the idea. Duhalde is persuaded that Europe derived this invention from the Chinese, who, in several provinces, make paper of rags nearly in the same manner as we now do. But this invention was practised by the Europeans before they had any communication with China, and before the taking of Constantinople, at which time the Greek refugees were supposed to have retired to Basil. The precise date of this discovery in Europe is not exactly known. Mabillon believes that it took place in the twelfth century, and cites a passage of Pierre de Clugny, born in the year 1100, to prove it. The books which we read every day, says De Clugny, in his treatise against the Jews, are written on sheeps' and calves' skins, or on oriental plants, or, finally, *ex rasuris veterum pannorum.* If these last words signify paper such as we use, there were books of it in the twelfth century. But this citation is the more to be suspected, as Montfaucon himself, after the minutest search in France and Italy, could find no book on this paper anterior to the death of St Louis, in the year 1270.

The epoch of this invention was not approximately determined till 1762, when M. Mierman proposed a reward to the person who could procure the most ancient manuscript written on this kind of paper. The collection of all the memoirs sent to him, along with the manuscripts, was published at the Hague in 1767; and it appeared that this paper had been used in Europe before the year 1300.

In 1782 the Abbate Andrez published a work, entitled *Dell' Origine, Progressi, e Stato attuale d'ogni Letteratura*, in which he speaks of the discovery of many kinds of paper, and particularly of that made of rags. The same person maintains, that paper made from silk was very anciently fabricated in China, and in the eastern parts of Asia; and that the art of making this paper was brought from China to Persia about the year 652, and to Mecca in 706. The Arabs substituted cotton, the commodity of their own country, instead of silk, or rather of bamboo. This cotton paper was carried into Africa and Spain by the Arabs. The Spaniards, from the quantity of linen to be found in the kingdom of Valencia, seem first to have adopted the idea of using linen rags; and hence the most ancient paper of this kind is that of Valencia and Catalonia. From Spain it passed into France, as may be gathered from a letter of Joinville to St Louis about the year 1260, and it is discovered to have been made in Germany in 1312. The first paper-mill in England was erected at Dartford by a German named Spielman in 1588, who was knighted by Queen Elizabeth. In consequence of paper made from cotton being imported from the Levant, paper made from linen was introduced much later into Italy than into France, Germany, and England.[1]

Art of paper-making in Europe.

This manufacture owes, in a great degree, the prodigious advancement which it has attained in Great Britain during the last thirty years, to the ingenious and successful application of machinery. Many of its formerly tedious and uncertain processes are thereby greatly simplified and abridged, a remarkable instance of which is the improvement of cylinder-drying. The drying process used formerly to be effected mainly by the agency of the atmosphere; but, since the paper-machine was perfected, the paper is now made to pass in the web, as it is formed, over the surface of a certain number of metal cylinders heated internally by steam, and is dried off in less than two minutes, whereas it was formerly, and especially during winter, kept for weeks or months in a damp state, or exposed to severe frost, to its certain and great damage.

The manufacture naturally divides itself into that which is carried on in *hand-mills*, where the formation of the sheet, as formerly, is still performed by manual labour;

[1] See the work of Abbate Andrez, printed at Parma, 1782, in 8vo; and Mierman's *Collection*, published at the Hague.

Paper.

and that which is carried on by *machine-mills*, where the paper is formed upon the machine wire-cloth in one continuous web. To give a distinct view of the subject, it will be necessary to describe all the important parts of the operation in their order, most of which are common to both modes of manufacture.

Materials.

The materials principally used in Great Britain are old linen and cotton rags, which are collected in great quantity at home. A large quantity of rags, chiefly linen, is annually imported from the different countries whence the exportation is not prohibited,—viz, Germany, Italy, Sicily, and Hungary. For many years past a very abundant supply of material, formerly considered as totally worthless, has been obtained from the cotton factories in Manchester and its neighbourhood. We allude to the cotton waste and sweepings of the cotton-mills, which, by being *devilled*, that is, cleaned by a machine used in the cotton manufacture called a devil or skreening machine, and afterwards boiled in alkaline solution, and bleached, are capable of being converted into very tolerable printing paper.

The selection of the rags, if it should not have been performed before they are brought to the paper-mill, is there performed by women sorting them into their various qualities, which facilitates the work of the rag-cutters, whose business it also is to sort the rags into their different kinds as they cut them. The rags are then assigned, in bags or bales of from two to five hundredweights each, to the women in the rag-house. These women stand at small tables of about 3 feet square, the upper surface being composed of iron wire cloth, the meshes of which are about one-fourth of an inch square, whilst underneath there is a drawer. A knife or short scythe is firmly fixed in the centre of the table, in nearly a vertical position, and the woman is placed so as to have the back of it standing next her, and with a large wooden box divided into several compartments upon the floor, on her right hand. She then opens and examines the seams and patches of the rags, and removes the dirt, as well as any other noxious substances, such as pins, needles, buttons, silk, and worsted pieces, &c., that may be attached, which would be hurtful to the machinery, as well as to the quality of the paper. She cuts the rags by drawing them to her across the edge of the scythe, into pieces not exceeding 4 inches square, which are sorted and thrown into the boxes above referred to, according to their different qualities. A great deal of the dirt, sand, &c., passes through the wire-cloth into the drawer of the table, which is opened and cleaned out at convenience.

The rags, after being thus cut and sorted, are again carefully examined by women called *overlookers* or *overhaulers*, who have the charge of seeing that the work is properly performed, and that none of the noxious substances above referred to are allowed to remain in the rags. Much of the beauty and cleanness of the paper, when finished, depend upon the attention bestowed on this department; for any dirty or noxious substances, when once comminuted by the trituration of the *stuff* into an endless number of small particles scattered over the surface of the paper, are of course wholly fixed and irremoveable.

Several machines have been invented for the purpose of cutting rags, and thereby abridging the labour and expense. By means of rollers they are carried round a large cylindrical drum, on which knives, placed diagonally, revolve with considerable velocity and power, and cut the rags into small diamond-shaped pieces. But such machines have hitherto been found of comparatively little service, as of course they cannot perform the work of selection, or the removal of the impurities from the material, which can only be done by careful and close examination at the time of cutting the rags, and with the advantage of using the sharp knife to cut or scrape off the injurious portion. These rag-cutting machines, moreover, have been apt to cut the rags into very unequal sizes, leaving one portion much too large, and another portion much too reduced, for the due trituration of them afterwards.

After the rags have been cut and carefully examined, they are inclosed in a cylinder called a duster, the whole periphery of which is composed of iron-wire cloth; it measures about $4\frac{1}{2}$ feet in diameter, and is about 5 feet in length; and a part of the circumference opens on hinges to admit the rags, from one to two hundredweights of which are generally inclosed at a time, and remain in motion for half an hour or an hour. On the axis in the interior of the cylinder there are a number of spokes, each about 1 foot long, fixed transversely, which pass through the rags when they are in rapid motion, and toss them about so as to make them part the more readily with the dust, sand, and dirt, which may still adhere to them. For the coarser and dirtier descriptions of rags this machine is used with good effect before they are cut, and renders the operation of cutting the rags less accompanied with dust, &c., and therefore less unpleasant and unwholesome to those engaged in it. A great recent improvement which we have to notice is that of the duster or willow, as it is termed, being now open at both ends. These willows are of a much larger size than formerly, and are placed on a slope. The rags, in order to be freed from dust and dirt, are placed upon a revolving travelling felt, from which they are dropt into one end of the willow referred to, and, after being carried partially round it for some time, are dropt out at the lower end of the willow upon another travelling felt, whence they are conveyed away for use, or for being stored up, upon another travelling felt.

The women engaged in the rag-house cut on an average about three quarters of a hundredweight of home rags (that is, rags collected in Scotland and England) in the day of ten working hours, and about one hundredweight and a half of foreign rags in the same time. This arises from the latter being of a much heavier and stronger substance, generally speaking, than the former. Their wages amount to from 10d. to 1s. per day on an average. The nature of their employment, though it subjects them to the inhalation of dust and fibrous matter floating through the air, does not seem at all to injure their health, nor to warrant the adoption of what medical men have sometimes volunteered to recommend, that of breathing through sponges placed over their nose and mouth, to prevent injury to their chests and lungs.

The next process is that of boiling the rags in an alkaline ley, which is rendered proportionally strong, according to the lowness of the quality of the rags and the quantity of the colouring matter to be discharged. In some mills large open-mouthed coppers, with fire under them, are used for this purpose; in others, where there is a full command of steam, the rags are boiled in large square iron boxes, capable of containing ten or twelve hundredweights at a time. Part of the lid is made to move on hinges, or with a rope and pulley and balance-weight, for the purpose of the rags being placed in and taken out of the vessel; and before the steam is allowed to pass into the chest, the lid is secured by being screwed tightly down, and the joints of it formed by oakum to prevent the blowing of the steam. The steam passes through an upright iron pipe of about an inch and a half in diameter, through the centre of the lid down to the bottom of the chest, whence it diverges through a number of pipes or radii towards the sides of the chest. There is a false bottom, also of iron, which is in moveable pieces, about 6 inches above the real bottom; it is perforated by a number of small holes, to allow the boiling ley to pass constantly through the mass. (A sketch of a chest of this description will be found under the article BLEACHING).

The boiling process, however, having been unequally and imperfectly performed, from the want of agitation through-

out the mass of material in the vessel, revolving boilers of a cylindrical shape have been introduced, made of strong wrought-iron. Patents for these have been taken out by Messrs Donkin and Fourdrinier, both of London, and by Mr Robertson, near Edinburgh, by which the rags are much more completely boiled, and with considerable economy in the amount of alkali used, and in the labour employed.

The quantity of alkaline matter varies from four to ten pounds of carbonate of soda to each hundredweight of rags, according to their quality, with about one-third part additional of quicklime, to render the ley caustic. The boiling is carried on upon an average for about eight hours, after which the rags are cooled as gradually as possible, since the process of cooling, if rapidly carried on, tends to fix some of the black colouring matter again in the rags. Some makers use only lime in the boiling process, whereas others use pot and pearl ashes to a considerable extent; but we believe that a ley composed of soda and a portion of quicklime is most commonly employed.

The rags, after being thoroughly cooled, to which a gentle flow of cold spring-water let into the boiler materially contributes, are laid aside in large wooden chests for use, or at once conveyed in boxes on wheels into the engine-house, there to be reduced to pulp. As this is one of the most important processes, and requires the whole power of the mill, we shall explain it, with reference to fig. 1. Figs. 1 and 2

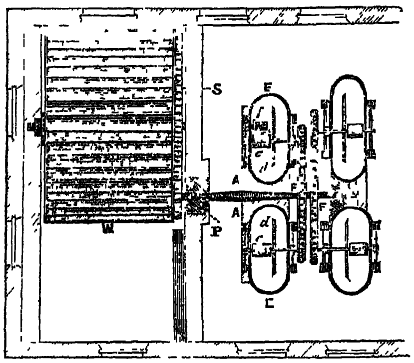

Fig. 1.

represent a plan and elevation of a paper-mill for four engines, E.E. W is the water-wheel, on which there are

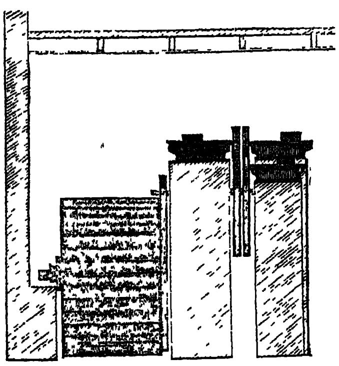

Fig. 2.

segments, S, of cast iron, which work into a main pinion P. This pinion is fixed on the same lying-shaft on which the spur or fly-wheels F are also hung. The motion is thus brought up to the proper speed, it being necessary that the pinions *p*, *p*, *p*, of the engines, and the engine-cylinders *c*, *c*, should perform about 150 revolutions per minute.

The engines, which are to be understood as large troughs of an elliptical form, with a division *d*, *d*, running nearly the length that intervenes between the foci of these imaginary ellipses, consist of two sorts, according to the purposes to which they are applied, viz., washing and beating engines,—the former being designed for washing and rubbing out the rags, and the latter for shortening or beating down the fibres, after the washing and bleaching processes have been performed.

These engines used to be made of strong wood, and lined inside with lead or copper; but for many years past they have been very successfully cast in iron, all in one piece, including the partition or mid-feather, as it is termed, although, from their awkward shape, it may be easily conceived to be rather a difficult matter to insure a good casting of such a mass. They measure about 10 feet in length, 4½ feet in width, and about 2½ feet in depth, being dimensions sufficient to contain about 112 or 120 lbs. of rags, but they are frequently capable of containing 2 cwts. From the rapid motion and weight of the machinery, and great friction necessary to triturate the stuff, it is evident that the solid fixing of the engines is a matter of extreme importance. It is usual, therefore, to build, from a solid foundation, a substantial mass of ashler-work (fig. 3, A A), of the size of each engine, for it to rest upon.

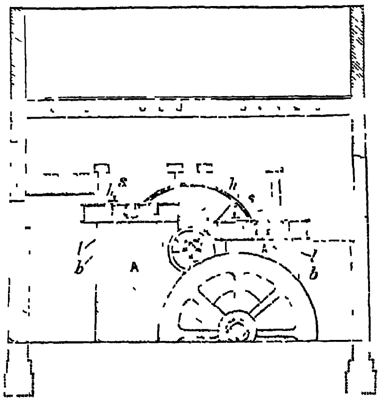

Fig. 3.

The cylinders in the engines, technically called the rolls, and by the revolution of which the rags are ground into pulp, are formed in general of solid wood. Elm is most generally used for this purpose. They are commonly about 2 feet in diameter, and 2 feet in length. Round the circumference are firmly fixed bars of steel parallel to the axis or spindle, in bunches of two together in the washing-engine, and three in the beating-engine, generally about eighteen or nineteen several bunches, and making therefore in all about thirty-eight bars in the washing-engine cylinder, and fifty-four or fifty-seven in that of the beating-engine. These steel bars are sunk and wedged into the periphery of the cylinder, and are, moreover, firmly fastened by means of hoops which are fitted into a groove in the ends of the cylinder, and, passing through the bars at a place cut out in them for that purpose, secure them firmly in their place.

Under the cylinder is what is called a plate (see fig. 3); that is, a number of steel bars, which lie fixed in a place provided in the trough *b* for them. They are accurately fitted, so as to form a segment of the same circle as the cylinder itself. The number of bars varies according to the kind of work performed at the mill; but in white-paper mills, in the washing-engines the plate has generally from twelve to eighteen bars, and in the beaters from twenty to twenty-four. The breadth of the plate is almost universally the same everywhere, namely, from 5½ to 6 inches. A plate 6 inches broad is found to require quite as much power, from the increased friction, as can in general be spared.

The thickness of the bars in the washing-engine plate is generally from about three-eighths to half an inch; and in the beating-engine from about three-sixteenths to one-fourth of an inch. In the latter they are made up with wooden or copper dividers, so as to afford the necessary thickness; in all, of five and a-half or six inches. The thickness of

the cylinder and plate-bars ought to be about the same proportion to each other; they are bevelled or tapered off about an inch or an inch and a-half from the edge, like a wedge; and those in the washing-engine being intended for opening and rubbing out the cloth and duly washing it, it is the opinion of the writer of this article that they ought not to be under the thickness of one-eighth of an inch, nor in the beaters under that of a shilling at the edge, after being ground—otherwise, by the too rapid conversion into pulp, the strength of the fibre would be materially injured.

The rags having now been boiled and brought into the engine-house, the engineer fills the engine or trough about half-full of water, till the bars of the cylinder, which project fully an inch from the wood, get hold of the water, and begin to turn it round. He then begins to put the rags into the engine, and spreads them with his hand. It will be seen from fig. 2 that the spindle *s*, which goes through the cylinder, is supported in its bearing upon an iron lever, called a lighter, *l*. A screw *h* is attached to it, and by moving that screw, the cylinder can be raised about three inches above, or depressed so as to come into contact with the bars of the plate.

Behind the cylinder it will be found that there is a rise (fig. 4, *r*) in the trough, which, on the side next the cylinder, forms a segment of a circle similar to that of the cylinder, and within an inch or two from it, and then descends by a rapid declivity to the natural bottom. This rise is called by the workmen *the backfall*, from the rags falling down upon it. The cylinder is always, when the mill is at work, inclosed in a wooden cover (fig. 5). The cover of the washing-engine used to have four slits or grooves cut down through the top of it, two on each side of the cylinder. The two slits *w* next the cylinder were made for a board of wood, which could be put in or removed at pleasure, being guided by grooves in the inside of the cover. The other two slits *c* contained two frames of very fine copper wire-cloth, having about 4900 holes in every square inch. These wire-cloth frames were generally fixed, being only taken out when any repairs were requisite.

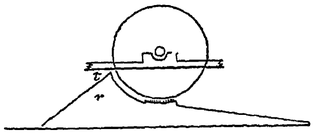

Fig 4.

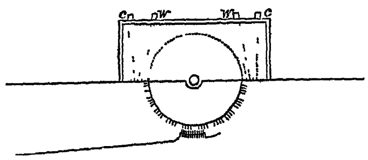

Fig. 5.

The washing process was formerly carried on by the rags or pulp being driven violently by the roller or cylinder in its rapid revolutions upon the wire-cloth frames referred to; but as this was found to be attended with a great waste of fibre, this plan has been very generally abandoned, and the dirty water now passes through the periphery of hollow cylinders covered with fine wire-cloth, which revolve *slowly* in the pulp, and which water is raised by inverted buckets inside of the cylinder, and conveyed away by a tube in the centre of the axis.

The rags being now filled into the engine, the cylinder, by means of elevating the screw (fig. 3, *h*) is raised as high as it will go, as there is thereby room for a greater quantity of water being carried round with the dirty rags. In the bottom of the trough (fig. 1) there is a false bottom *f*, which is punctured through by a number of small holes, and which communicates with a cock. This cock, when kept fully open for the first twenty or thirty minutes, has the effect, in consequence of the pressure of water and suction, of carrying off a great deal of dirty water, as well as sand and loose particles from the rags, which have escaped former cleaning operations.

When the engine has been once filled with rags and water, of which there must be a large supply constantly flowing, the cylinder, by its projecting bars, working like the paddles of a steam-boat, draws them in. It then throws them up to the top of the "backfall" formerly alluded to, and the rags or pulp descend the declivity. By this means a regular progressive motion of the stuff is produced, which comes again and again under the action of the cylinder bars and plate. The cylinder is gradually depressed as the washing goes on, till it comes as nearly as possible in contact with the plate when at its lowest point. The plates are not placed directly in line with the bars of the cylinder, but lie at an angle of about five degrees. This prevents the one from being locked against the other, should the cylinder, from any cause, be too much depressed; and it is moreover necessary that they should be in that position, to promote the reducing of the rags to pulp, on somewhat of the same principle with the cutting process, performed by a pair of scissors—the one blade forming an angle with the other.

To make good paper, a great deal depends upon the state of the engines, bars, and plates. If these be not in proper working order, well fitted together, and adapted for the description of material worked, it is impossible that any subsequent care can remedy the mischief done in the engine-house. It is much to be regretted that the great demand which has prevailed for paper for many years past has induced manufacturers generally to sacrifice quality to quantity, by hurrying the process, which impairs the strength of the fibre, and injures the texture of the paper.

If the bars and plates of the washing-engines are kept so sharp as to cut the rags, nothing can be conceived more injurious. Every paper-maker knows that the stuff is rendered mellow and soft by being rubbed out by blunt bars and plates. The longer the time occupied by this operation the more water will the stuff incorporated with it hold when it is worked into paper, and the less easily will the water drain off from it, which is always a sign of strong paper. Stuff, on the other hand, which has been quickly prepared by sharp tackle, never has the water properly beaten up with it; but the fibres, having been *cut* down, as it were, are held in suspension in the water merely, and the paper made from such stuff is always weak, flimsy, and perishable.

An abundant supply of fine water is very essential to produce paper of fine quality. When the rags are first begun to be washed, the engine consumes about a hogshead per minute for the first half-hour; but this quantity is soon diminished by the rags being opened up into pulp, and thereby taking up more room for themselves in the engine, till, towards the conclusion of the washing process, the water which passes through the washing-cylinders does not amount probably to one-twentieth part of that quantity.

In reducing the rags to half-stuff, about three or four hours have been hitherto considered as necessary for fine papers; but, from the desire to produce a large quantity, it is the practice of most machine-mills now to do this in half the time, to the great injury of the fabric. The power required to keep each of the cylinders moving the stuff, when pretty near to the plate, is equal to about seven horses.

The rags having undergone the process of being washed and *broken in*—that is, rubbed into half-prepared pulp, the engineer shuts off the supply of washing water, and then, by means of an iron hook two feet and a half long, which he inserts into the cavity of a conical brass valve, fitted into a pipe at the bottom of the trough or engine, raises that valve, and the half stuff then flows through a pipe of about six inches diameter, into the bleaching-house, situated in the under story, where it is received into a draining-chest of pretty large size, and suffered to part with the water, which flows through a number of very small holes

bored in the wood. As soon as the stuff is emptied, the washing-engine is again filled with rags as before.

The bleaching process is carried on in some mills by the rags being subjected in close chambers to the action of chlorine, which is produced in leaden retorts, from sulphuric acid, sea-salt, and the black oxide of manganese, and for an account of preparing which, we refer to the article BLEACHING. In a great many mills, however, where this mode was long carried on, it has been entirely abandoned, and the practice of steeping the rags in a solution of chloride of lime has been very generally substituted. The advantage, in the latter process, consists in the stuff not being so much injured in the fabric as if exposed to the chlorine itself; and although the whitening effect may not be produced so speedily or completely as if done by the action of the gas, yet, by giving the steeping process plenty of time, that is nearly compensated for, and there is much less waste in the latter than in the former process.

The bleaching-house for steeping consists of a long apartment, regulated in extent by the number of chests necessary for the carrying out of the works. A passage of three or four feet wide goes down the middle, and on each side are arranged stone chests, about three feet deep, and containing about fifty-seven cubic feet. In each there is a false bottom, which has been made of many different materials—viz., lead, copper, zinc, wood, stone, slate, &c., none of which is so effective as could be wished in resisting the action of the chlorine, and which therefore require frequent renovation. The false bottom is pierced through with a number of very small holes; and under the false bottom there is a small pipe, into which a valve is fitted, and attached by a wire reaching up to the top of each chest, by pulling which the liquid is allowed to escape at pleasure into a large tank extending under the whole of the chests. In this tank is sunk a pipe, with a pump, for the sake of raising the liquor. Although this solution be now very weak, yet it is much better for the purpose than pure water.

The half-stuff having come down from the washing-engine into the draining-chest, which is situated about three feet higher than the level of the stone bleaching chests, and being now freed by drainage of a great part of the water with which it descended from the engine, a part of one of the sides of the draining-chest, being a kind of door on hinges, is opened, and the stuff is promptly raked into an iron square box lined with wood or metal, which moves on a railroad fixed along the passage above referred to, and is carried to each of the chests in succession, as they are ready to receive the stuff. About one hundredweight of rags is laid in each chest, and receives upon an average from six to eight pounds of Tennant's strong saturated chloride of lime, according to the quality of the rags, in solution with about twelve gallons of water; and the chest is then nearly filled up with the weak liquor pumped from the tank. Great care is necessary to keep the stuff frequently stirred, otherwise the whitening throughout would not go on regularly. A great saving of time and labour is derived by the process of stirring being performed in what is called a "poaching-engine;" that is, a trough or engine with a cylinder in it, being provided to contain the rags after being *broken in*, into which the necessary quantity of the chloride of lime is introduced, and the contents thoroughly agitated by the action of the cylinder, as above described in the case of the washing-engine. It is always found that, from the effect of the air and light, the upper stratum of the stuff in the chests becomes white, whilst what is under is for some time but little affected.

The stuff is allowed to remain in the steep for twenty-four hours before the liquor is allowed to drain off, and of course there must be as many chests as there are hundredweights of stuff prepared in the twenty-four hours. But it is found not to have reached its maximum of whiteness even in twenty-four hours, for the stuff which has been set to steep on Saturday, is always found on the Monday mornings to be of a somewhat purer white than on any other day.

After the time for steeping has expired, the stuff is again lifted into the iron box formerly mentioned, which, being full of stuff, is moved on the railway till it is placed on a moving sole of a Bramah hydraulic press, which is situated in a convenient part of the passage; and the water being injected by pumps moved by the machinery of the mill into the piston of about ten inches diameter, causes by its great pressure the iron sole, with the wet bleached stuff upon it, to rise against a wooden "ram," as it is called, of the exact size of the box containing the stuff. What remains of the chloride in solution, as the ram enters into the box, is thus gradually pressed out, and flows into the tank formerly mentioned as situated under the chests. The ram enters into the box about one-half of its whole depth, and it will be seen by the annexed table what space is occupied by a hundredweight of the material in its raw and manufactured state at different stages of the process.

One hundredweight of linen rags, cut but not pressed, occupies a space of about......	$5\frac{1}{2}$ cubic feet.
When in the washing-engine in process of washing...	46 "
When drained of all the water that will flow from it	$25\frac{1}{2}$ "
When pressed by the ram	$7\frac{1}{2}$ "

The object of pressing out the liquid weak chloride of lime is to lighten the labour of raising the stuff to the higher story of the engine-house again, and also to render the process of washing it out the more easy; for it is most essential that none of the bleaching matter should be left in it.

This washing is performed in precisely the same way as that of the rags, and goes on for about an hour, after which, in the same engine, the pure water being shut off, the pulp is reduced considerably in length of fibre in the same engine with *blunt* tackle, which tends to soften the stuff, and make it mellow. The engine which is specially set apart to wash out the remains of the chlorine, and to soften the stuff, is sometimes called the intermediate engine; the stuff being now half way between rags and paper, and called *half-stuff*.

The stuff is then let down to the beating-engine by lifting a valve in the pipe, and it is then beaten down by tackle considerably sharper than that in the washing-engines. The stuff is here, as it were, combed out into fibres of perhaps one-twentieth of an inch in length, and this operation for fine paper ought to take from four to five hours; and, from the friction between the cylinder bars and those of the plate, the stuff ought to become moderately warm. It is now in a condition to be made into paper; and, by a valve being lifted, it flows out of the beating-engine by a pipe which conducts it to a large stone or wooden reservoir, called a chest, in the vat-house or machine-house.

Making paper by the hand.

The apparatus for the formation of the paper in single sheets at a time by the hand consists of—

1. A chest for receiving the prepared stuff, and which, if there be enough of fall in the situation, it is extremely desirable to have situated about three feet higher than the vat, in order that the stuff may flow from the chest to the vat gradually as it is worked into paper, otherwise it must be lifted by a lad at intervals by means of a copper pan.

2. The vat, which is a stone vessel about six feet square, and about four deep. It is agitated by a *hog* or little wheel about twelve inches in diameter, which revolves through the whole length of it, to keep the stuff constantly stirred; for the fibrous particles, being heavier than water, would otherwise sink.

3. The moulds or frames, of which a pair is required, so that when the vatman is dipping the one into the stuff, the coucher may be placing the sheet on a layer of felts, of which from four to eight quires, according to the size of the paper, form a *post*,—that is, the whole quantity which is brought under the press at one time. The vatman stands at one side of the vat, and the coucher at the far corner of the side, on the vatman's left hand, and facing him; and between them is a narrow ledge of wood, on which the mould is sent from the vatman to the coucher. The vatman always holds in his hand a frame of wood called a *deckle*, which is about an inch broad, and is made to fit exactly all round the edge of the mould, for the purpose of forming a clean and not a ragged edge to the sheet: it is this which is called the water-edge, and which is so easily distinguishable from any species of edge that can be otherwise produced, as to have been generally adopted in paper used for bank-notes. This description of paper is, in consequence, generally made on moulds of the size of the note, that it may possess the water edge, for the purpose of rendering forgery more difficult.

The moulds are made of brass wires or wire-cloth fixed upon a wooden frame, which is generally made of mahogany. A number of wooden ribs are fixed across the frame, placed at intervals of about one inch from each other, for the wires or wire-cloth to rest on. When *wires* only are used, these are *laid* longitudinally along the frame and across the wooden ribs, and interlaced with a wire somewhat thicker than the wires running lengthways, which is placed on the top of each rib. Paper made on such moulds is called *laid*, in contradistinction to what is made off the *woven* wire-cloth, and which is therefore called *wove* paper.

When the vatman dips the mould into the vat with the deckle upon it, he takes up a quantity of the pulp, which has been previously mixed with a great deal of water, and well agitated by the *hog:* he then throws off a great portion of the stuff and water over the edge of the mould farthest from him, and bringing the mould to a horizontal position, shakes it to and from him, which connects the fibres together so as to form one uniform fabric, and shakes out the water. To attain this method perfectly requires a long apprenticeship, simple as it may seem. As soon as the pulp is no longer in a liquid state on the mould, the workman raises the deckle with his fore-fingers and thumbs from off the mould, and with his remaining fingers shoves the mould along the ledge before referred to to the coucher, who is ready to receive it, and who places it in an inclined position upon a small wooden curved stay, on which it reposes for a few seconds, that the water may be further drained from the newly-formed sheet. The coucher is in the meantime pitching a felt or piece of blanketing upon a wooden plank of the proper size, and then takes the mould and presses the face of it upon the felt, which receives and takes off the sheet of paper from the mould, still in a very wet state. The mould being now freed of the sheet formed upon it, is pushed back along a wooden bridge, as it is called, which is joined to the ledge, and is placed at right angles to it. The bridge crosses the vat in front of the vatman, and the mould lies on it ready to be used by him, whilst the other mould is employed by the coucher. The process is continued till all the felts, being placed above each other with a sheet between each, are employed, which takes about half an hour. A heavy plank is then placed on the top of the *post*, as this quantity is called, and the whole is drawn in on a railroad, or rollers, under a press which is contiguous, and where the water is squeezed out, either by means of a screw, or by a Bramah hydraulic press. The paper, when it comes out of this press, is so coherent as to admit of being handled, and the sheets are accordingly laid together in a pack by themselves, the felts being placed on a wooden deal between the person who takes off the sheets from the felts, called the layman, and the coucher, who immediately, with the aid of the vatman, begins a new post. The water-mark is produced by wires in the shape of the letter or design being raised upon the surface of the mould.

After a number of packs have been made, they are put into another press, where they are made to *sweat* by pressure; that is, just to part with a small quantity of water, which comes from them in single drops. If the pressing be carried on too quickly or too long, the paper would be damaged by the sheets adhering to each other, and *peeling* or tearing when attempted afterwards to be separated.

The paper is then parted sheet by sheet, so as to be enabled to undergo another pressure before it goes to the loft to be dried. In fine writing paper, it is the practice to part the paper twice over, pressing between each parting. This is to make the sheets lose the marks of the felts, and to get the paper as dry as possible before it goes to the loft.

The lofts consist of a number of spaces filled with *tribbles*, that is, hair ropes fixed into spars of wood, the ends of which are made to slide up and down the upright posts of wood, one of which is fixed at the corner of each space. The paper is hung up in *spurs*, as they are called, of five or six sheets thick, upon the ropes, by the help of a wooden cross, shaped somewhat like the letter T. The workman holds this cross at the lower part of it, and the top of the cross must be as long as the width of the sheet. The dry-worker then, with his left fore-finger and thumb, pinches the corner of the hard-pressed *pack*, which has undergone one, two, or, if fine writing paper, three hard-pressings since it left the felts. He then partially raises by that corner the spur of five or six sheets, and with the cross gently catches the paper, which he slips over the hair-line, and leaves it there suspended. The pack is placed on a table which moves on small wheels, and against which the workman stands, and which he can push or draw with ease to any part of the loft that he pleases. When the tribble lines are all full, he pushes up the sides or spars upwards along the upright posts, which are bored all the way up for small pins of wood that support the tribbles. About eight or nine tribbles fill a *room*, as it is called,—that is, each space. The sides of the lofts are boarded with spars of wood placed vertically, about four inches wide and four separate. Inside of these are shutters made exactly similar, but fixed on wheels which move in a groove, so as to shut in the loft entirely or partially, or leave it open, according to the state of the weather. Many lofts have, in addition, woollen curtains within the shutters, which, with the addition of the heat derived from steam carried round the loft in pipes, are most serviceable for drying, when the state of the weather renders it impracticable to dry by the air. When the weather is favourable, the paper, before being sized, may be dried in twenty-four hours. After being sized, it ought not to be dried in less than three or four days, as by too rapid drying the size has a great tendency to fly from the paper; and therefore, when hung up after undergoing this process, the shutters are, in general, immediately closed upon it, so as to make the drying as gradual as possible.

The paper up to this point is quite bibulous, and therefore unfit to bear the ink. It is therefore transferred, when dry, to the sizing-house. The size is made from the refuse of tan-yards, called *scrolls*, consisting of the parings of skins, pates, ears, &c.; which materials range in price, according to quality, from about L.40 to L.70 per ton when thoroughly dried. The scrolls, as these pieces are called, are, after being made as clean as possible, immersed in water, which ought not to exceed in temperature

130 degrees, being sufficient to dissolve the gelatine, otherwise the gelatine is of a darker or browner colour. The gelatine is then gradually and carefully strained off through straw, branches of trees, charcoal, &c., and lastly, through fine flannel bags. An addition of alum, to the amount of about one-fourth of the weight of the scrolls, is then made. The size is run into chests or casks for use, where it soon congeals. When run off, it is much too strong to size any description of paper with. When the sizing operation is to proceed, therefore, it is mixed up and diluted with water, in a small boiler, and heated with steam. From the boiler it is made to flow in a spout into a tub of about five feet square, which is also heated with steam introduced under a false bottom, it being very essential to use it always very hot. An additional quantity of alum is also made use of, which is placed in the spout, and is gradually dissolved as the size flows down in contact with it. The workman stands close to the tub, and dips the paper in handfuls, containing about six quires on an average, with a wrapper at top and bottom, which he soaks thoroughly, turning it backwards and forwards, so that every portion becomes completely penetrated with the size. It is also allowed to remain some minutes soaking in the tub, being held by wooden pincers suspended by a balance-weight. He then carefully lifts them out one by one, and places them in a press, adding to the heap till the press is full. The surplus size flows, and is then, by a moderate pressure, squeezed out of the paper, the edges of which are next rinsed by hot water, before the pressure is taken off, to prevent them from adhering together; and with the same view the heaps of paper, when taken out of the press, are enveloped with woollen cloths, so as to exclude the cold air. Moreover, to prevent the paper from sticking when it is strongly sized, it is separated or parted sheet by sheet, after which it is pressed moderately, so as to make the *spurs* slightly adhere together. It is better to keep the sized paper forty-eight hours before hanging it up to dry, and then the more gradual the drying the better. Another mode of sizing, which tends to save both labour and wrappers, is by means of a machine or wooden table about two feet from the floor, above which are placed two spars of wood parallel to each other, supported from the table. The spurs of paper are placed vertically on the table, that is, their long edge resting on the table and across it; and between each spur a thin slip of wood is introduced, which is attached to the spars of wood by means of hooks and eyes. The slips of wood are then pressed somewhat tightly together, so that the whole mass is easily raised, by a pulley fixed overhead, to a small carriage, by which the paper, when raised from the table, and thus suspended in the air, can be wheeled right over the tub, into which it is let down to receive the size. This tub is divided into two compartments by a wooden sole affixed to a screw, which lies horizontally, and is worked by some wheels, so as to press the paper. The paper, when let down into the other portion of the tub, has the frame and slips hooked away from it as soon as it is gently pressed by the screw, so as to keep it from falling down. The hot size is then allowed to flow in amongst the paper, on which, when thoroughly soaked with size, the screw is made to work, and to press it. A board which has been pressed down against the paper is now fastened to a board of similar construction by means of strong iron clamps, and the screw is worked back again, leaving the paper still under pressure. A strong false bottom of wood, on which the paper rests, is now raised by means of a rack and pinion, and with it the paper and the heavy planks confining it, above the liquid size; and whenever the pressure is removed, it is at once set aside as sized. The size left in the tub is then pumped back to the boiler to be again heated.

There cannot be a stronger evidence of the necessity for the stuff being well prepared, in order to obtain a sound paper, than the process of sizing. If the stuff has been slowly prepared by trituration, so as to hold a good deal of water, it will also hold and keep the size in a manner corresponding thereto; whereas a quickly prepared stuff, which has been cut rather than rubbed out, however strong the size that may be employed, can scarcely be got to keep it. It is also very injurious should any of the chlorine or chloride of lime be left in the paper unwashed out, as the glutinous matter is thereby decomposed, and rendered of no avail.

After the paper has again been thoroughly dried, it is taken to the *salle* or finishing-house, where it is pressed very often, in order to take out the marks of the lines, and to improve the surface generally.[1] The hot-pressing is carried on by means of smooth paper boards which have been glazed by passing through metal rollers. The paper is placed alternately between these, and heat is communicated by hot iron plates being laid upon these at intervals of about six quires. These plates are heated in an iron box, into which a supply of steam is sent, and where they do not generally require to be more than five or ten minutes. These plates, by means of pressure, communicate a good deal of heat throughout the paper, after it has been all brought under the action of the hydraulic press.

In consequence, however, of the general use of steel pens, and perhaps to some extent of the fashion of the day, it is necessary to finish fine letter-papers now with a much higher gloss, and various methods have been adopted for this purpose. One of these methods consists in using, instead of the hot-pressing smooth glazed boards, copper plates made very smooth, on which the sheets of paper are laid, a copper plate and a sheet of paper alternately. These, when filled with about one quire of paper, are passed between a pair of iron rollers, where the pressure is equal to twenty or thirty tons, and which are driven by the machinery of the mill. By moving a clutch, a small wheel is thrown in and out of gear at pleasure, so that the workman can instantaneously reverse the motion of these rollers, and they can be made either to take the copper plates away, or to return them again towards him after they have passed through, so as to sustain the pressure twice over. Another workman attends on the other side of the rollers to return the copper plates. It requires three women to be attending to fill and empty each set of copper plates, one filling in the rough, another taking out the smooth paper, and the third lifting off the copper plates in succession, and placing them on the sheets of paper as these are laid down. When the paper has had three or four pressures, it is pretty smooth, and is then denominated *rolled* or *hot-pressed*; but if it be passed more frequently through the rollers, it acquires a higher surface, and is then called *glazed*. Each set of three women can in this manner fill in about twenty reams of paper in one day. The work is laborious, from the quickness with which it is done; and, from the sharp edges and corners of the copper plates, and of the paper itself, the women are very liable to have their fingers cut, so that this department of work is not very popular, and in some manufactories it has acquired the name of the *tread-mill*.

Another mode of giving a higher surface to paper is

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[1] A very laborious operation, and one injurious to the paper, used to be performed in the salle—that of picking out the knots and lumps in the paper by means of small knives. The paper could not fail to be injured by this system of scraping, and the ink was always apt to sink where it had been scraped; but this operation is now rendered almost unnecessary by the invention of the strainer, through which the pulp is strained before it passes into the vat.

Paper.

by passing it through a calender, or cylinders which have been made of cast-iron, copper, or brass, or one of them, like the ordinary calenders, consisting of a paper bowl. But these, although they be accurately fitted and polished, are all more or less liable to receive marks or indentations from any minute hard substances, or from folds or creases which may be in the paper, and which they give out again, and thus mark the paper.

The paper is now, after being rolled or glazed, told out into quires or half quires, folded, and made up into reams, and is subjected to pressure under hydraulic presses in every stage. It is then tied up in a wrapper, with a label on it, for the protection of the duty, and the label being filled up by the trader and officer respectively, the paper is weighed by the latter, and stamped, so as to denote the amount being charged against the maker.

Machine paper-making.

Hitherto we have considered this manufacture as carried on by the hand. But the hand-mills in different parts of the kingdom are nearly extinct. Excepting for some kinds of drawing-papers, papers for account-books, and some others, all paper is now made by the machine, and we do not believe that the quantity or weight of hand-made paper amounts to one per cent. on the whole quantity manufactured.

Fourdrinier's machine.

The machine which is now used so universally all over the kingdom is the invention of Louis Robert, and was brought to this country by M. Didot of Paris, who came over to England, and, with the assistance of the MM. Fourdrinier, and Donkin the engineer, succeeded in perfecting the invention, and in acquiring a patent right, which was afterwards renewed for a longer period by Parliament, in consequence of the patentee's not having derived sufficient compensation.

The stuff flows out of the chest C (Plate II.) by a pipe furnished with a cock, which is opened more or less wide, according to the thickness of the paper to be made. It falls into the spout, where it meets a large supply of water, which has been in great part passed through the web of pulp before, as will be afterwards explained. It then falls into the vat at the opening of the spout, and is there agitated by the little hog, as it is called.

The strainer S is generally used before the stuff flows into the vat. It consists of a brass rectangular trough 6 feet long, 2 feet wide, 4 inches deep, the bottom being a plate of brass cut into very fine slits or grooves, to suit the length of fibre of the pulp usually put through it. The strainer is driven by means of a light iron or brass shaft which passes above it, and has two small notched wheels, one placed above each end, and working into the frame of the strainer. When the shaft revolves, therefore, it will be seen that at every notch the strainer is raised, and then quickly descends by its own weight, so as to produce a continual jerking motion, making about a hundred and thirty strokes per minute. The stuff is now flowing in, and the bars are placed so close to each other that the fibres must necessarily pass longitudinally, and any knot or extraneous substance larger in diameter than the width of the slit is kept out of the pulp.

After the stuff has been strained and mixed in the vat by the agitator working in it, it is allowed to flow out by a number of holes in the side of the vat on an endless fine wire-cloth, *w*, on which the web is formed. This wire-cloth, which must be perfectly level, moves upon a number of small copper rollers, about an inch and a half diameter, and an inch and a half separate. These rollers rest upon a frame, which is left so far free as to be moved laterally by a rod which is attached to a crank, and thus is produced a vibration, more or less quick, according to the nature of the stuff, which causes the water to flow through the wire-cloth, and connects the fibres of the pulp together. A large shallow wooden vessel is placed below the wire-cloth, called the save-all, which receives the water and the flour of the pulp in large quantity. The water then passes through a spout on the side of the machine, and flows into a box, from whence it is thrown back by stuff pumps into chests CC.

Paper.

The edges of the paper are formed by pliable deckles, which were formerly made of leather, then of woollen cloth. Belts or deckles, however, composed of alternate layers of linen and caoutchouc, firmly cemented together, are now most generally employed. These belts are half an inch thick, and about sixteen feet long, and are drawn by the pulley upon the shaft *g*. It will be seen that they move under a solid plate of iron or brass, which is moderately pressed down upon them, but not so much so as to impede their free motion along with the wire-cloth, whilst they fit sufficiently tight to it to prevent any of the stuff from flowing away laterally before the paper is set.

By the time these caoutchouc deckles leave the wire-cloth, the stuff is no longer fluid, though a good deal of water still flows from it. The wire-cloth then passes on with the pulp upon it through the cylinders *tc*, *uc*, of which the under one is of metal, covered with a jacket, as it is called, of felting or flannel; and the upper one is generally of wood, but hollow, and covered with mahogany about an inch and a half thick; that wood being less apt to shrink or get out of shape than any other; and this roller also has a jacket. A slight pressure is given by these, which are called the wet-press cylinders; and after this stage, the paper pulp is led upon an endless felt, which must proceed exactly at the same speed as the wire-cloth, as, by any irregularity in their motion, the pulp would break. The wire-cloth returns back round the under wet-press cylinders, to receive a new supply of pulp, and is supported by a series of copper tube rollers, which revolve by the friction of it. The wire-cloth is generally about twenty-five feet in length by five feet in width, and has about sixty holes in the lineal, or 3600 in the square, inch.

The web of paper, still in a very wet state, is now carried away by an endless felt, between cast-iron cylinders *k*, *k*, where it sustains a severe pressure, and where a great deal of water is squeezed out, after which the paper may be handled. It then passes through a second pair of press cylinders, that the mark of the felt which was impressed on the under surface by the first pressure may be removed; and for this purpose the under surface is now placed next the metal cylinder. The web then passes over the surface of a number of cylinders, heated with steam, and arranged as to number and relative position according to the ideas of the manufacturer or millwright. When the web has passed over about 70 lineal feet of surface heated in this manner, it is dry, and is wound upon a reel, or wooden roller of small diameter, in order to be either sized in the sizing-machine, or, if already sized in the pulp, to be passed through the cutting-machine hereinafter described, as the case may be.

The paper-machine moves at the rate of from twenty-five to sixty or seventy feet per minute. The whole process, therefore, in its transition from liquid pulp at the one end to dry paper at the other, occupies scarcely two minutes. This, in the ordinary state of the weather, could not formerly be done in less than seven or eight days. Supposing, therefore, that the machine makes ten yards lineal of a web per minute, or 600 in the hour, this is equal to a mile in three hours, or four miles per diem of twelve hours. The paper is generally made about fifty-four inches wide. Reckoning that there are 300 machines in Great Britain, and that they work twelve hours each day on an average (many go both day and night), the length of web would altogether be equal to 1200 miles, and the area of what was made would be about 3,000,000 yards daily.

Printing paper, which is now entirely made by the machine, is in general sized in the pulp. White soap, starch, glue, and dissolved rosin, are principally used for this purpose, with the addition of a few pounds of alum. Such of

these as are used are put through a sieve into the beating-engine. The web, before being dried off, is also in some mills passed through hot size, the surplus of which is pressed out between two cylinders. This tends to strengthen the paper materially; but it is not easy for paper to keep the size if it be dried off hastily on the cylinders; and this is difficult, if not impossible, in the finer descriptions of paper, where the material is not so strong as that for more common kinds, and not so favourable for being thoroughly sized.

The fine bluish tinge which so many writing papers possess used to be derived from a mineral but very expensive blue, namely, the oxide of cobalt, generally called smalts. This article used entirely to be imported from Saxony, Denmark, and Sweden; but it is now almost entirely displaced by the artificial ultramarine, which has been chiefly derived from Nuremberg, Lyons, and more recently from the Prussian Rhenish provinces. The latter blue is much cheaper, and of an equally brilliant azure as that of the smalts; the only disadvantage being, that if the sized paper remain long in the damp state, the beautiful deep blue is apt to pass into a greenish shade by the action of the sulphuric acid in the alum upon the ultramarine.

The finest writing-papers, which are now almost wholly manufactured upon the machine, are sized by being passed in the web through a solution of gelatine and alum, at a temperature of about 100°, and are thereafter, in some mills, and without loss of time, dried off by being carried round a succession of drums or circular frames, on iron rods or wooden spars; there being inside of each drum a fan driven at great speed, and projecting the air (about 80° Fahr.) upon the surface of the paper. This mode of sizing constitutes one of the great improvements introduced within the last twenty years, and was chiefly the invention of the late Mr Ranson of Ipswich. By the agency of the atmosphere, it formerly required, in favourable circumstances, two or three days for the drying of gelatine-sized paper, when hung upon the hair-lines in the drying-lofts. At present the web of sized paper travels over the surface of the drums, which are usually arranged in pairs. These are generally of the diameter of about 3 feet; and there being for each machine about thirty of them, the paper travels about 300 feet in about ten minutes, when it comes out at the end perfectly dry, and is then passed through the cutting-machine, where it is cut into sheets of the size intended. In many mills in England and Scotland, the operations of forming the web on the wire cloth, drying on the heated cylinders, again wetting it by passing it through the size, pressing out the surplus thereof, drying it by currents of air as above described, and then cutting it into sheets, are performed continuously and in the same apartment.

Excepting in great Britain and Ireland, almost all writing-paper is sized or made capable of bearing ink by means of a vegetable size, consisting generally of a resinous soap, and introduced into the pulp of the beating-engine when nearly ready for being made into paper. In Great Britain and Ireland, as already described, an animal size from gelatine is employed for such papers. The former takes a more glossy surface, and is of a more silky feel, whereas the gelatine-sized paper has more firmness and what is called in the trade more "mettle," which is more in consonance with our natural taste than the softer and more highly polished surface of the foreign papers referred to.

The process of water-marking machine-made paper in the web was, fifteen or twenty years since, considered an impossibility; but is now very effectually and ingeniously accomplished. A very light wire cylinder, of about 6 inches diameter, is placed in framings so as to rest across and upon the wire-cloth of the machine, and to be moved by it. The cylinder is covered with wove wire-cloth, or formed of "laid wires," containing letters or devices similar to those stitched on the wove or laid moulds used in making paper by hand. The cylinder being driven by the friction of the advancing wire-cloth, impresses on the pulp, at the place where it has scarcely ceased to be fluid, the devices and letters upon the surface; and as, by means of the vacuum-box, over which the wire-cloth passes immediately thereafter, the water is rapidly drawn from the pulp, the water-mark remains clear and distinct by the pulp being deprived at once of all fluidity, which would cause the pulp partially to run together again, and thus a faint or imperfect water-mark would be produced.

Cutting-machines.

Several machines have been invented for cutting paper as it is made by the machine. Amongst others, one by MM. Fourdrinier of Staffordshire has been very generally introduced and approved of. As it is capable, however, of cutting five or six thicknesses of paper at once, it is not in general attached to the machine, but is found in some contiguous convenient place. The paper is reeled, as described above, on small rolls of about 6 inches diameter, and these are placed with the spindles lying in grooves in a curved frame, whence they are taken and passed round a drum, and then through some small rollers. After the web is divided longitudinally by circular knives, which are set opposite each other upon shafts on each side of the paper, the progress of it is stopped for an instant by a very ingenious contrivance, when a knife descends, beginning at one side of the web, which is held fast by a heavy weight laid across it, and cuts it across. The web then goes on till it has passed as much paper through as is the requisite size of the sheet, when the knife again descends. The sheets thus cut are carried on by a small felt moved in connection with the rest of the machinery.

The paper-machine is peculiarly suited for making thin papers, which are not easily made by hand without great damage in the couching department, from the difficulty of getting off the sheet whole upon the felt; namely, the thin paper for copying letters, tissue-papers used for putting before prints, &c. A large quantity of remarkably thin paper, also, made from old ropes of a better description than usual, and called pottery tissue, is made for printing the colours on china, &c., which could never have been made by hand. The machine has also been of immense service in producing paper of large sizes of sheets for newspapers, which could not have been worked by hand. It would have been very serious and laborious work for a man to make paper even large enough for a single sheet of the *Times* newspaper, which measures 2 feet by 3. Indeed, till about 1825, the legislature restricted the size of newspapers to 22 by 32 inches, beyond which they could not be stamped; which restriction was done away with just as soon as it became possible to make by machinery any size of paper that might be desired. But perhaps in no department of paper-making has the advantage of the machine shone so conspicuously as in the paper used for paper-staining, and the consequent great reduction in price of the hangings. Before the application of the machine, the paper used by paper-stainers was of the size of 28 by 23 inches, called elephant. It required, in order to form a piece of 12 lineal yards, that sixteen or eighteen of these sheets should be pasted together, which is now rendered wholly unnecessary by the paper being furnished to the stainers in sheets of 12 yards each in length.

The chief seats of paper manufacture in Great Britain are:—

1. Kent, where it was first established, and where there are a great number of hand-mills for making fine water-marked writing papers. There are also a good many machines for fine writing and printing paper.

2. In Hertfordshire, Buckinghamshire, and Oxfordshire, the manufacture of fine printing papers is very extensively carried on, and all made by machinery.

3. In Lancashire and the continguous counties, it is car-

Paper.

ried on to a very large extent, the material, as already noticed, being chiefly derived from the refuse of the cotton mills, to which is added a mixture of cotton-bagging, of which there is a large supply, and which tends to strengthen the paper. This description of paper, however, both from the impurities which are inseparable from so very dirty a material as the sweepings of the cotton-mills, and from its soft spongy texture, is very inferior to that which is made out of a sound strong rag.

4. In Scotland the manufacture is carried on to a large and rapidly increasing extent. From the ready communication with London, and other causes, both fine writing papers and others find a ready market there. Independently of the white paper, there is manufactured in all parts of the country a large quantity of brown paper, made from old ropes, sacking, flax waste, &c.

Paper is considerably adulterated with plaster of Paris, sometimes to the amount of 30 per cent., for the purpose of gaining weight. This can easily be detected by burning a portion of a sheet, when the plaster will remain after combustion in an ashy whitish-coloured residuum. Brown paper is also often mixed up with a good deal of ochre or clay, the makers saying that it is for the purpose of giving it a nice brown colour, though it may be doubted whether it be not also with the intention of increasing the weight.

The following table, showing the strength of different kinds of paper, has been prepared from actual experiment. It denotes the number of pounds avoirdupois required to break a strip of paper 2 inches wide, both ends being secured above, and the weights attached to a small wooden roller, resting upon the strip of paper:—

	Wt. in grs. avoir of a superficial foot.	Wt in lbs., supported by a strip 2 in. broad.
Bank post, very thin writing paper, sized.	65	23
Ditto unsized, but thinner....................	48	13
Thick writing paper, machine made......	139	42
" " made by hand......	143	60
" drawing paper, machine made......	217	55
Newspaper, sized at the machine	113	39
Paper used for Scotch bank-notes...... ...	95	70
Strong cartridge-paper........................	135	64
Pink blotting-paper.......................... ..	90	10

The manufacture of paper has immensely increased in Great Britain and Ireland within the last twenty-five years, consequent upon the penny postage, the repeal of the newspaper stamp and of the restriction of the dimensions of newspapers formerly prescribed by law, and also from the greatly increased amount of our manufactures and exports. This will appear from a comparison of the account of the duty charged twenty-five years ago, and what it has amounted to since.

Up to 1836, all paper, excepting brown paper, made from old ropes, paid a duty of 3d. per lb.; but in that year the duty was assimilated and made 1½d. per lb. for all kinds, including the duty upon millboards and pasteboards, which were till that period respectively charged 3d. and 1¾d. per lb. The amount of paper, and the rate of duty in 1833 were as follows:—

First-class paper.........Lbs.	49,404,408	at 3d. per lb. duty.	
Second...................... "	15,531,059	at 1½d.	"
Millboard.................. "	28,325	at 3d.	"
Pasteboards.............. "	15,148	at 1¾d.	"
Total...............	64,978,940 lbs.		

and the amount of duty gross was L.763,104.

If this weight of paper had been charged at the same rate of duty which was imposed in 1836, and has continued ever since, the duty would have amounted to L.406,118 7 6

Add 5 per cent., imposed on all excisable articles in 1841, and ever since........ 20,305 18 4

L.426,424 5 10

Now, the actual duty charged, by the last report of the Commissioners of Inland Revenue for 1858, was,—Year ended 31st March 1857, lb. charged, 192,297,399; gross duty, L.1,244,143: 31st March 1858, lb. charged, 187,414,667; gross duty, L.1,244,723; showing the marvellous fact, that the quantity produced is as nearly as possible three times as great in 1858 as it was twenty-five years previously.

The supposed scarcity of the raw material, in consequence of the greatly increased consumption, has given rise to a vast amount of enterprise not always put forth with much wisdom, whereby all kinds of vegetable material have been collected throughout the world, and operated upon with the view of their being used in place of rags. Such materials being often procurable at a very low price, and in unlimited abundance, have been conceived to offer great advantage to the manufacturer; but it has been too frequently overlooked, that the cost of boiling and bleaching such materials is very great, and the waste attending their use is enormous, to say nothing of their unsuitableness in many cases for the purpose. Straw, which is used in several mills in England, and from which a pretty good paper for newspapers is made, costs only about L.2 to L.3 per ton; but we believe the cost of bleaching it will make the amount L.16 or L.18 in all; and when to this is added the fact, that we have reason to believe that not one-half, or even one-third, of the weight of the straw employed is got back in paper, and that the paper is necessarily much more brittle than that from rags, there appears to be no great advantage derived from its use. We allow, however, that as the reduction of straw, or such like materials, into pulp is much more a chemical than a mechanical operation, a great amount of mechanical agency is saved in the triturating process. We have seen many fibrous productions introduced as specimens from tropical countries, and particularly from the East and West Indies, several of which have been manufactured into paper of fine quality. The supply of such materials is stated to be unlimited; and no doubt, as soon as a demand for a new raw material exists, it will, through the enterprise and skill of Englishmen, be speedily forthcoming to any extent that may be desired.

The following statistics of paper-making will show the progress of that manufacture in the chief paper-producing countries besides Great Britain; viz., the United States, France, Belgium, and Germany. Paper-mills existed in Massachusetts and Pennsylvania as early as 1730; but it was not till 1830, when paper-machines began to be constructed in Connecticut and Massachusetts, that a marked advancement took place. The progress up to 1850 was such that in that year the quantity of paper imported did not exceed 2 or 3 per cent. of the amount consumed; and this small per-centage consisted chiefly of fine writing and fancy papers from England and France. Owing to the extensive demand for newspapers and cheap literature, more paper is said to be now consumed in the United States, in proportion to the population, than in any other country, or equal to the consumpt of France and England together. The quality of American paper is generally inferior; but of late years the finer sorts have been also produced by the aid of calenders. In 1850 the mills producing over $500 worth annually (L.104) were confined to the New England States, and those of New York and Delaware. The number of mills has since increased in the southern and western states; and in 1853 there were 750 mills, with 3000 engines, producing 120,500 tons of paper, valued at L.5,400,000. Of the 180,800 tons of rags required, 10,163 tons were imported (worth L.204,758), about one-fifth of which was from Italy; but the supply from that country is annually decreasing.

A paper-machine was first erected in France in 1815.

In 1850 there were about 200 machines, estimated to produce annually about 39,000 tons of paper, besides 250 vats producing over 2000 tons; in all, 41,000 tons. The following table shows the amount and descriptions of papers exported from France in 1849, as well as the amount imported:—

	Exported.	Imported.
White or ruled paper for music,............	6,283,145 lb.	10,802 lb.
Coloured, in reams or quires, for binding,	149,875 „	2,827 „
Envelopes, coloured............................	1,795,142 „	4,065 „
Paper-hangings.	1,421,315 „	276 „
Silk, India, and Chinese papers, &c,.......	2,029 „	13,416 „

The quantity of rags imported into France in the same year was nearly 800 tons; exported, less than 1 ton. Besides what is imported in the shape of rags, the cotton received from America, amounting annually to 55,800 tons, falls ultimately into the hands of the paper manufacturer, as its exportation is prohibited by statute.

Paper-making was not successfully carried out in Belgium till the close of the seventeenth century, and but little advancement was made till about the year 1820. Since that period, however, the number of mills has greatly increased. In 1849 there were 80 mills, with 2168 hands employed; the paper exported was valued at L.36,040, and the amount imported at L.2774. Of rags and other materials for paper-making only 14½ tons were imported.

In various parts of Germany during the last few years rapid progress has been made in the production of paper; and in the Zollverein States the exports in 1850 exceeded the imports. The number of mills in 1850 was 794, having 116 paper-machines, which produced about 37,000 tons annually. It is an important fact, that while at Berlin, and several other cities of Germany, very fine qualities of paper are produced and partly exported, the papers imported are almost exclusively of common quality. The kingdom of Prussia exported, in 1850, 14 tons of paper, and imported 1 ton. The first paper-machine was established at Berlin in 1818. In Austria there were in 1845, 40 machines and 940 vats, producing 15,000 tons of paper, and in 1850, 49 machines and 900 vats, producing 32,500 tons. In 1854 the number of mills was 350, chiefly in Lower Austria, Lombardy, and Bohemia. In Russia the manufacture is virtually in the hands of the government, who have had for many years several machines constructed in England, combining all the then existing improvements. The importation of paper is prohibited by means of enormous duties. (C. C.)

PAPER-MONEY. See Money.

PAPHLAGONIA was a country of Asia Minor, separated from Pontus on the E. by the River Halys (*Kizil Ermak*), and from Bithynia on the W. by the River Parthenius (*Bartan-Su*), and bounded on the N. by the Euxine, and on the S. by Galatia. The physical character of the district was not very favourable. The Olgassys, and another parallel mountain-chain, ran from E. to W., sending off many branches; the soil, especially in the south, was cumbered by large primæval forests, and the rivers were small, and had short courses. The country, however, was celebrated in the earliest times for the fine breed of horses that were reared in its pastures, and in later times for the beasts of chase that roamed through its wilds. All that is known of the history of the Paphlagonians consists of little else than mere notices of their subjugation by the great powers that successively ruled the destinies of Asia Minor. After living for many ages under native princes, they were first reduced by Crœsus, King of Lydia. On the fall of that monarch, their country was incorporated with the empire of Cyrus. They freed themselves from the Persian yoke only to come in course of time, along with Pontus and Cappadocia, under the power of Eumenes, one of the generals of Alexander. Then, after again enjoying an interval of independence under the government of native princes, they were again subjugated by Mithridates the Great. From the dominion of Mithridates their kingdom eventually passed into the hands of the Romans. Paphlagonia formed part of the province of Galatia, until, in the reign of Constantine, it was constituted a separate province. The chief towns on the coast were Sinope (*Sinab*), Cytorus, and Amastris (*Amaserah*). Those inland were Pompeiopolis and Gangra.

PAPHOS, the name of two ancient cities of Cyprus which were situated on the S.W. coast of the island. Old Paphos stood on a height about 10 stadia from the shore, and was said to have been founded by Cinyras, the father of Adonis. It was famous throughout the ancient world, and celebrated by the ancient poets on account of its association with the name of Venus. There the goddess is said to have come on shore immediately after she had started into life out of the sea; and there her worship is supposed to have been set up by the Phœnicians. There also were her grave and altar, which are mentioned in the Odyssey; her spacious temple, which is still seen in ruins; and her image, which was nothing else than a white, twisted, pyramidal stone. About 60 stadia N.W. from Old Paphos was New Paphos (modern *Baffa*). It stood upon the sea; and was said to have been founded after the destruction of Troy by Agapenor, the leader of the Arcadians. Although, like its more ancient namesake, it was the seat of the worship of Venus, it was best known for its good harbour. It is also notable as the place where Paul struck Elymas the Sorcerer with blindness. (See Baffa.)

PAPIAS, an early Christian writer, flourished in the beginning of the second century as bishop of Hierapolis in Asia. According to Irenæus, he was a hearer of John (probably the Evangelist), and a companion of Polycarp. A few fragments of *An Explication of the Words of the Lord* are the only specimens of his works that are extant. They are found scattered among the writings of Irenæus, Eusebius, and other authors, and are valuable for the traditions they contain regarding the Scriptures of the New Testament. The best collection of them is contained in the first volume of Routh's *Reliquiæ Sacra*, 8vo, Oxford 1846–48.

PAPIER MACHÉ. Articles in this substance are made of cuttings of white or brown paper, boiled in water, and beaten in a mortar, till they are reduced to a kind of paste, and then boiled with a solution of gum-arabic or of size, to give tenacity to the paste, which is afterwards formed into different articles, by pressing it into oiled moulds. When dry, the work is done over with a mixture of size and lamp-black, and afterwards varnished. The black varnish for these articles is prepared as follows:—Some colophony, or turpentine boiled down till it becomes black and friable, is melted in a glazed earthen vessel, and thrice as much amber in fine powder is sprinkled in by degrees, with the addition now and then of a little spirit or oil of turpentine. When the amber is melted, the same quantity of sarcocolla is sprinkled in, and the ingredients are stirred, and more spirit of turpentine is added, until the whole becomes fluid; it is then strained clear through a coarse hair bag, pressing it gently between hot boards. This varnish, mixed with ivory-black in fine powder, is applied, in a hot room, on the dried paper paste, which is then set in a gently heated oven, next day in a hotter oven, and the third day in a very hot one, and allowed to remain each time till the oven grows cold. The paste thus varnished is hard, durable, and glossy, and is not affected by moisture or even by hot liquids.

The better kinds of *papier maché* work are prepared in the following manner:—Porous paper, saturated with a solution of flour and glue, is placed in repeated layers upon a metal mould of somewhat smaller size than the required object, a drying heat of about a 100° being used between the layers, of which there are about ten for an ordinary tea-tray, but the number varies with the nature of the article. When a sufficient thickness has been attained, the shell is removed from the mould and is planed and filed to shape. Various coats of varnish are then laid on, and the article is stoved after each varnishing. The article is next smoothed with pumice-stone, and the artist then steps in and ornaments the work in bronze powder, gold, colours, &c., after which several coats of shell-lac varnish are added, and the article having been stoved at a heat of 280°, is polished with rotten-stone and oil, and is finished off by hand-rubbing.

Articles in *papier maché* are subject to two great faults, namely, inappropriateness and over-ornamentation. The manufacturer is not content to execute in this material such articles as tea-trays, screens, portfolios, ink-stands, work-boxes, &c., but he invades the domain of other materials, by executing chairs, tables, piano-fortes, &c., for which *papier maché* is not suited. The articles are also usually over-loaded with ornament; and the free use of mother-of-pearl becomes objectionable, especially when it is employed in landscapes to represent the moon, a river, or a ruined tower. In contrasting some articles in japanned ware from Japan and China, with similar articles of English make, the jury of the Great Exhibition of 1851, in remarking on the good taste of the former, and the bad taste of the latter, observed, that "vulgar forms and bad ornament are not necessarily connected with cheap manufacture."

Sharp and well-defined architectural ornaments in *papier maché* are prepared by glueing sheets of brown paper together, pressing the mass into a metal mould, and when the moulded paper has been trimmed to shape, a composition of paper-pulp, mixed with rosin and glue, is put into the mould, and the paper impression being again inserted is pressed upon the pulp composition, which permanently adheres to it. *Carton-pierre* ornaments (which are lighter and stronger than those of plaster of Paris) are made of paper-pulp, mixed with whiting and glue pressed into plaster piece-moulds, backed with paper, and when sufficiently set, are hardened by drying in a hot room. (C. T.)

PAPINIANUS, ÆMILIUS, one of the greatest jurists of antiquity, was born about the middle of the second century, and, after studying under Q. Cervidius Scævola, was appointed *advocatus fisci* by the Emperor Marcus Antoninus. A high-toned integrity, adorned with all the penetration, erudition, and sagacity of a consummate lawyer, was the quality which distinguished his character, and determined the fortunes of his career. It secured for him the confidence of the Emperor Septimius Severus; so that he was appointed in succession *libellorum magister* and *præfectus prætorii.* Yet it also brought upon him the enmity of Caracalla, the son and successor of that monarch; for this imperial fratricide felt himself rebuked by the lofty morality of the lawyer, and could not pursue his bloody career in peace until he had put him to death. The writings of Papinian attained a reputation unsurpassed by those of any other Roman jurist. He is quoted with the highest commendation in various parts of the *Code* of Justinian; and the Constitution of Theodosius and Valentinian sets him up as the chief legal authority. Further, the law students of the third year assumed the name of "Papinianistæ," and kept the first day of their session as a festival in honour of the great lawyer after whom they were called. There are 595 excerpts from Papinian's works in Justinian's *Digest.* They are extracted from the thirty-seven books of his *Quæstiones*, the nineteen books of his *Responsa*, the two books of his *Definitiones*, the two books of his *De Adulteriis*, the single book of his on this same subject, and his Greek fragment on the Office of the Ædile. Papinian is also quoted by Paulus, Ulpian, and Marcian.

PAPPUS. See GEOMETRY.

PAPUA, or NEW GUINEA. See AUSTRALASIA.

PAPYRUS (*Papyrus niloticus*, *P. Ægyptiacus*, *P. antiquorum*), a plant of the order *Triandria digynia*, and of the genus Cyperaceæ, used by the ancient Egyptians in the manufacture of paper. (See PAPER.)

PAPYRUS, the paper made of the papyrus-plant, and used by the Egyptians, as also by the Greeks, Romans, and other nations of antiquity. (See PAPER.)

PAPYRUS-ROLL, a sheet of papyrus paper, or several sheets united into one, rolled upon a slender wooden cylinder for the purpose of writing thereon letters, contracts, official acts, funereal and sacred books, historical records, and other compositions. Frail and perishable as is the papyrus-paper, very many such rolls, some of them of the remotest antiquity, have come down to us in a high state of preservation; and are commonly known under the name of *papyri.* As the Egyptian papyri, besides the high intrinsic interest which they possess, have contributed in a very remarkable way to the solution of the great problem of the hieroglyphic question, it seems necessary, although they have been cursorily noticed already under the head EGYPT (p. 444), to devote to the subject a special article, which shall also embrace the Greek papyri, and the few which have reached our time in Latin or other ancient languages.

It is impossible to fix with precision the period in Egyptian history at which the practice of writing on papyrus began; but it is unquestionably of the highest antiquity. The hieroglyphics which the extant papyri contain, judging by their form and character, belong to the time of the fourth and fifth dynasties (Lepsius, *Chronol. der Ægyptier*, p. 33); and, indeed, among the hieroglyphical characters on the monuments of that date, are found the *papyrus-roll itself*, as well as the rest of the writing apparatus. Many of the extant papyri seem certainly to belong to a very remote period. Lepsius refers the well-known papyrus which he himself has edited, under the name of *The Book of the Dead*, and which we shall have hereafter to describe, to the earliest Pharaonic times; and Bunsen agrees in this estimate of its age. Wilkinson places the Turin *Book of Kings* in the reign of the third king of the nineteenth dynasty, Rhamses II., whose name it bears upon the back; and the Rev. Dunbar Heath is satisfied that the rolls of which he has published an account, under the name of *The Exodus Papyri*, are actually contemporaneous with the events to which he supposes them to refer.

The subject naturally divides itself into three heads—Egyptian papyri, Greek and Roman papyri, and papyri of the later empire.

I. The Egyptian papyrus-rolls first came into notice in Europe when the celebrated French expedition opened Egypt, and her history and antiquities, to the researches of the learned. Since that time many collections, of greater or of less value, have been deposited in the public and private libraries and museums of Europe; and a good deal has been done towards the publication and illustration of the more important among them. They are for the most part funereal; and they have generally been found in the mummy-cases, placed between the thighs or the arms, and sometimes upon the stomach, or in the bend of the knees, of the mummy. Considerable collections of them were formed by different travellers or residents in Egypt, and they have for the most part been deposited in the several great libraries of the European capitals; the British Museum, the Bibliothèque Impériale at Paris, the Vatican, the Berlin library, the Vienna library, the library of Trinity College, Dublin, and especially the Royal Library of Turin. The first specimen of the Egyptian rolls of any real in-

Papyrus-Roll.

terest made public in Europe was printed in 1805, by M. Cadet,[1] and afterwards in a most beautifully-executed facsimile in the great French collection, *Description de l'Egypte*.[2] Since that time have appeared many most costly and elaborate specimens, to the most important of which we shall have occasion to allude; and there can be little doubt that, in the progress of Egyptian studies, and with the increased advantages which modern students possess, every fragment of interest which has been preserved will eventually find its way into print.

The papyri are found written in various characters. Of those in the Egyptian language, some are in the hieroglyphic character, but very many more are in the hieratic, and also in the demotic. (See HIEROGLYPHICS.) Some of the Egyptian papyri are in the Greek language and character. Those in the ancient Egyptian language may be divided into three classes—the funereal, the historical or literary, and those which relate to judicial, domestic, or social affairs. All these, but particularly the first class, have been found in tombs, especially at Thebes and Memphis.

(1.) The funereal papyri were the first to attract attention, from their number and the frequency of their occurrence. It would seem, indeed, that a copy of one of these papyri was regarded by the Egyptians in the light of a passport after death and a protection to the soul in its journey towards the realms of judgment. An interesting funereal papyrus, found in the collection of Trinity College, Dublin, contains a rubric to the effect, that, "if this book be recited on the earth, and this chapter be put in writing upon a person's coffin, he shall be manifested in the light, with all the honours due to him; when he goes to his house, he shall not be turned back; there shall be given to him bread, liquors, and the choicest meats on the altar of Osiris; and he shall go to the fields of Aalon."[3] Hence there was a busy trade in the production and sale of copies of these papyri. Many of those still preserved were plainly prepared beforehand for sale, blanks being left for the names and titles of the deceased, to be filled up as the occasion arose. These blanks are frequently found filled up in a hand different from the body of the document; and in some copies the blanks still appear, owing to the forgetfulness or neglect of the undertaker. In a very highly-finished papyrus in the Dublin collection, the blanks are left unfilled throughout the entire document.[4] These funereal papyri, numerous as they are, are all, in substance, copies, somewhat varied, of one common original, or of certain portions of it, the most complete copy of which now known is that preserved in the Turin Museum. The papyrus published by Cadet, and in the *Description de l'Egypte;* those published by Young in the collection of the Egyptian Society;[5] by Leemanns in the *Monumens du Musée des Pays Bas;* by Von Hammer at Vienna in 1822; by Mai in 1825; by Sankowski in 1826; by Rosellini, Salvolini, and still more recently, by Brugsch and Forshall, are all evidently drawn from that same original, although different portions are selected in each instance, and although where the same portion is repeated in two or more of the papyri, the forms of expression seem to vary considerably. It will be sufficient, therefore, to describe the nature, and briefly to indicate the contents, of the copy which is found in the Turin Museum, supplying from other papyri some additional illustrations and pictorial representations. This remarkable papyrus was first examined by Champollion, who found it to contain twice as much as that published in the *Description de l'Egypte*. Champollion regarded it as a copy of the funereal ritual of the Egyptians, an opinion from which Lepsius dissents, but without much apparent reason; although, perhaps, the title which the latter writer proposes, *Das Todtenbuch*, "The Book of the Dead," describes its character more exactly. Champollion, after a careful study of the text, divided it into four parts, according to the supposed order of the subject, each of which he subdivided into chapters. Dr Lepsius, however, who copied the entire in 1836, and published it in a most elaborate facsimile in 1842,[6] proposes a different and apparently more intelligible division into chapters, which is now generally adopted. Each of these chapters (which are 165 in number) has, generally speaking, a title and an illustrative picture prefixed; and the division of the chapters is commonly indicated by two lines, and by the words *hè re* or *ki re* ("another chapter"). The first fifteen chapters appear in themselves to form a connected whole, and are entitled *Ha' t em re u nu her em heru en Hes-iri*—("beginning of the chapters of the appearing of the light of Osiris"). This first portion of the *Book of the Dead* is regarded by Lepsius as the most ancient, and indeed as the germ of the entire, out of which all the subsequent parts have grown as developments or additions. It occurs in many papyri, and the illustrative vignettes are generally the same, although differing much from each other in the richness and beauty of execution. In these vignettes are represented the funeral procession, the mourners, the boat with the bier of the deceased sailing upon the sacred river, the train of domestics bearing libations and other offerings; and finally, the deceased himself in the act of adoring the sun. Then follows a series of mystic representations bearing upon the destiny of the deceased, and of invocations to the god Thôth, in which he is entreated, as "Thôth who justified Osiris in the sight of his mercies," to "justify Osiris[7] Anfanχ, even as he justified Osiris in the presence of the great Tetmessu."[8] The vignettes which follow represent the act of placing under the protection of the several deities before whom the deceased is thus justified, the several limbs or parts of the body of the deceased—his head, eyes, mouth, heart, arms, hands, feet, legs, stomach, &c.; and the various combats which he is obliged to undergo. Next come pictures of his deliverance from various perils; of the refreshments which are vouchsafed to him; of his worshipping various deities; of the reunion of his soul with the body; of his passage through the fields of Tmé (the Egyptian Elysium), in which he is represented as ploughing, sowing, reaping, thrashing, and lastly, rowing across the infernal river a boat containing the cakes which he has made; of his subsequent journey to the mystic region called Rosattou, and his arrival at the hall of the Two Truths, where is represented his denial to the forty-two assessors of Osiris, of forty-two distinct offences with which he is charged before them, and in which is placed the remarkable scene of the Psychostasia, or weighing of the soul in the scale of justice. Most of the papyri contain pictures of this very interesting monument of the Egyptian creed, varying slightly in detail, but all exhibiting the same great features. At the left side of a great hall, with the well-known frieze and pillars, is seated Osiris, who is represented with his habitual whip and crook, and generally (though not in the

[1] *Copie figurée d'un rouleau de Papyrus trouvé a Thebes dans un Tombeau des Rois*, Paris, 1805.
[2] *Description de l'Ægypte* (*Antiquités*), ii., pp. 72–75.
[3] *Catalogue of the Egyptian MSS. in the Library of Trinity College, Dublin*, by Edward Hincks, D.D., p. 31.
[4] Ibid., p. 11.
[5] Hieroglyphics collected by the Egyptian Society, 1823.
[6] *Das Todtenbuch der Ægyptier, nach den hieroglyphischen Papyrus zu Turin, mit einem Vorworte, zum erstenmal herausgegeben* von D. R. Lepsius, Leipzig, 1842.
[7] In the copies of the Ritual found in the mummy-cases, the deceased is always called by the prenomen Osiris, as if by anticipated adoption.
[8] The four attendants or ministers of Osiris—Amset, Hapi, Sin Mut'f, Kebh-Senu.

Papyrus-Roll.

Turin papyrus) with the tablet of Mà, the goddess of justice, upon his breast. On the right enters the deceased, above whose head appears in hieroglyphics the usual invocation of Osiris. He is received by the goddess of justice, Mà, who is often represented in the two-fold character of reward and punishment. In the centre stands a pair of scales, in one of which Anubis is represented placing as a weight a little figure of the goddess Mà, while in the other scale the deceased is shown placing a heart-shaped weight (sometimes with the word *keti*, "heart," inscribed upon it), the emblem of his own works, good or evil, during life. The well-known hawk-headed figure adjusts the balance; above sits the forty-two assessors of Osiris, sometimes with the deceased kneeling before them; while Thôth, the justifier of Osiris, and of all the just, is represented writing down the result of the trial. After this most interesting picture come the purgatorial scenes, and those in the Hall of the Propylons, which are exceedingly curious. The deceased demands to be admitted. "I will not allow thee to enter," begins the lintel of the door, "till thou tell me my name." "——" (not satisfactorily interpreted) "is thy name." "I will not allow thee to enter by me," says the left post of the door, "until thou tell me my name." "Hanti-n-tmè (Pillar of Truth) is thy name." Similar demands are made in succession by the right post, the threshold, the lock, the key, the bolt, the floor, &c. Without pursuing this farther, however, it will be enough to say that many other equally curious representations, illustrative, not only of the creed of the Egyptians, but of scenes of their every-day life, are found in these singular relics of ancient Egypt; and they have supplied a most valuable key to much that was obscure in the manners and customs of this remarkable people.

Another of the funereal papyri, but of later date, has still more recently been published by Dr Brugsch at Berlin, under the title of *Sai an Sinsin*.[1] It is in the hieratic character, and furnishes a very valuable supplement to Lepsius' *Todtenbuch*. It will be enough to say, that in these two publications, which are both accompanied by translations and elaborate annotations, the reader will find all the latest and best information on both the general subject of funereal papyri, and on all the details which they ordinarily present.

(2.) The historical Egyptian papyri have come more recently into notice, but they have contributed to throw a great deal of light on many difficult questions of Egyptian history and chronology. The most important of these are the Turin *Book of Kings*, *The Campaign of Rhamses the Great against the Scythians and their Allies*, and the so-called "*Exodus Papyri*."

The history of the Turin Papyrus of the Kings is a curious one. It originally came into the possession of the Turin Museum in the collection of Signor Drovetti, which was purchased by the Piedmontese government; but this particular papyrus had been so injured by time or by neglect, that it seemed little better than a mass of fragments. Champollion, however, while he was inspecting the Egyptian antiquities of the Turin Museum, at once perceived its value, and carefully selected, from a mass of papyrus fragments among which it lay in a confused heap, all the scraps which contained the names of kings, putting them together in the best order which he could devise. This work, however, has since been done over again with exceeding skill and judgment by Dr Seyffarth, who, by carefully examining with a microscope the fibres of the several fragments, has succeeded in restoring the papyrus to a tolerable degree of completeness. This manuscript was printed by Lepsius in his *Auswahl*; but, as that copy did not contain the inscription on the back, the papyrus has since been published entire by Sir Gardner Wilkinson.[2] Its contents have already thrown light on many points, both in the native monuments of Egyptian history and in the collateral indications supplied by the Bible narrative: and, although there is much in this and all other Egyptian records which disappoints inquiry, it is hardly possible to overrate the importance of the study in itself, or the hopes which may not unreasonably be entertained from a more complete and systematic investigation. This papyrus appears to have been written in the time of Rhamses II. It does not contain the name of any king later than the eighteenth dynasty.

Papyrus-Roll.

The *Scythian Campaign of Rhamses the Great* is a papyrus which originally formed part of M. Sallier's (of Aix) collection. It was published in 1835[3] by Salvolini, the pupil of Champollion. It has unfortunately but little of the strictly historical character, consisting in great part of encomiums of Rhamses, bombastic addresses to his soldiers, dialogues of the king with the gods, and similar rhetorical materials; but it is nevertheless highly curious and characteristic.

The "Exodus Papyri," of which the Rev. Dunbar Heath has published an account,[4] are naturally, from their subject, even more interesting, inasmuch as he considers these remarkable compositions so many contemporary collateral evidences of the Bible history of the exodus of the Jewish people. Much remains still to be done for their full elucidation; but enough is stated by Mr Heath to create a deep interest in the subject. These papyri, which originally formed part of the Sallier and of the Anastasi collections, present many most striking coincidences with the Mosaic narrative. The most important of them is a letter or report addressed by Enna, a scribe, to his superior officer, who had commissioned him to carry out an order that a certain slave people should be allowed four days of holiday for the observance of their festival, complaining that this order had been resisted by a certain Tahpanhes. Now, according to Mr Heath, in these curious documents we meet with a Jannes mentioned five times, a Moses twice, a Balak the son of Zippor at a place called Huzoth, with the word Hebrew, and with the "feast of passing the dead." We find also that a people, among whom a Moses was leader, marched towards Palestine by the route of Tasacarta, Megdol, and Zoar; that they were connected with the names Midian and Aram; that there was a contest at the place of a great water-flood; that an enslaved Aramæan people, located about Tahpanhes, met great opposition from the governor in celebrating the four days' feast at the beginning of their year; that a Moses is again named as cattle-owner among them; that a royal or noble youth is described as meeting a sudden and mysterious death; that a royal order is immediately issued for the hasty departure of a people, for their feast of passing the dead; and that miracles are named as performed by their leader in the palace of Lower Egypt. (Pp. 57–8.) And although the coincidences may not be complete, nor the evidences entirely satisfactory, yet they are quite enough to create an interest in the subject of the very deepest kind. Several other papyri in the British Museum and other collections are historical. In the *Select Papyri of the British Museum* (London, 1844) there are four; and Lepsius (pp. 33–4) mentions two others in Berlin, and a third in his own possession.

Of strictly so-called literary papyri among the Egyptians little is known; but we may mention one very curious one, of

[1] *Sai an Sinsin; sive Liber Metempsychosis veterum Egyptiorum. E duabus Papyris funebribus hieraticis signis exaratis edidit, Latinè vertit, notas adjecit*, Henricus Brugsch, Berlin, 1851.

[2] *The Fragments of the Hieratic Papyrus at Turin, containing the Names of Egyptian Kings, with the Hieratic Inscription at the Back*, by Sir J. G. Wilkinson, London, 1851.

[2] *Campagne de Rhamses le Grand contre les Scheta et leurs Alliés*, Paris, 1835.

[3] *The Exodus Papyri*, by Rev. D. J. Heath, with Introduction by Miss Fanny Corbaux, London, 1855.

which an account is given in the *Revue Archeologique* for 1852–3 (pp. 385–97). It is the story of two brothers, Anepou and Patou, one of whom is the Egyptian counterpart of Joseph in the Bible history. He is tempted by his brother's wife in exactly the same words employed by the wife of Potiphar, and on his resisting her seductions, is denounced by her to her husband. The subsequent narrative, which it would be too tedious to detail, is a strange medley of the natural and supernatural; but the whole piece presents in a very curious light not only the domestic usages of Egypt, but the popular notions which then prevailed as to the interposition of the gods in the affairs of men.

Under the head of Egyptian papyrus literature, may perhaps be mentioned the well-known and valuable fragment of Homer on papyrus, which was found in one of the tombs at Thebes. It is of course in Greek, but as having been found in an Egyptian tomb, may be considered as Egyptian.

(3.) The Egyptian papyri which relate to civil or judicial affairs are generally in the enchorial character: they relate for the most part to sales or transfers of property, houses, lands, tombs, &c., the particulars of which they describe in most curious detail. The subjects of many of them may to some appear tedious and unimportant; but in reality it is to them that Egyptian antiquarians have been indebted for most of the details of the judicial processes of Egyptian law, as well as of many of the particulars of the private life of the Egyptians.

II. By far the most important Greek papyri are those of Herculaneum, which have been elsewhere described. (See HERCULANEUM.) Unhappily the condition of these rolls is so lamentably defective that at best only fragments can be hoped from their decipherment; and it must be confessed too, that the books which have been hitherto discovered, and of which the *Volumina Herculanensia* contain the remains, are not of a nature to make the loss a subject of much regret. There are two of them, the titles of which, as bearing upon Homer, might seem calculated to create an expectation of something which might give us an idea of the principles of criticism which then prevailed; but they are miserably meagre and unsatisfactory; and the same may be said even of what bears upon the Epicurean philosophy, although the author, Philodemus, was a follower of that sect.

But the strictly Egyptian papyri in the Greek language are no less valuable, as illustrating the manners and customs of the Egyptians, than those in the Egyptian language; and they have the additional advantage of being at once perfectly intelligible, and of serving as a key to the enchorial language of Egypt. Several collections of these papyri have been published; the most notable are those of Amedeo Peyron, whose labours as an editor of palimpsest literature have been described in another place. (See PALIMPSEST.) He published in 1826 a considerable collection[1] with a very interesting introduction and notes; and a few years later, he added to these a commentary on some papyri selected out of a similar though smaller selection from the museum of Vienna,[2] which had been published by Giovanni Petrettini.[3] These papyri, which are all of the class already described, are most curious and highly important for the student of Egyptian domestic and social antiquities. A selection from the Greek papyri of the British Museum has been published by Mr Forshall;[4] but, as the text only is given, unaccompanied by illustrative notes, this publication is far inferior in interest to that of Amedeo Peyron, or to a similar one of his nephew, Bernardino Peyron, printed several years later. An additional item in the value of these papyri, and one which was early appreciated by Young in his hieroglyphical studies, is the fact, that many of them are but the Greek transcripts of the enchorial original of the deed of sale, contract, or judicial procedure, and therefore serve, to some extent at least, if not as a translation, at all events as a guide to the sense of the original.

III. The papyri in Latin and other ancient languages are not of much interest. Of the rolls in Herculaneum, many were in Latin; but unhappily the folds of all these were so firmly agglutinated that they went to pieces in the attempt to unrol them. One scrap alone, in hexameter verse, has escaped, and is published in the second volume of the *Volumina Herculanensia*. It is a fragment of a poem on the battle of Pelusium, and is ascribed by the editors to Rabirius, a writer of whom little else is known.

Of the later period, a copy of St Augustine's Letters is the only Latin relic on papyrus of any interest. A few specimens of charters and similar records on papyrus are given by Silvestre in his *Palæographie Universelle*. In the same work also are one or two papyri in the Syriac and Arabic languages.

(Besides the works cited above, see *Sammlung Demotish, Griechischer Eigennamen Agyptische Privat leute, aus Inschriften und Papyrus-rollen zusannumgestellt*, von Ernest Brugsch, Berlin, 1851. See also *Lettre a M. E. De Rougè au Sujet de la Decouverte d'un MS. Bilingue Papyrus en Ecriture Demotico-Egyptienne et en Grec cursif de l'an* 114 *avant notre ete.*, Berlin, 1852, by the same author.) (C. W. R.)

PARA (in full, *Santa Maria de Belem do Gram Pará*), a town of Brazil, capital of a province of the same name, stands on the right shore of the estuary of Pará, or south arm of the Amazon, which is here 7 miles wide, about 70 miles from the Atlantic. The streets are straight and well paved, crossing one another at right angles; and the houses are well and substantially, some even elegantly, built of stone. They are not generally high, few having more than two stories, and many of them only one. There is a large and handsome cathedral, and several fine churches. The Jesuits' seminary, now partially used as an episcopal palace, and the governor's palace, are among the finest buildings in the town. There are two convents, and the buildings of a third are now used as barracks. Pará has also a college, several schools and hospitals, a botanic garden, a theatre, and a court of law. The anchorage of the city of Pará is capacious and perfectly safe, being rarely exposed to strong winds, except momentary squalls, and varying in depth from 7 to 3¼ fathoms, or less. With the exception of two large shoals at the entrance of the river, the approach is practically unobstructed, there being abundant breadth of channel, varying from 7 to 11 fathoms in depth. The entrance-channel at the mouth of the river is deep and clear for a W.S.W. course, and there is little or no difficulty in entering by daylight; but for sailing-vessels of large draught the outlet (which is through another channel) is not quite so safe, as it is narrow and much shallower, and as the wind sets directly into it. A redoubt in front of the palace overlooks the anchorage, and a small fort 4 miles below the town commands the approach. The commerce of the port is very considerable; it was formerly the source whence most of the countries in the world were supplied with India-rubber; and though the discovery of that article in the East Indies, Africa, and in other parts, has somewhat diminished the quantity exported, yet it still constitutes one of the chief staples of the trade of Pará. The quantities exported in 1856 were,—to Great Britain, 1,984,940 lb.; to the United States, 2,444,580 lb.; and to other countries, 367,309 lb. The export of cocoa, however, is at present greater than that of India-rubber. It is chiefly sent to France, where a great demand was created for it during

[1] *Papiri Græci Taurinensis Musæi*, 2 vols. 4to, 1826.

[2] *Papiri Greco-Egizi di Zoide del Museo di Vienna*, 1828.

[3] *Papiri Greco-Egizi del Museo Imperiale di Vienna*, 1826.

[4] In 1839.

the recent war. The quantities of this article exported in 1856 were,—to France, 5,260,155 lb.; to other countries, 103,255 lb. There are also exported large quantities of Brazil nuts, rice, sugar, cotton, dye-woods, &c. The most important articles of importation are hardware, calico, and soap, all of which are chiefly obtained from the United States. The following table exhibits the shipping entered and cleared, as well as the total value of the imports and exports since 1851:—

Year.	Vessels entered		Imports.	Vessels cleared.		Exports.
	No.	Tonnage.		No.	Tonnage.	
			L.			L.
1851	81	14,194	238,876	82	14,825	383,280
1852	88	15,457	240,029	85	14,693	274,214
1853	113	18,370	392,676	111	18,131	516,651
1854	114	19,777	367,906	111	19,157	662,336
1855	100	18,765	267,484	104	19,909	318,920
1856	92	18,782	332,602	90	18,479	408,725

The climate of Pará, though hot and liable to thunderstorms, is very healthy for Europeans. Pop. estimated at 28,000, of whom about 4000 are slaves.

PARÁ, a maritime province of Brazil, of which the above town is the capital. It lies between Lat. 9. S. and 4. 30. N., Long. 45. and 64. W.; and is bounded on the N. by the three Guianas and the Atlantic, E. by the provinces of Maranhao and Goyaz, S. by that of Matto-Grosso, and W. by that of Alto-Amazonas; area, 1,155,253 square miles. On the northern frontier it is separated from Guiana by a range of mountains, and from these the ground gradually slopes downwards to the bed of the Amazon, which traverses the country nearly due E. On the other side of this river the surface again rises as it approaches the watershed between the Amazon and the Rio de la Plata; but there are no very great heights in this direction. Except a few small streams, the Amazon is the only river in Pará that falls directly into the sea; but it receives many large tributaries in this province, among which are the Madeira, forming part of the western boundary, the Tapajoz, the Chingua, and the Tocantines, which joins the Pará or southern arm of the Amazon. The mineral wealth of the province is considerable, though hitherto it has been entirely neglected. Gold, iron, quicksilver, and copper among the metals, as well as diamonds, salt, coal, &c., have been found in various parts of the province; and some of them in large quantities. The soil is fertile, and the surface of the country is covered in some parts with vast and rich plains, and in others with dense, luxuriant forests. Comparatively few tracts have been brought under culture, and in these rice, coffee, cotton, sugar-cane, &c., are raised. The principal exports and imports of the province have been already noticed in speaking of the town of Pará, through which all the trade is carried on. Pop. (1856) 207,400.

PARÁ, or "Father of Waters," a name originally applied to the Amazon, but now restricted to the southern arm of that river, which receives the Tocantines from the S. It has a length of about 200 miles, and a breadth at its mouth of 40. It is at this mouth of the Amazon that the influence of the tide is most conspicuous, producing at spring tides a huge wave 15 feet high.

PARABLE (*παραβολή, a comparison*, from *παραβάλλειν, to compare, to collate*), denotes in general any discourse expressed in figurative, poetical, or highly ornamented diction. Thus it is said, "Balaam took up his *parable*" (Num. xxiii. 7); and "Job continued his *parable*" (Job xxvii. 1). Under this general signification it is used in Scripture to denote—1*st*. An obscure or enigmatical saying, as in Ps. xlix. 4; lxxviii. 2. 2*d*. A fictitious narrative, invented for the purpose of conveying truth in a more engaging form than that of direct narration. Of this sort is the parable by which Nathan reproved David (2 Sam. xii. 2, 3), that in which Jotham exposed the folly of the Shechemites (Judg. ix. 7–15), and that addressed by Jehoash to Amaziah (2 Kings xiv. 9, 10). To this class also belong the parables of Christ. 3*d*. A type or emblem, as in Heb. ix. 9, where παραβολή is rendered in our version *figure*.

Parables or fables are found in the literature of all nations. They were called by the Greeks *αἶνοι*, and by the Romans *fabulæ*. It has been usual to consider the parable as composed of two parts,—viz., the *protasis*, conveying merely the literal sense; and the *apodosis*, containing the mystical or figurative sense. It is not necessary, however, that this second part should be always expressed. The excellence of a parable depends on the propriety and force of the comparison on which it is founded, on the general fitness and harmony of its parts, on the obviousness of its main scope or design, on the beauty and conciseness of the style in which it is expressed, and on its adaptation to the circumstances and capacities of the hearers. The parables of the Old Testament are admirable specimens of this species of composition. Witness those of Jotham (Judg. ix. 7–15), of Nathan (2 Sam. xii. 1–14), of Isaiah (v. 1–5), and of Ezekiel (xix. 1–9). But the parables of our Saviour claim pre-eminence over all others, on account of their variety, appositeness, and beauty.

(See Gray, *Delineation of the Parables*, 1777; Bulkley, *Discourses on the Parables*, 1771; Collyer, *Discourses on the Parables*, 1815; Kromm, *Homilien uber die Parabeln Jesu*, 1823; Unger, *De Parabolis Jesu*, 1828; Bailey, *Exposition of the Parables*, 1829; Schultze, *De Parabolis Jesu Christi*, 1827; Lisco, *Die Parabeln Jesu*, 1832; and Trench, *Notes on the Parables of Our Lord*, 7th ed. 1857.)

PARACELSUS, PHILIPPUS AUREOLUS THEOPHRASTUS BOMBASTUS *von Hohenheim*, a famous alchemist and enthusiast of the sixteenth century, was the son of a physician, and was born in 1493 at Einsiedeln, a small town of the canton of Schwitz, distant some leagues from Zurich. Although his regular education seems to have been but small, a keen and general curiosity was his characteristic from an early age. While still a mere boy he made himself an adept in the juggling of the magician, the spells of the conjuror, and the arts of the alchemist. He then set out, a penniless vagabond, to search through the world for knowledge. There was scarcely a country in Europe which the feet of the strolling schoolman did not visit. His cool, self-possessed countenance was seen at the universities of Germany, France, and Italy, picking up stray scraps of medical knowledge. His voluble tongue was heard in the villages of Spain, Portugal, Prussia, and Poland, wheedling mystical lore from monks, quacks, jugglers, and old crones. He appeared among the lonely mountains of Bohemia and Sweden, inspecting the labours of the miners. He was even seen accompanying the son of the Khan of Tartary to Constantinople, to learn from a Greek the secret of the tincture or elixir of Trismegistus.

It is not known at what period he returned to Germany; but it appears that, about the age of thirty-three, several remarkable cures which he wrought on persons of distinction gave him such celebrity, that in 1526 he was, on the recommendation of Œcolampadius, called to fill the chair of physic and surgery in the university of Basil. Here Paracelsus commenced his career by burning publicly in the hall the works of Avicenna and Galen; assuring his auditors, that his shoe-ties knew more than these two physicians, that all the universities, and all the writers united were less instructed than the hairs of his beard, and that he should be regarded as the sole monarch of physic. The novelty of his doctrine, the confidence with which he spoke of his success, the power to which he pretended of prolonging his life and curing the most inveterate diseases,

and the use of the vulgar tongue in his lectures, made him very popular. Many students crowded to hear his prelections. Many patients came to consult him. Among others, Erasmus, who had long suffered from gravel, applied to him; and this circumstance led to a correspondence (which has been preserved) between these two men, who enjoyed such opposite kinds of celebrity. But even at Basil people soon began to discover that the new professor was an impudent and presumptuous quack. Scarcely had a year elapsed when his prelections were deserted. As soon as the novelty wore off, his jargon was found to be incomprehensible, and his empiricism a mere cloak for ignorance. The sottishness of his life also became notorious. Rarely did he appear in his lecture-room without being half-drunk, and seldom did he dictate to his secretaries except under the influence of wine. If called to visit a patient, he first soaked himself with liquor. He had the custom of sleeping in his clothes, and sometimes passed whole nights in low taverns drinking with boors. At length he happened to assail a magistrate with the grossest abuse, and dreading punishment for such an outrage, found himself under the necessity of decamping from Basil towards the end of the year 1527. The close of Paracelsus' career, like the beginning, was spent in ceaseless wandering. He appeared at Colmar in 1528, at Nuremberg in 1529, at St Gall in 1531, at Pfeffers in 1535, and at Augsburg in 1536. He then made some stay in Moravia, where he once more compromised his reputation by the loss of some distinguished patients, and was in consequence obliged to take his departure for Vienna. From that capital he passed into Hungary, and in 1538 appeared at Villach, where he dedicated his *Chronicle* to the states of Carinthia, in gratitude for the favours which they had bestowed on his father. But his stay here appears to have been short; for in 1540 we find him at Mindelheim, whence he proceeded to Saltzburg, the ultimate term of all his wanderings. On the 24th of September 1541 he died in the hospital of St Stephen at that place, in the forty-eighth year of his age, and in a state of abject poverty, notwithstanding he pretended to the possession of the double secret of transmuting metals and prolonging life even to the extent of several centuries.

The medical reputation of Paracelsus is not founded on any actual discoveries, but on the importance which he gave to pharmaceutical chemistry. By his bold language and still bolder practice, he dispelled the prejudices of the Galenical physicians against the productions of the laboratory. Mercury was introduced into general use by him as a cure for the venereal disease. He also seems to have been the first who used opium both as a narcotic and as a remedy for gout, fever, and similar diseases. Paracelsus is likewise notable for his general services to experimental science. How great these services were is described in Dissertation First, part i., chap. i.

Paracelsus published very few works in his lifetime, and those which are attributed to him exhibit so many contradictions that several of them have been ascribed to his disciples. It would be a useless waste of space to enumerate the titles of all his works: we shall therefore content ourselves with indicating the different complete collections. 1. The German editions, Basil, 1575, in 8vo; ibid. 1589–1590, in 10 vols. 4to; and Strasburg 1603–1618, in 4 vols. folio. 2. The Latin editions, *Opera Omnia Medico-Chymico-Chirurgica*, Frankfort, 1603, in 10 vols. 4to, and Geneva, 1658, in 3 vols. folio. 3. The French editions, *La Grand Chirurgerie de Paracelse*, Lyons, 1593 and 1603, in 4to; and Montbéliard, 1608, in 8vo. (See Adelung, *Histoire de la Folie Humaine*, tom. vii.; the *Biographie Universelle*, article Paracelse; and Sprengel, *Histoire Pragmatique de la Médécine*, tom. iii.)

PARADISE (παράδεισος), the term which, by long and extensive use, has been employed to designate the garden of Eden, the first dwelling-place of human beings. Of this word the earliest instance that we have is in the writings of Xenophon, nearly 400 years B.C., and his use of it answers very closely to our English word *park*, with the addition of gardens, a managerie, and an aviary. The real origin of the word, however, is to be sought neither in the Greek nor the Hebrew, but in the languages of Eastern Asia. "Paradise," says Fürst, is "a name common to several oriental languages, and especially current among the Persians, as we learn from Xenophon and Julius Pollux; Sanscrit, *pardeesha;* Armenian, *pardez;* Arabic, *firdaus;* Syriac, *fardaiso;* Chaldee of the Targums, *pardeesa.*" (*Concord. V. T.*, p. 920, Leipsic, 1840.

(For an outline of the various geographical theories which have been advanced respecting the vexed and indeterminable question of the situation of Paradise, see Appendix to Rosenmüller's *Biblical Geography of Central Asia*, by Rev. R. Morren, 1836.)

The term soon began to be used metaphorically for the abstract idea of exquisite delight, and was transferred still higher to denote the happiness of the righteous in a future state. (See Eden.)

PARADOX (παράδοξος, *contrary to opinion*), a proposition seemingly absurd, because at variance with some ascertained truth, or with some commonly-received opinion, but which nevertheless may, on strict scrutiny, prove to be correct.

PARAFFINE. See Peat.

PARAGUANA, a peninsula of Venezuela, in the province of Eoro, projects into the Caribbean Sea, and is connected with the mainland by a long and narrow isthmus; length, about 40 miles; breadth, 35. It is hilly in the centre, and gradually slopes towards the sea; and it is chiefly occupied by pasture-ground.

PARAGUAY, a republic of South America, lying between S. Lat. 27. 18. and 21. 20., W. Long. 54. 23. and 58. 46.; and bounded on the N. and E. by Brazil, and on the S. and W. by the Argentine Republic. Its form is nearly that of a parallelogram: its length, from N. to S., about 416 miles; average breadth, 180; area, 72,160 square miles. Paraguay forms a sort of inland peninsula, being surrounded on three sides by the River Parana, and its tributary the Paraguay, which joins it at the S.W. corner of the state. The centre of the country is traversed from N. to S. by a mountain-chain called the Sierra Anambahy, which separates itself into two at its southern extremity, forming the valley of the Tibicuary, an affluent of the Paraguay. The whole of the rivers of this country flow either into the Paraguay or the Parana; and as the central mountain-chain which divides their waters is in no place more than 100 miles from either of these rivers, the streams of the country are more remarkable for number than for magnitude. By far the longest and most important of these is the Tibicuary already mentioned, which has a tortuous course, and waters the southern portion of Paraguay. This southern region is a rich and beautiful country, presenting a striking contrast to the adjacent parts of the Argentine Republic. It consists of broad valleys and plains affording excellent pasturage, undulating slopes, and hills covered from top to bottom with magnificent forests. The soil here is very fertile; and cultivation is more extensively carried on in this district than in any other part of the interior of South America. White cottages may frequently be seen in the midst of trees surrounded by cultivated fields; but even here it is only scattered patches of ground that are tilled. Portions of this southern region are occupied by extensive marshes and broad but shallow lakes. The northern and eastern part of Paraguay is but little known. It seems to be a rugged and mountainous country, densely covered with forests, and watered by numerous rivers, which have many rapids and waterfalls. In the N.E. there is a branch of

dirty; but they contain some fine stone fountains, and many of the houses have a picturesque aspect. It contains several Greek churches and mosques. Pop. 5000.

PARANA. See PLATA, *Rio de la*.

PARANAGUA, a town of Brazil, province of São Paulo, 180 miles S.S.W. of São Paulo. It contains several churches; a court-house; a town-hall, with a prison attached to it; a custom-house, formerly a Jesuits' college; several schools; a theatre; and an hospital. The harbour is good, and capable of receiving large ships. An active trade is carried on in timber, flour, rice, pulse, Paraguay tea, cattle, &c. Pop. of the district, 7000.

PARAPET. See Glossary to ARCHITECTURE.

PARAPHERNALIA is a legal term, derived ultimately from the Greek παράφερνα, signifying "that which a bride brings over and above her dower," and applied to the personal attire and ornaments of a wife, which, under certain restrictions, are considered as her own peculiar property. (See HUSBAND AND WIFE.)

PARAPHRASE (from παραφράζω, *I add words*) is the rendering of an author's meaning in words different from, and generally more abundant than, his own. If it is a foreign language which is paraphrased, the paraphrase, as a loose, free translation, is opposed to the metaphrase, or literal rendering of the original. The paraphrase, in short, partakes alike of the version and the commentary, without belonging exclusively to either. The word is sometimes extended to poetical as well as prose translations of an author's meaning. Such are those sacred songs known as *paraphrases*, which are poetical renderings of certain passages of Scripture.

PARASANG (Gr. παρασάγγης; Persian *ferseng*), a lineal measure among the Persians, frequently alluded to by Greek writers. Owing to the original indefiniteness of itinerary distances, it seems to have differed considerably at different times. The estimate of its length most commonly received is that given by Herodotus, Suidas, Hesychius, and Xenophon, and which is equivalent to about 30 Greek stadia, or 3¾ English miles. Rödiger, in Ersch u. Gruber's *Encyclopadie*, takes the word to be connected with the Persian *seng*, a stone, in allusion to the stones which were placed at certain intervals on the public roads in that country to indicate distances, after the manner of our mile-stones.

PARASCENIUM. See Glossary to ARCHITECTURE.

PARASITE. In modern times, we have various examples of terms which once had a religious signification being applied to a secular or profane interpretation. A pilgrimage to Rome was, in its origin, a circumstance of earnest gravity, but such iniquity was at last connected with it, that to "go Roming," as it used to be written, was a phrase employed to depict the course of life of idle and impure vagabonds of either sex. Again, a crusade to the "Sainte Terre" had a pious end in view; but, in support of expeditions thither, the land became covered with lazy mendicants, who lounged from village to village begging or exacting alms in support of the enterprise in the Holy Land. Thence these fellows, and ultimately others of similar quality, acquired the name of *Saunterers*. In like manner, when the once solemn cavalcade to the shrine of Thomas à Becket at Canterbury, became nothing more than groups of gay riders, who trotted easily down to the ancient city, with set phrases of profession, and certain practices of a different tendency, the tone and the pace gave two words to our language which still survive,—namely, "cant" and "canter,"—the first was to talk, and the second to ride, like the pilgrims who visited the great shrine near which lay some at least of the bruised limbs of the hero of his day, and the "saint" of after times.

It has been something the same with the term *parasite*, which, in its origin, signified an official of considerable dignity in the temples of the heathen gods, but which afterwards designated a miserable class of professional diners-out,—men

> "Whose flanks grew great,
> Swell'd by the lard of others' meat,"—

and which name and class did not expire till a few years ago, when there ceased to appear among French advertisements intimations of certain individuals ready to enliven, for duly named fees, wedding banquets; to serve as *seconds* in duels, which were followed commonly by joyous breakfasts; and who were always ready dressed at the dinner hour, prepared to go to any house where, without them, there would be "thirteen at table."

The *parasite* and the *fanatic* have encountered a similar destiny. The latter, as noticed in the article FANATICISM, was originally he who "performed the duties of a temple, the religious personage, the priest, who in the temple was the organ of the god." Subsequently, the ancients called those "fanatics" who passed their time in temples, and being often seized by a kind of enthusiasm, as if inspired by the divinity, exhibited wild and antic gestures. At present, wherever a blind and obstinate fury in the furthering of any object has extinguished reason, judgment, and well-directed zeal, *there* is fanaticism. The parasite has as dignified an origin as the fanatic, but the word itself has become subject to more comic yet equally contemptuous applications. In the palmy days of heathenism he too was an official in various temples, but especially in those of Apollo and Minerva, and at the shrine of the divine hero Hercules. The Greek words παρα and σιτος, signify literally "near" and "corn," and they bore the further meaning, idiomatically, of "messmate." The parasites of Greece have been compared with the *epulones* of the Latins, and in *one* respect some similarity may be found. It was the custom of the Romans, not only on certain festive occasions, but also when danger threatened the commonwealth, to give a grand banquet (*epula* or *lecti sternia*), in some convenient temple, to the principal gods to whom they acknowledged allegiance. The statues of the deities were placed on lofty couches, and before these marble guests a sumptuous banquet was spread, provided and solemnly served by the *epulones*, the duly-ordained clerical stewards at such ceremonies. In the ranks of the priesthood, the *epulo* seems to have been of equal dignity with the *augur;* and Pliny the Younger, thinking neither of the offices unworthy of his acceptance, once applied to Trajan to be nominated to one or the other, on the first vacancy.

The parasite, like the *epulo*, was an officer of the temple tables, but after another fashion. It was his duty to select the corn for the sacrificial banquets, and probably for the beasts that were to be sacrificed. He occasionally gathered it from the "religiously and devoutly disposed," or he chose it from the crops which flourished on the temple lands. When the corn was thus got together, the parasites distributed it to the various temples within their limits of office, within which limits some were of more exalted dignity than others. Their trouble or zeal was rewarded by one-third of the ox sacrificed. The other two-thirds went to the priests, and nominally to the deities. The Latin *epulo* was appointed to the office by nomination of the head of the government. The Greek parasite was generally elected; he was not even chosen by lot. At Athens twelve individuals were selected by the citizens as *worthy*, and then the richest and the most noble of these were elected as the most *efficient*. In some cases there were certain tribes privileged or taxed to furnish two parasites yearly; and we also find particular families required, when necessary, to furnish a parasite from among their members. In no case could the person elected or summoned refuse to accept the office. A symptom of reluctance was immediately met by an irresistible magisterial process of compulsion, under which the individual repaired at once to his well-known official residence, the *Parasiteion*.

In some parts of Greece there existed families from whom those then important officials, the heralds, were chosen. From these same families were selected two parasites who served in the temple of Apollo in Delos, during a year. At the shrine of Hercules the parasites performed monthly sacrifices with the priests; and in some temples of Apollo we find Acharnensian parasites exclusively engaged, whose distribution of offerings gave one-third of the best bulls to the games, and divided the remainder between the parasites and the priests. Offerings of fish were accepted by the former from the fishermen, and were similarly divided; and in Athens one-sixth of every bushel of barley was set apart for the table in the temple at which the Athenian citizens feasted.

It was not alone to the temples that parasites were attached. Each archon had two, and each polemarch one, in his suit. In course of time the fashion or custom prevailed whereby other officials of a certain dignity appointed parasites in their households; and from this may probably be dated the commencement of the decline of this singular branch of the priesthood in public respect. In this last employment the parasites were, in the households to which we allude, something like what the ordinary family chaplain was in English country mansions at the close of the seventeenth and beginning of the eighteenth centuries,—namely, the flatterer, the servant-companion, and the butt of the head of the establishment. As regular attendants at banquets, the parasites are supposed to have first appeared in Sicily, a locality famous for its feasts, and for the superexcellence of its cooks. Subsequently the profession extended and degraded itself, and its members became the prey of the comic poets and the laughing-stock of the people. The parasites of the comic drama were undoubtedly caricatures of well-known living characters. They were to be found under various appellations, but the parasite proper was ordinarily accoutred in a black robe; the mask worn by the performer had a comic expression; the nose was flattened, looking in outline almost like an ace of clubs; and the ears hung down, to indicate the frequency of the blows dealt to the poor buffoon.

The professional parasite, who lived at the cost of his patron for the hour, supped or dined wherever a taste of his quality was required; and at wedding-feasts presented himself without invitation, as knowing that he would be welcomed for his jests. Some of the sharpest of these were showered, with something harder than words, on the heads of the guests who omitted to laugh at the jokes of the master of the feast. When his own comicality was not to the taste of the latter, the guests, in their turn, would unceremoniously kick the sorry fellow into the street, and, by tearing to rags his only dress-suit, render him unfit for company till he had repaired the damage. With a good share of facetiousness, impudence, and sensuality, he could contrive to lead a luxurious yet a precarious style of living. For succulent repasts and a fair reward, he not only expended jokes, but submitted to any indignity. He was hailed by coarse names, often buffeted, and when not too drunk himself, exercised the office of carrying out the more drunken. From always being present at feasts, he received the distinguished title of "sauce;" occasionally, to give him a mock dignity, a patron would lend him a slave, and, in return, the parasite was always ready to serve as a bully, and more or less cruelly assault such persons as had the ill luck to be out of favour with his employer.

These parasites were huge feeders; but some of them, in order to procure engagements the more readily, advertised their abstemiousness and their social qualities in combination. Chiefly, and with reason, they boasted of their powers of flattery. They would imitate the infirmities of their rich employers; and there was no habit of the latter ever so filthy or horrible which they would not praise as something highly pleasant and worthy of laudation. Human nature shudders at the thought of what these officials sometimes witnessed at table, and which they readily imitated or extravagantly eulogized. They professed to have a patron in heaven in Ζεὺς ὁ φιλιος; but their profane blasphemy was astounding, some of them not hesitating to offer to princely patrons the divine worship which was due only to the gods. Even some of these august patrons could object to or scorn such homage as this. We have an example in the case of Alexander: when taking medicine with childish reluctance, Philarches, his parasite, exclaimed, "What must mortals suffer when they swallow physic, if you who are a divinity can hardly do it." The idea of a god drawing health from an apothecary's phial was too much even for Alexander, who declined to accept the apotheosis, and called Philarches "an ass."

There were two families in Salamis in which the offices of parasite and spy were hereditary: these were the Gerginoi and the Promalangoi. The former did the dirtier work, and reported to the latter the private conversations of citizens, which the Promalangoi at the table of the Anactes or princes communicated with much flattery to their masters. It was an evil fashion which has not expired on the Continent.

The old practitioners gloried in their calling. "Truly," exclaims a parasite, in a fragment of Antiphanes, "since the most important business of life is to play, laugh, trifle, and drink, I should like to know where you would find a condition more agreeable than ours!" On one occasion, the condition was one of great dignity, though purchased by treachery. The three parasites, or "adorers and flatterers" of Cnopus, King of Erythra, after murdering their master, gained possession of the kingdom by a *coup d'etat*, the success of which saved them from the merited fate of assassins, and raised them to the rank of heroes. They administered a ferociously-abused sort of justice at the gates of the city; violated every law of man, of nature, and of God; boasted of their popularity, when they had slain, imprisoned, or otherwise silenced every opponent; attired themselves gorgeously in effeminate costumes; and daily sat down to dinner, in diadems that dazzled the company by their lustre. When these strange rulers felt, or said they felt, light of heart, it was the duty of the city to exhibit a corresponding joy, and if the circumstances of the hour induced them to put on a gravity of deportment, duly appointed officers went through the city with many-lashed whips, and flogged the people into wearing expressions of devout horror! It was the remark of the present Emperor Napoleon, when writing in the *Progrés de Calais* against the repressive laws of Louis Philippe, that "every despotic government falls by the very measures which it takes to support itself." It was so with this extraordinary government of the parasites. The Erythrians ultimately plucked up their courage, and just when the authority of the parasites seemed most firmly established by the suppression of all liberty, the exasperated and long-suffering people arose in irresistible wrath, and swept these tyrannical *parvenus* into Hades.

Thus, it will have been seen that the parasites, although they seized on royal authority, were incompetent to retain it. Having exhibited them in so many varieties of condition, there remains little to be added, save to recommend those who are curious on the subject to study the comedies of Plautus. In *them* the parasite figures as necessarily as the impudent valet in a Spanish comedy. It is worthy of remark, that Plautus jokingly calls the parasites *poetæ*, as being addicted to lying; and it is singular that the Gauls named their poets "parasites," because of their fondness for good living. Previous to the era of printing, the professional parasite, with his jests, anecdotes, and histories, was a sort of living circulating library. Saturion, one of the examples in Plautus, professes to be tranquil in his

mind, because, as he remarks, he can provide for his daughter by bequeathing to her his rich collection of jokes and dinner-stories. "They are all sparkling Attic," he exclaims, "and there is not a dull Sicilian anecdote among them." This reference to his daughter suggests the idea that there were female parasites, as at Christian courts there were not only male but official female "fools." However this may have been, it is certain that the parasite, in his more servile condition, was a personage, the fire of whose attachment blazed up or faded according to that in the kitchen of the Amphitryon by whom he was patronized. In short, throughout life, the parasites worked only for the banquet and the wine-pot; even after death some of them longed for libations, as appears from the epitaph on the parasite Sergius of Pola:—

Si, urbani, perhiberi vultis
Arenti meo cineri,
Cantharo piaculum vinarium festinate.

If you've any regard for this carcase of mine,
Be so good as to wet it with hogsheads of wine!

Athenæus, in the 34th chapter of his 6th book, has cited what may almost be termed a multitude of authors, each of whom affords some illustration of the parasite in his dress, bearing, manners, morals, objects, virtues, vices, or unutterable nastiness and atrocity. Instead of selecting a specimen from a book which, even in an English form, is now accessible to all, it will perhaps be preferable to resort to a lively painter uncited by the diligent grammarian of Naucratis, and conclude with the following sketch from Martial, as translated by Hodgson:—

When from the bath, or hot or cold, you come,
The kind Menogenes attends you home.
When at the courts you play the healthy ball,
He picks it up adroitly, should it fall.
Though wash'd, though dress'd, he follows where it flies,
Recovers and returns the dainty prize,
And overwhelms you with civilities;—
Calls for your towel and, though more defil'd
Than the foul linen of a sickly child,
He'll swear 'tis whiter than the driven snow;—
Comb your lank hair across your wrinkled brow,
And, with a tone of ecstacy, he'll swear,
"Achilles had not such a head of hair."
Himself will bring th' emetic to your hand,
And wipe the drops that on your forehead stand,
Praise and admire you till, fatigued, you say,—
"Do, my good friend, do dine with me to-day!"

(J. D—R—N.)

PARASITES, or PARASITIC PLANTS. See BOTANY.

PARATI, a seaport-town of Brazil, province of Rio de Janeiro, at the head of a small arm of the sea, in the Bay of Angra dos Reis, 100 miles W.S.W. of Rio de Janeiro. It is regularly laid out and well built, containing several churches and schools, a town-hall, and an hospital. An extensive trade in rum, sugar, coffee, rice, &c., is carried on. Pop. 10,000.

PARCÆ (Greek, Μοῖραι), the Fates, were variously represented in classical mythology as the daughters of Erebus and Nox, or of Jupiter and Themis. Their number was generally supposed to be three: *Clotho* the spinner, *Lachesis* the disposer of lots, and *Atropos* the inevitable. They are described under many different aspects by many different authors. The following are some of the principal traits of their character as it has been developed by the combined representations of various ancient writers:—The three dread sisters held the universe entirely under their control, and executed all the purposes of nature with an inexorable decision which regarded neither gods nor men. In particular, they had unlimited power over the thread of human destiny. Clotho held the distaff, Lachesis twirled the spindle, and Atropos cut the thread. They also presided over other great events in the life of men. For example, on nuptial occasions they foretold in chants the fortunes of the newly-wedded pair; and when any dark crime was perpetrated, they hunted down the offender with retribution. The Fates were generally represented by the poets as old women, lame, withered, savage, and ugly. There were shrines erected to them in many parts of Greece.

PARCHIM, a town of Mecklenburg-Schwerin, on the left bank of the Elde, 21 miles S.E. of Schwerin. It contains a town-hall, churches, and schools. In the neighbourhood there are medicinal springs and bathing establishments. Weaving, distilling, and the making of tobacco, straw hats, &c., are carried on, as well as a considerable trade. Pop. 6450.

PARCHMENT, the skins of animals so prepared as to render them proper for being written upon, or used in covering books. The skins of most animals are adapted to the manufacture, but as the better kinds are used in making leather, sheep-skins are preferred. The finer kind of parchment, known as *vellum*, is from the skins of calves, kids, and dead-born lambs. The stout parchment of drum-heads is from the skin of the wolf, although that of the ass or calf is sometimes used; the parchment of battledores is from the skin of the ass; and that used for sieves from the skin of the he-goat.

The word *parchment* comes from the Latin *pergamena*, the ancient name of this manufacture, which is said to have been taken from the city of Pergamus. Eumenes, the king of that place (who reigned B.C. 197–159), has the honour of the invention; although, in reality, that prince appears rather to have been the improver than the inventor of parchment. According to Diodorus, the Persians of old wrote all their records on skins; and the ancient Ionians, as we learn from Herodotus, made use of sheep and goat skins in writing many ages before the time of Eumenes. Nor need we doubt that such skins were dressed for the purpose after a manner not unlike that in which our parchment is prepared, though probably not so artificially.

The manufacture of parchment is begun by the skinner, and finished by the parchment-maker. The skin having been stripped of its wool and placed in the lime-pit, the skinner stretches it on a wooden frame, called a *herse*, consisting of four bars perforated with holes, in each of which is a peg. Pieces of twine, extending from the edges of the skin to the pegs, retain the skin in an extended state, in which the skinner pares it with a knife, called, from its shape, a *half-moon knife*. This being done, it is moistened with a rag; and powdered chalk being spread over it on the flesh side, the skinner takes a large pumice-stone, flat at the bottom, rubs over the skin, and thus scours off the flesh: this is called *grinding*. He then goes over it again with the knife, moistens it as before, and rubs it again with the pumice-stone without any chalk underneath, by which means the flesh side is considerably smoothed and softened. He then again passes the knife over it, which is called *draining*. The flesh side being thus drained, by scraping off the moisture, he in the same manner passes the knife over the grain side, and then scrapes the flesh side again. This finishes the draining; and the more it is drained, the whiter it becomes. The skinner now throws on more chalk, sweeping it over with a piece of lamb-skin which has the wool on; and this smooths it still farther. It is then left to dry, and when dried, taken off the frame by cutting it all round. The skin, being thus far prepared by the skinner, is taken out of his hands by the *parchment-maker*, who first, whilst it is dry, pares it on a *sumner*, or calf-skin stretched in a frame, with a sharper instrument than that used by the skinner; and, working with the arm from the top to the bottom of the skin, takes away about one-half of its thickness. The skin, being thus equally pared on the grain side, is again rendered smooth by being rubbed with the pumice-stone on a bench covered with a sack stuffed with flocks, which leaves the parchment in a

condition fit for writing upon. Should any small holes appear in the skin, they are stopped by cutting the edges thin and laying on small pieces of parchment with gum-water. The parings taken off the skins are used in making glue, size, and the like.

The green parchment used in book-binding is coloured by means of verdigris, for which purpose thirty parts of crystallized verdigris, and eight parts of cream of tartar, are boiled in 500 parts of distilled water; when the solution is cold, four parts of nitric acid are added. The parchment is moistened with a brush; the colour is spread evenly over it; and, when dry, polish is given by means of white of egg or gum-arabic. (C. T.)

PARDON, in *Criminal Law*, is the remitting or forgiving an offence committed against the king.

Law, says Beccaria, cannot be framed on principles of compassion to guilt; yet justice, by the constitution of England, is bound to be administered in mercy. This is promised by the king in his coronation oath; and it is that act of his government which is the most personal and most entirely his own. The king condemns no man; that unpleasant task he leaves to his courts of justice; the great operation of his sceptre is mercy. His power of pardoning was said by the Saxons to be derived *a lege suæ dignitatis;* and it is declared in Parliament, by stat. 27 Henry VIII., c. 24, that no other person has power to pardon or remit any treason or felonies whatsoever, but that the king has the whole and sole power thereof, united and knit to the imperial crown of this realm.

It is impossible to lay down any abstract rules for the administration of mercy. Each case must be judged of according to its own circumstances.

That human nature is such as in the aggregate to need control, no one who is acquainted with it will deny; and there appears to be no other method of controlling mankind but by general laws; but then, through the natural imperfection of human affairs, they may be cruel in one case while they are just in another. Cases may likewise occur where the sentence of the law, without its execution, will answer every purpose which could be expected from it, and where the execution of it would be extreme cruelty, although it might in strict language be called justice, because in conformity with the letter of the law. Yet though such cases may and do often occur, it would be absurd to abolish any of those laws which the security of civil society has required; and therefore the only mode of regulating their operation in criminal matters seems to be the system of absolute or conditional pardons.

It is possible to define a particular crime, and to annex a particular punishment to the commission of it; while the moral guilt of criminals may vary. The real guilt consists not in the external action, but in the motives which prompted to it. Definite law, however, cannot always make such distinctions; besides, after the sentence of the law is pronounced, circumstances may emerge which present the case in a very different aspect from what it previously bore. Then there are what may be called accidents of the case, which could not be previously defined. To particularize and define, in laying down a law, every mode of an action which imagination can conceive, or which experience has shown us may happen, is utterly impossible; and therefore it seems equitable that there should be a power vested somewhere to modify and control, or even to discharge altogether, the judgments of the law in criminal cases; and that power in this country is judicially vested in the sovereign in council, or in Parliament by acts of indemnity. It is not exercised so as to affect the private rights of third parties; and therefore, though the manslayer may be pardoned, the private right of the next of kin to damages is not thereby prejudiced.

PARDUBITZ, a town of Bohemia, circle of Chrudim, stands at the confluence of the Elbe and the Chrudimka, 13 miles S. by W. of Königgrätz. It has a castle surrounded with walls and ditches, an imperial stud, linen factories, copper and iron forges, and a population of 4150.

PARÉ, AMBROISE, the father of French surgery, was born at Laval, in the province of Maine, in 1509, and died in 1590. A collection of his works was published at Paris in 1561, and was afterwards frequently reprinted. Several editions have also appeared in German and Dutch. Among the English translations was that of Thomas Johnson, London, 1634. (For an account of Paré's professional career and services, see SURGERY.)

PAREDES-DE-NAVA, a town of Spain, in the province of Palencia, stands on a pestilential lake, 16 miles N.W. of Palencia. The parish church of St Eulalia contains some carvings by Alonso Berruguete, who introduced the *cinque-cento* style into Spain. There are also a town-hall, prison, nunnery, several schools, and an hospital. Manufactures of woollen stuffs and serges are carried on. Pop. 6014.

PAREJA, JUAN DE, a Spanish painter, was by descent a mulatto slave, and was born at Seville in 1606. His knowledge of art was acquired in a singular manner. Becoming at an early age the bond servant of Velasquez, he was employed to do the menial work in the studio of that great artist. The daily sight of the creations of genius coming out in form and beauty on the blank canvas kindled within him an inextinguishable love of art. During the day he eagerly watched his master's hand, and during the night he stealthily practised with his master's brushes. Thus, after many years of clandestine assiduity, he attained to no mean skill in painting. Equally singular with this manner of acquiring excellence was Pareja's manner of divulging it. Knowing that the king, Philip IV., would visit the studio on a certain day, he hung up a picture of his own among his master's, with its face to the wall, and loitered close by to wait for the result. The king turned the picture, and admired it; Velasquez in surprise disclaimed all knowledge of the painter; and then the slave, dropping down on his knees before his Majesty, confessed his secret studies, and obtained on the spot not only forgiveness, but also freedom. Pareja proved himself a grateful freedman. During the remainder of Velasquez's life he continued in the house in the two-fold character of an attendant and a scholar. Then he transferred his services to his master's daughter, and remained with her till his death in 1670. A large picture by Pareja, entitled "The Calling of St Matthew," is in the royal gallery of Spain, and is remarkable for its successful imitation of the colouring and manipulation of Velasquez. (Stirling's *Artists of Spain.*)

PARENT AND CHILD. Children born in wedlock, or within a competent time after its dissolution, are legitimate. In some countries legitimacy is conferred on children by the marriage of their parents to each other subsequent to the birth of the children (see HUSBAND AND WIFE); or, in certain circumstances, is admitted where no marriage was, or could lawfully be, entered into. Children born in other circumstances are called illegitimate. By the law of England, children born before marriage are incapable of succeeding to their father's English property except by will, even although they were born in a country which recognises legitimation by a subsequent marriage; and the same rule exists in reference to children born after the marriage of a British subject to his deceased wife's sister, though it take place in a country where such a marriage is lawful. In Scotland, a subsequent lawful marriage removes the legal stain of bastardy. Scotch institutional writers are not agreed as to the principle on which it does so. Some suppose that, by a legal fiction, the marriage is held to have occurred prior to the birth; while others, on better grounds, think it results from the expediency of converting what was

at first an irregular into an honourable relationship. The former necessarily hold, that if either of the parents contracted an intermediate marriage with a third party, the fiction was destroyed, and the children remained illegitimate; while the latter, discarding the fiction altogether, maintain that when the intermediate marriage is dissolved, the Scotch law permits the parents to marry, for the express purpose of putting an end to illicit intercourse, and of conferring legitimacy on the children previously born. This last may now be regarded as the law of Scotland, unless the birth be the result either of incestuous or (probably) of adulterous intercourse. To confer the privilege of legitimation, the subsequent marriage must take place when the father has his domicile in Scotland, or in a country which holds, in this respect, a similar law; for if he be domiciled at the time of the marriage in England, or in any country, the law of which, like that of England, does not recognise such a mode of legitimation, the children will continue to be regarded as bastards in Scotland, and disqualified to succeed as heirs to their father. So entirely does this mode of legitimation in Scotland depend on the father's domicile at the date of the marriage, that although both the birth and the marriage occur in Scotland, if the father be domiciled in England at the time of the marriage, the children born previously to the marriage remain illegitimate. On the other hand, and on the same principle, though both the birth and the subsequent marriage take place in England, yet if at the time the father's domicile be in Scotland, the children will be regarded as lawful children in Scotland; and it is probable that they would be so regarded though only the subsequent marriage occurred when the father's domicile was in Scotland. A father domiciled in England at the time of his marriage there to a woman by whom he has previously had children, and afterwards acquiring a Scotch domicile, cannot confer legitimacy on such children by his again going through in Scotland the ceremony of marriage with their mother.

The obvious result of this difference between the law of England and Scotland is the incongruous one, that if a father domiciled in Scotland die intestate, leaving estates in both countries, and two sons, both by the same mother, the one born before and the other after his marriage with her, the son born before the marriage will succeed to the Scotch estate, and the son born after it will succeed to the English estate, each in the character of being his father's eldest lawful son in these countries respectively. If the one of these sons who was born before the marriage had died before his father, leaving a child, such child, as representing its father, acquires all the rights which its father would have acquired in Scotland had he survived, to the exclusion of the son first born after the marriage, and his heirs; and this although the marriage does not take place till after the death of the son who was born before it.

In all these cases of legitimacy by subsequent marriage, it is necessary that the husband acknowledge himself to be the father. The acknowledgment, if distinct, need not be in any specific form. It may even be inferred from the conduct of the father,—such as his presence at the child's baptism, or receiving the child into his family and treating it as his own.

A question has arisen whether, in any case, children can be legitimate where their parents went through the ceremony of marriage, but could not have been lawfully married? If a man and woman go through the ceremony of marriage with each other, knowing that they are disqualified by relationship, their children will remain illegitimate, even although the legality of the marriage may not have been called in question during the lifetime of the parents. But what if the parents acted in blameless ignorance? Of course, on the discovery of the disqualification, the marriage may be annulled as being unlawful; but if it were entered into innocently, the legitimacy of the offspring is secured by the good faith of the parents. Accordingly, in Scotland, the good faith of both parents was held to save the rights of the children in a case which occurred more than a hundred years ago. The jurist who reported that judgment gave it as his opinion, that the good faith of either of the parents would have led to the same result; and this point became the subject of litigation within the present century, but unfortunately the claimant died before judgment could be pronounced. This doctrine is not new. At a period prior to the Reformation, when impediments to marriage were absurdly extended, it was sometimes discovered, after children were born, that their legitimacy was doubtful; and it became more reasonable to support the legitimacy than to bastardize children who were begotten in utter absence of any intention to violate the law. After the Reformation the Commissary Court in Scotland acted in accordance with this view.

The presumption in favour of the legitimacy of children born in wedlock is so strong, that it can only be overcome by evidence leading to the conclusive conviction that the husband is not the father. The presumption is against the legitimacy if the parents were entirely separated between eleven solar and six lunar months antecedent to the birth. The most open adultery of a married woman will not of itself bastardize her offspring, unless it be rendered credible by other facts and circumstances that her husband is not the father. Even the united declaration of both husband and wife, that the husband is not the father, though always important, is insufficient, because they may be acting collusively and falsely for improper purposes. But if, in addition to the manifest adultery of the wife, with the admission, probably, of the paternity by a third party, there are circumstances which seem to infer that a child was not lawfully begotten, then the declaration of the parents will become matter of grave consideration. Looking to the whole conduct of the married pair, prior and subsequent to the birth, the House of Peers has on more than one occasion found it morally impossible to believe in the legitimacy of a child, and has therefore given judgment against it, even where the physical possibility was not absolutely excluded. In one of these cases, the married pair dwelt near each other, but then the birth was studiously, and for a considerable period successfully, concealed from the husband, while the paternity was acknowledged by another man with whom the woman had been intimate, and who bequeathed his whole property to the child. Some circumstances extinguish the plea of legitimacy at once; as, if the child were a Mulatto, the husband being a white man. No reliance is placed on family resemblance, as being too fanciful; though in one case the House of Peers heard an argument partly founded on that circumstance.

We shall now briefly notice,—1*st*, The duties of parents to their lawful children; 2*d*, The powers of parents over their children; 3*d*, The duties of children to their parents; and 4*th*, The duties and obligations between parents and illegitimate children.

1. *The Duties of Parents.*—In every civilized country a father is obliged, if he be able, to support his children, and to train them to be able to support themselves. This is the dictate of nature. It is scarcely possible, however, for a court of law to interfere with the details of the father's management, unless it be obviously cruel or immoral. In regard to education of children, it has been thought that, except in extreme cases, "there is no farther obligation than what nature has implanted" in the father's breast. If the father be dead, and the child is in the custody of tutors, courts of law find no difficulty in interfering, wherever it appears that the child is being reared in a manner unsuitable to its position and prospects. When children have attained an age at which, under ordinary circumstances,

they should be able to support themselves, the father's obligations cease, unless they become disabled by accident or disease; and then the father, if able, is bound to provide them with necessaries only, and nothing more. If a father, being able, refuses to aliment his children, whereby they become chargeable to the parish, he is punished by fine and imprisonment, under the statute 8 and 9 Vict., c. 83, § 80. It is not the policy of law to tempt children to lead idle lives. A gentleman of fortune, however, will hardly be relieved of his obligation to support his son on his being qualified to become a lawyer or a physician, because, by training his son to any such profession, the father virtually undertakes to maintain him until he can support himself by it. Still more, if a wealthy father were not to train his son to any profession or trade whatever, he raises against himself an obligation to support him beyond majority, if he be otherwise destitute. If the father be incapacitated to support his minor children, his duties fall first on the mother, if she have independent means of her own, and next on the father's nearest ascendant, going backward according to their ability, rather than on the parish, with a right of relief against the father of the children if he afterwards become possessed of means. But a grandfather is not bound to support his indigent daughter-in-law. The obligation of support ceases in the lower ranks when children are able to support themselves by labour; and in the upper ranks, when they obtain the means,—as when a son gets a commission in the army,—unless he is thereafter incapacitated by some blameless cause, as a stroke of palsy, in which case the father is the sole judge as to how and where the support shall be given. It has been decided by the House of Peers that the amount of aliment in such a case "is, support beyond want, and all that is beyond that, is left to parental affection." Under all circumstances, a child drawing profits from any source is bound to bear his own expenses so far as he is able, but he is not bound to repay what his father may have expended on him out of any property which he may subsequently succeed to or acquire. If a wealthy father neglect his duty to a disabled son, a third party supplying him with necessaries has a good action against the father for payment; but not the lender of money, unless he prove that it was truly expended in providing what should have been provided by the father. If, in advancing money to a son, to enable him to purchase a commission or to enter into business, the father take a voucher for it, or enter it in his books against the son, a debt rather than a donation will be implied. If a father become bankrupt, his obligations to support his children are altogether subordinated to his obligations to pay his other lawful debts; so that children cannot be ranked like ordinary creditors on their father's estate, excepting in certain cases where a credit has been created in their favour, as by an antenuptial contract of marriage. If an heir succeed to an estate through his father, and the latter have left children in poverty, the obligations of the father are transferred to the heir. This results, not from relationship, because a man is not bound in law to support his brother or sister, and still less more remote relatives, but from the heir representing, and taking possession of the estate of, his ancestor. In such a case, the liability of the heir does not exceed the liability of the ancestor, had he survived. Every such case, however, must be governed by its own circumstances. For example, if a father die, leaving several sons and daughters, and an estate clogged with debt, the daughters, like their brothers, must betake themselves to some employment; while the heir of a large unburdened estate is liable to support his sisters, if they have not been trained to work, until their marriage. On that event, the obligation expires.

The law of England does not prevent a father from disinheriting his children. The Roman law allowed him to do so only if he could show a sufficient reason. In Scotland the father can disappoint his heir of his unentailed lands by the expedient of giving them to the person he desires to prefer, in terms implying a *present* conveyance, under reservation of his (the father's) liferent, and power at any time to revoke the deed. Such a deed, if unrevoked, receives effect at his death.

2. *The Powers of Parents.*—At one period the Roman law set no limits to the parental authority; and though it subsequently did so, it never interfered with the father's right to the whole of his child's earnings. By the laws of England and Scotland the father is entitled to the custody of his children, even though he may have violated his conjugal duties, except in the extreme cases already hinted at; and he has a right to inflict that moderate degree of chastisement which is necessary to secure obedience, and to promote the real welfare of his minor children. After their majority, if they require assistance, he may exact residence in his family as the condition of granting it. So long as they reside in family with their father, he has a right in England to the profits of their industry, and in Scotland to such profits to the extent of the expense which they occasion to him. The father is tutor to his children while in puberty, and their curator thereafter until their majority. In the former capacity, he acts for them; and in the latter, with them. No legal proceedings are necessary to invest a father in these offices; and he is not required, like a stranger, to take the oath to act faithfully, nor to find security for his intromissions, unless he be insolvent. No deed by a minor is binding if it be disapproved of by the father,—not even articles of apprenticeship,—although to such a deed his consent may be implied from his tacit acquiescence for a length of time to his child remaining in the service. A minor, although living independently on his own fortune, cannot grant leases, remove tenants, or sell or burden his lands, without his father's express consent; because the parental guardianship is designed to supply the immaturity of the child's judgment and experience. Without such consent, the minor's bond or bill for borrowed money affords no ground of action, after his majority, to a greater extent than the sum which the creditor can prove was applied to the profitable uses of the minor. Unsuitable furnishings to a minor never afford a good ground of action against him; and if he have no means of his own, even furnishings which are suitable in their own nature constitute a debt, not against the minor, but against his father, unless the father have previously sufficiently supplied the minor. It is the duty of third parties to make inquiry before giving credit to a minor. Where the minor is not residing in the family of his father, these rules may not be so strictly enforced against the merchant; but in no case will an action lie for unsuitable furnishings, nor for necessaries too frequently given, unless they may eventually become available to the minor. A minor is not entitled to restitution for the loss he may have suffered from his unsuitable purchases with cash, the father or guardian being to blame for having allowed him the command of the money, whereby the merchant may have been thrown off his guard. And if a minor be so nearly major that the merchant might be mistaken as to his age, and he fraudulently imposes on the merchant by pretending that he has attained majority, and thus gets credit, the minor, by his fraud, will create a debt against himself for which he may be justly sued in majority.

The father's right of administration in reference to any estate to which his children may succeed by the will of a third party, is excluded wherever the granter either gives the administration to another, or simply excludes that of the father. In this last case, the court will appoint a guardian in reference to such estate. The marriage of a minor daughter puts an end to the guardianship of her father, and

Parent and Child.

transfers it to her husband; and it is excluded wherever the child has an action at law against the father, and wherever the father has an interest adverse to the child: the court in these cases appoints a curator.

One cannot here help noticing a remarkable difference between the laws of England and Scotland in this respect, that in England the consent of the father is required to prevent the marriage of a minor from being invalidated, while in Scotland such consent is not required. Somewhat inconsistently with itself, the law of Scotland requires the father's approval of very unimportant transactions on the part of a minor, and yet allows a girl of twelve years of age and a boy of fourteen to enter into the contract of marriage, on which the happiness of their lives may depend, without the concurrence or advice of any guardian whatever.

In England and in Scotland both sexes are enfranchised at the age of twenty-one.

3. *The Duties of Children to their Parents.*—These are very strongly written on the heart, though it is not always easy for human laws to enforce them. Children should yield to their parents obedience in youth, and affection and reverence through life. The maltreatment of parents by children is justly punished as an aggravated offence. Some of the duties of children are not extinguished even though their parents may be the reverse of exemplary. For instance, children are bound at all times, if able, whatever the character or conduct of their parents may have been, to support them when indigent, in return for the support which they (the children) received in infancy; and this altogether independent of the question, whether they succeeded to any property through their parents or not. The obligation of a child to support, if able, his indigent mother, does not depend on his representing his father, as it does in the case of brothers or sisters. It is a natural obligation, incumbent on himself according to his ability, and which the law will enforce.

4. *Of the Duties and Obligations between Parents and Illegitimate Children.*—These are very inferior to those above referred to. At one time, the bastard was treated as if he had been a delinquent. For example, unless he had heirs of his own body, he could not make a testament without letters of legitimation from the crown; but this disability was removed by the statute 6 Will. IV., c. 22. At present, a bastard cannot succeed to his father, except by will. In England the rights of an illegitimate child "are only such as he can acquire, for he can inherit nothing, being looked on as the son of nobody."

In Scotland, as in England, so far as succession is concerned, the illegitimate child is regarded as having no father; and therefore, on the one hand, he is not his father's heir, and on the other, the father has no right to the custody of, neither has he a right to act as administrator at law to, the unfortunate infant. It follows that the father cannot appoint tutors or curators, or guardians of any kind, to his illegitimate child, unless he leave property by special deed to him; in which case he can only appoint guardians in reference to the property left, on the same footing with a person leaving property by will to a stranger. The law compels the father, when the paternity is ascertained, to contribute along with the mother for the support of the bastard; the amount, which is only for "support beyond want," varying a little with the rank and condition of the parents, and never for a longer period than until the child attain an age at which it is able to work for itself; the mother till then being entitled to the custody of the child. The father can only exclude the mother's right to the custody by proving that she is an improper person for such a trust, or is guilty of cruelly maltreating the child. Even her right to the custody expires on her illegitimate son becoming seven, and her illegitimate daughter ten years of age; and then the father may, if he wish it, make his right to have the custody a condition of his giving farther aliment, unless the mother can show (which at these tender years is not always difficult) the existence of circumstances sufficient to justify an extension of her right. Practically no aliment is awarded by law after bastards have reached twelve or sixteen years. If the father be dead, his executors cannot at any period demand the custody from the mother. The father is not liable to third parties for any debts which the mother of illegitimate children may contract on account of their upbringing; and on the other hand, he cannot claim any portion of the gains which may be acquired through their talents or industry. But if they be residing in family with their father, he may take such gains to the extent of the expense which they occasion. So little is there of mutual obligation between these parties, that if the illegitimate child make no claim on the father, the father has no power whatever over the child; and the illegitimate child is not liable, though he be able, to support his indigent father. The mother, however, stands in a very different position. The relationship between her and her illegitimate child is at least indisputable; and therefore the child is bound, if able, to support her when in poverty, according to the rules by which lawful children are bound to support their mother. For the same reason, though a bastard does not succeed to his father's estate, he does so to his mother's. A man is not bound to support his son's bastards. Failing their father and mother, they must be supported in infancy by the parish of their mother's settlement. The Poor Law Act, 8 and 9 Vict., c. 83, § 80, renders a father liable to fine not exceeding L.10, or imprisonment not exceeding 60 days, who leaves a bastard, acknowledged or proved to be his, to become chargeable on the parish. (M. L.)

Parent-Duchatelet || Parga.

PARENT-DUCHÂTELET, ALEXIS-JEAN-BAPTISTE, a sanitary reformer, was born in Paris in 1790, and was educated for the medical profession. After practising for some time as a doctor in the French capital, he directed his attention to the subject of public health. Actuated by pure philanthropy, and undeterred by any considerations of personal comfort and health, he visited all those places where noisome effluvia were daily killing their unconscious victims. Common sewers, tobacco manufactories, pyroligneous acid factories, burying-grounds, and dissecting-rooms, all came under his scientific inspection, and were described to the public in a great number of pamphlets. His last investigation was upon the prostitution of the capital. A report of it was published in 1836, the year in which he died.

PARGA, a town of European Turkey, in Albania, stands on a rocky peninsula on the shore of the Mediterranean, nearly opposite the island of Paxo, 47 miles S.W. of Janina. The streets are narrow and dirty; and the ground on which the town is built is so steep, that from the sea the houses look as if they stood on the top of one another. On the summit of the hill is a small but strong castle, from which a fine view may be obtained along the sea-coast and into the adjacent country, which is fertile and beautiful, abounding in olives, gardens, and citron groves. Parga has a harbour, defended by a small fortified island; and carries on a considerable export trade in oil, wine, fruit, and tobacco. It has played a part of some importance in history since the beginning of the fifteenth century. It maintained its independence, under the protection of Venice, from this period till the fall of the Venetian power in 1797, when it was for a short time garrisoned by the French. Ali Pasha, the governor of Albania, besieged it in 1814; and as the French would not defend them, the inhabitants applied for aid to the British, who took possession of the fortress. Parga was finally given up to Turkey by the treaty of 1817; but the inhabitants, not wishing to come under the Ottoman sway, migrated to Corfu and Paxo. The town was then occupied by the Turks. Pop. 4000.

PARHELIA. See CHROMATICS, METEOROLOGY, and OPTICS, part viii.

PARIA, GULF OF, an inlet of the Atlantic Ocean, on the coast of Venezuela, between the island of Trinidad and the mainland. Its form is nearly rectangular; and it is about 100 miles long by 40 broad. On the N. it is separated from the Caribbean Sea by a peninsula about 70 miles long, projecting from the continent, and terminating in Cape Punta de la Peña, or Paria. Between this headland and Trinidad, about 20 miles off, there are three rocky islands, forming four straits, the widest of which, called the Dragon's Mouth, lies nearest the mainland, and is about 6 miles across. A strong current runs northwards through all the straits, and the tides are also very powerful; so that ships can only enter with a strong breeze. The southern entrance, about 10 miles wide, between Cape Punta Icacos in Trinidad and the delta of the Orinoco, is so obstructed by a sand-bank as to leave only a narrow passage for ships. This channel is called the Serpent's Mouth. The depth of the gulf varies from 3 to 30 fathoms, and the anchorage is everywhere good; so that it forms one of the best harbours in the world.

PARIAN CHRONICLE. See ARUNDELIAN MARBLES.

PARIAS, or PARIAHS, a word derived from the name *Parriar* in the Deccan, is employed to designate one of the best known and the most degraded of the impure classes of the Hindus, amounting, it is said, to one-fifth of the whole population of Hindustan. They act as scavengers, porters, and hostlers, and generally sell themselves, with their wives and children, to the farmers, who treat them with the utmost severity. They belong properly to no caste, and are supposed to be descended from original occupiers of the soil of India, long since overcome by foreign invasion. They live apart from the other inhabitants, who hold them in great abhorrence, and subject them to the meanest and most degrading drudgery.

PARIMA, SIERRA, a chain of mountains between Venezuela and Brazil, extends in a S.W. direction from the western extremity of the Sierra Pacaraima, between N. Lat. 4. and 6. 30., W. Long. 64. and 67. They seldom rise higher than 1800 or 2000 feet from the sea; and many of the summits are only 500 or 600 feet in height. In geological structure, the base of the mountains is believed to be of granite, while trap and quartz rocks are also met with. Many of them are bare and rocky, or covered only with grass. The rivers Orinoco and Parima take their origin in this range; the latter flowing first E., then S., and falling into the Rio Negro, an affluent of the Amazon.

PARINI, GIUSEPPE, an eminent Italian poet, was born in the district of Bosisio, in the Milanese territory, in 1729. Although brought up in the midst of poverty, and compelled to earn a scanty livelihood by copying manuscripts, he cultivated his poetical faculty with distinguished success. In 1752 he published a volume of anacreontic poems, a book which showed a remarkable lyrical talent; and in 1763 he produced the first part of his *Giorno*, a work which described in a fine vein of irony the frivolous occupations and insipid amusements of an Italian nobleman's day, and which raised the author to the position of one of the greatest moral poets of his native country. This success was the means of placing Parini in several high public offices at Milan; and he was thus enabled to appear to great advantage in more characters than that of a poet. In the chair of belles lettres in the Palatine schools, and in the chair of eloquence in the College of the Brera, he proved himself to be a clear, precise, learned, and successful teacher. In the office of magistrate, to which he was appointed by Bonaparte, he also showed all the liberal-minded sagacity and cool intrepidity of one of the great citizens of classical times. The death of Parini took place in 1799. His works were published in 6 vols. 8vo, Milan, 1801-4; and in 2 vols. 8vo, Milan, 1825.

PARIS, the capital of France, situated on the river Seine, about 110 miles in direct distance from its mouth, in N. Lat. 48. 50. 49., E. Long. 2. 20. 15. It is in the department of the Seine, of which it is the chief town, and is distant about 210 miles S.S.E. from London, and 159 S.S.W. from Brussels.

Paris takes its name from the Parisii, a Gallic tribe, whose chief town, called by themselves *Loutouhezi* (*i.e.*, a dwelling surrounded by water), and by the Romans *Lutetia*, stood on the island now known as La Cité. It is first mentioned in history as the place where, in B.C. 54, Julius Cæsar convoked an assembly of the Gallic tribes. In the following year, when these tribes revolted under Vercingetorix, the Parisii were among the foremost to take up arms. Though they made a desperate resistance, and set fire to their city to save it from falling into the enemy's hands, they were finally subdued; and in the distribution of Gaul, were incorporated in the province of Lugdunensis Quarta. For 400 years after this date the name of Lutetia is hardly mentioned, except by the geographers. In A.D. 360 it became associated with the name of Julian the Apostate, who fortified the Ile de la Cité, and built on the mainland the Thermæ Juliani (a palace with baths, of which the extensive remains are still in excellent preservation), besides other edifices on both sides of the river. At this time, or even earlier, Lutetia was a bishop's see. According to one account, St Denis, the patron saint of France, suffered martyrdom at Paris about the middle of the third century. To the Romans succeeded the Franks, who, under Clovis, seized Paris in 494. Most of this monarch's successors fixed their abode there, and, having embraced Christianity, founded many churches and abbeys, and otherwise enlarged and embellished the town. Under the Merovingians, Paris rose to considerable importance, being regarded by the Salian or Neustrian Franks as the capital of their dominions. In 574 it was burned to the ground in a war waged by Sigebert, King of Metz, against his brother Chilperic, King of Soissons. By the princes of the Carlovingian line Paris was neglected, and its fortifications allowed to fall into decay. On this account, when it was attacked by the Northmen in 841, it fell an easy prey. Fifteen years later, the Normans again appeared before the ruined walls, and burnt some of the churches, holding the rest to ransom. In 861 a third invasion of these northern pirates, attended with the same results as before, showed the necessity of putting the town in a state of defence. This was done by Charles le Chauve, and so effectually, that when the Normans assaulted the city for the fourth time in 885, they were completely foiled, and only escaped destruction by concluding with Charles le Gros a treaty which cost that monarch his crown. The vacant throne was then offered to Count Eudes or Otho, in whose family it became hereditary in the person of Hugo or Hugues Capet in 987. This monarch chose Paris for his residence; and from that time the city became the capital of the kingdom of France. In the reign of Louis VI. (Le Gros), the Louvre was rebuilt, the Palais de Justice was commenced, and the fortresses of Le Grand and Le Petit Chatelet were constructed to command the bridges that joined the Cité with the mainland. The fame of Paris as a seat of learning began to spread, and many new streets were erected for the students who flocked thither in crowds. Ten men sufficed, however, to collect all the taxes; and the duties levied at the North Gate produced under Louis VI. only 12 francs a year, or about 600 francs of present money. A wall was thrown round these extended suburbs by Louis VII., whose successor, Philippe Auguste, enlarged the limits of the city by inclosing a wide sweep of ground with a new *mur d'enceinte*. The space thus inclosed was in course of time

covered with the churches and other religious establishments erected by St Louis between the years 1226 and 1270. Of these the only one that has survived is the Sainte Chapelle, now restored in more than its original splendour. In the reign of St Louis the bourgeoisie of Paris were confirmed in many important privileges, in return for the help which they afforded to the king against his rebellious barons. There was no recognised municipality in Paris at this time; but the guilds of merchants and traders, which had existed since the times of the Romans, were amalgamated by St Louis into a sort of municipality, sometimes called the *marchandise* or *hanse Parisienne*, whose chief, under the title of *prévôt des marchands*, exercised a wholesome judicial authority. One of his functions was to administer, in concert with the *prévôt de Paris*, the police of the city, which till this time had been very defective. In 1250 the Sorbonne was founded; and soon afterwards a hospital for the blind, a school of surgery, and a body of notaries were instituted. Under the successors of Louis the progress of the city was seen in the foundation of numerous colleges, abbeys, and churches, and the growing spirit of independence among the towns-people. In 1306 the citizens for the first time rose in arms against the king. They rebelled against the heavy taxation to which they were subjected by Philippe IV. (Le Bel). After a temporary success, the mutineers were quelled, and twenty-eight of the ringleaders were hanged. Philippe, however, found it convenient for the future to fill his coffers by means more popular than the taxation of his own subjects. Accordingly, Paris saw with scarcely a murmur the Jewish residents among them banished and robbed of all their property, and in the following year (1307) the cruel extirpation of the Knights Templars. In this reign, however, the streets and highways were improved, and some courts of law were established. During the absence of King John as a captive in England the peace of Paris was embroiled by the faction of the Maillotins under Etienne Marcel, prévôt des marchands, instigated by Charles le Mauvais, King of Navarre. Marcel, however, was slain by his own partizans; and the Dauphin, afterwards Charles V., quelled the mutiny. The faubourgs had meanwhile been considerably extended beyond the *mur d'enceinte;* and as they were threatened from time to time with attacks by the English, new walls and ditches, which it took sixteen years to complete, were drawn round them in 1367. Under Charles V., the Bastille and the Palais des Tournelles were built, and the Louvre enlarged and repaired. Charles V. was succeeded in 1380 by Charles VI., in whose reign the bridges of St Michel and Nôtre Dame were built in 1384 and 1414 respectively. In 1420, by the treaty of Troyes, Paris passed into the hands of the English. An unsuccessful attempt was made in 1429 by Joan of Arc to retake the city. A second attack, conducted by Dunois and the Count de Richemond, in 1436, had a different issue. The English garrison was surprised and put to the sword. A few men only, who took refuge in the Bastille, were allowed to escape with their lives. Under Charles and some of his immediate successors, Paris was desolated by war, pestilence, and famine, to such a degree that at one time it was seriously intended to transfer the seat of government to some healthier and safer city on the Loire. Such was the insecurity of life, that in the environs, and occasionally in the streets of the capital itself, numbers of people were destroyed by the wolves. So rapidly, however, did it recover from its disasters, that by the time of Louis XI., who came to the throne in 1461, the population was upwards of 200,000, and the city and the surrounding country were in such a flourishing condition that, in the words of Comines, "C'est la cité que jamais je visse entourée de meilleurs pays et plantureux, et est chose presque incrédible que des biens qui y arrivent." Louis XI. had an especial favour for Paris, and used to say, "Ma bonne ville de Paris, si je la perdais, tout serait fini pour moi." He encouraged trade and commerce to the utmost of his power, and set up in the Sorbonne the first printing-press that was established in France. Though neglected by the immediate successors of Louis, Paris continued to grow and prosper, and added to its old monuments some new ones of great importance, such as the Fontaine des Innocents, the Hôtel de Cluny, the churches of St Merry and St Eustache, and the College of France. Francis I. restored the fortifications and enlarged the circuit of the city, besides adorning it with some handsome public buildings. The old castle of the Louvre was demolished, and a new and splendid palace, which still remains, was erected on its site. The Faubourg St Germain, which had been destroyed in the wars, was restored, and the foundations of the Hôtel de Ville were laid. In 1563 the chateau and garden of the Tuilleries were formed by Catherine de Medici, and the enceinte enlarged so as to comprise them within its circuit. Paris was at this time regularly divided into sixteen quarters, and its administration was conducted by—1*st*, The *Prévôt de Paris*, appointed by the King, and having under him two lieutenants, one civil and the other criminal, who presided in the court of the Chatelet, with its twenty-four members; 2*d*, The *Prévôt des Marchands*, chosen by the trades, and assisted by thirty-two assessors; 3*d*, The *Garde Bourgeoise;* and 4th, The *Guet Royal*, consisting of 500 foot soldiers and three companies of archers or musketeers. These tribunals exercised their functions with great and often undiscriminating severity, yet were sometimes unable to make head against the bands of thieves, vagabonds, and beggars, who, to the number of fourteen or fifteen thousand, frequently combined to plunder and disturb the town. It was not till the time of Louis XIV. that the arm of the law was strong enough to put down these ruffians completely. In the religious wars of the sixteenth century, Paris suffered severely. The events that followed the massacre of St Bartholomew in 1588, the formation of the League, the *journée des barricades*, and the sieges sustained by the city from Henri III. and his successor Henri IV., destroyed great numbers of the inhabitants, and the streets and houses in which they dwelt. When the edict of Nantes restored peace to France, Henry had leisure to carry out his plans for embellishing the capital. The Pont Neuf, begun in the previous reign, was completed; the Hôpital St Louis was founded; the Place Royale, the Rue Dauphine, and some fine quais along the river, were laid out; the building of the Tuilleries, and of the galleries connecting that palace with the Louvre, was vigorously prosecuted; and the two westernmost of the islands in the Seine were united to that of La Cité. Under Louis XIII. many splendid structures were added to the city. The Palais Cardinal, now the Palais Royal, was begun by Richelieu, who also founded the Académie; the Luxembourg was commenced by Marie de Medici; the Jardin des Plantes was laid out by Labrosse, one of the royal physicians; the enceinte of the city was extended almost to the line of the present boulevards; the quais and bridges of the Ile St Louis were constructed; the Pont au Change was rebuilt; and a wooden bridge, now replaced by the Pont Royal, connected the quarter of the Louvre with the Faubourg St Germain, where many splendid hotels now began to rise. The police, though now a little better administered than of old, was still so badly administered that crimes and vices of the most hideous kind might be indulged in with impunity. During the supremacy of Mazarin, Paris was harassed by the never-ceasing outbreaks of the Frondeurs; and insurrections, barricades, and street-fighting recurred periodically. The distress occasioned by these feuds was such, that on one occasion in 1653 it was estimated that of the entire population of the city, then amounting to about 400,000 souls,

one-tenth was without any ostensible means of livelihood. As soon as he attained his majority, Louis XIV. began to carry out the plans of his father and grandfather. Eighty new streets were laid out, and many of the old ones repaired and embellished. Thirty-three new churches, besides chapels, were erected; while the Hôpital Général, or La Salpêtrière, afforded shelter to the homeless poor, and the Hôtel des Invalides to old or disabled soldiers and seamen. The observatory, the colonnade of the Louvre, and the Pont Royal were completed; and the Champs Elysées were planted. The palace of the Tuilleries was finished; and its gardens were laid out nearly as they now stand. The Place Vendôme and the Place des Victoires were formed; and the triumphal arches of St Denis and St Martin substituted in room of two of the old city gates. The ancient fortifications of the northern part of the city were demolished, and their site converted into a splendid succession of promenades. The streets were now for the first time lighted at night; the police was greatly improved, and the drainage and sewerage of the town received special attention. In 1710 the population of Paris amounted to 490,000 souls. Under Louis XV. the progress of the city was neither so rapid nor so great as under his predecessor. Some of the splendid streets in the faubourgs St Honoré and St Germain were opened in his reign; the Palais Bourbon, now the seat of the Legislative Assembly, the Panthéon, or church of St Geneviève, the Mint, and the École Militaire were founded; the Place de la Concorde was laid out; and the porcelain manufactory at Sèvres established. The peace of the city was during this reign never broken by such feuds as had troubled it in past ages. Some slight tumults resulted from the general distress that followed the bursting of the Mississippi bubble, and the other financial schemes of Law, but they were easily suppressed. Louis XVI. continued the Pantheon and began the Madeleine, and other less important churches. The Français, the French, Italian, and comic opera-houses, and some minor theatres, rose in rapid succession. Many new fountains were opened, and the water of the Seine was distributed through various parts of the city by means of steam-engines erected on its banks; the enciente of the capital was again extended, and some villages, such as Chaillot, Roule, and Monceaux, formerly beyond the walls, were now incorporated with the city. The Palais Royal, diverted from its original use, was parcelled out into shops, and the gardens inclosed in its quadrangle were thrown open as places of public recreation. The population of Paris at this time, according to Necker, amounted to about 620,000. The reign of Louis XVI. was inaugurated with bread riots, forecasting the more terrible events that were speedily to follow. The history of Paris during the Revolution becomes a history of the Revolution itself, all the leading events and ideas of which originated in the capital. On the 14th July 1789 the Bastille was taken and destroyed. The sufferings of the people from famine during the ensuing months led to almost daily riots, in which many lives were lost. In the October of this year the king, then living at Versailles, was brought in triumph to Paris by the mob, and the National Assembly likewise transferred its seat to the capital. Order was not restored till martial law had been proclaimed; but despite the utmost exertions of the authorities, *émeutes* were constantly taking place during the next two years. On the 20th June 1792 the mob rose and attacked the Tuilleries, where the royal family was then residing; on the 10th August of the same year the attack was repeated, and the Swiss bodyguards of the king were slain to a man: Louis himself was deposed and confined a prisoner in the Temple. On the 2d of September 1792 the mob rose, broke open the prisons, and murdered all the inmates, to the number of about 5000. The National Convention supplanted the Assembly, and the doctrines of the Mountain became rampant. On the 21st of January 1793 Louis was executed on the guillotine which had been set up in the Place Louis XV., or, as it is now called, de la Concorde; and when the "Reign of Terror" was inaugurated, on the overthrow of the Girondist party in the Convention, and the supremacy of the Clubs, executions took place daily to the number of fifty or sixty, sometimes even of a hundred. After a time, the guillotine was removed from the Place Louis XV. to that of the Bastille, and thence to the Place du Trône, where it remained till brought back to its original site for the decapitation of Robespierre and the leading terrorists. Before the Convention gave place to the Directory, it had introduced some important reforms,—abolished the commune of Paris; silenced the Clubs, or reduced them to order; and organized the Bureau des Longitudes, the Polytechnic School, and the Institute of France. The Directory maintained itself in power from 1795 till the revolution of the 18th Brumaire (8th November 1799) left Napoleon virtually master of France. In the course of twelve years, as first consul and emperor, the new ruler of France expended upwards of four millions sterling on the extension and embellishment of the capital. Three new bridges were built over the Seine; three great cemeteries were formed beyond the walls, and five abattoirs constructed; many new fountains and markets were opened in different parts of the city; the quais were extended along the banks of the river; and a number of new and handsome streets were begun. The churches destroyed during the Revolution were restored, many of them in more than their former beauty. On the abdication of Napoleon in 1814, Paris fell into the hands of the allies after a gallant defence by the garrison, the National Guard, and the students of the Polytechnic and Veterinary Schools. The events that followed Waterloo and the final deposition of the emperor again gave up Paris into the hands of the stranger, but on neither of these occasions was much damage done to the city. The Prussians had made arrangements for blowing up the Pont de Jéna, but were prevented from carrying out their design by the firmness of the Duke of Wellington. Louis XVIII. entered Paris on the 8th of July 1815, and the old Bourbon line was reinstated on the throne of France. He carried out many of his predecessors' plans; built three new bridges and three churches, and greatly improved the lighting and cleansing of the metropolis. During his reign Paris enjoyed almost undisturbed tranquillity. The only *émeute* that occurred took place in 1827, on the occasion of an election of deputies to the Chamber. Barricades were erected, but the troops proved faithful to the king, and the insurrection was put down with little loss of life. Subsequent attempts to renew it proved equally abortive. Charles X. was less lucky or less prudent than his brother. On the 27th of July 1830 he published the famous ordinances, suppressing the charter of 1814, annulling elections, and abolishing the liberty of the press. Instantly the Parisian people were up in arms. Four thousand barricades were raised; the Swiss guards, and the gendarmerie under Marshal Marmont, fought desperately for a time, but failed to make head against the mob. The troops lost about 400 men in killed and wounded; the insurgents 783 slain, and 4500 put *hors de combat*. In honour of these patriots, a monumental column, with their names inscribed in letters of gold, was erected in the centre of the Place de la Bastille. Their bodies were deposited in vaults beneath the column, which was completed and solemnly inaugurated on the 28th July 1840. The Orleans branch of the family succeeded to the throne in the person of Louis Philippe. The new sovereign was fortunate enough to escape all the repeated attempts to assassinate him, and lived to complete numerous works of great beauty and importance. Among those which he finished may be men-

tioned the churches of the Madeleine, St Vincent de Paul, Nôtre Dame de Lorette, and St Denis; the Hôtel de Ville, and the triumphal Arc de l'Etoile. The Place de la Concorde was remodelled, and adorned with splendid statues and fountains, and an interesting obelisk of great size brought from Luxor in Upper Egypt. Some of the old quais were widened, and new ones were built and planted with trees. Gas was introduced into the town, and vast works were undertaken for the drainage of the streets. The greatest and most costly, however, of all the public works were the fortifications of Paris. The whole of the city and its faubourgs were surrounded with a fosse and a high rampart, commanded along their whole line by fourteen detached forts, some of them of great size and strength. The cost of these works exceeded twenty millions sterling. Till the year 1848, Louis Philippe's reign secured peace and prosperity to Paris and to France. Some of his later acts, however, rendered him very unpopular; and when, in 1848, he obstinately opposed the movement for electoral reform, the mob rose, and the army eventually sided with the people. Louis Philippe abdicated in favour of his grandson, the Count of Paris; but it was too late. A democratic republic was proclaimed, and a constituent assembly convoked to draw up the constitution. The extreme party, the Red Republicans as they were called, disgusted with what seemed to them the too conservative spirit of the new government, began to embroil the public peace by their violent teaching of the wildest doctrines of socialism. Clubs were formed which, by the 15th of May, became strong enough to seize the Hôtel de Ville and establish a provisional government of their own. The leaders of the movement were arrested and thrown into prison; but new leaders appeared; and on the 23d of June the civil war broke out. The eastern half of Paris was in the hands of the insurgents, who threw up barricades in all the great thoroughfares, some of them exceedingly strong and scientific in their construction. For three days—the 24th, 25th, and 26th of June—a bloody combat was fought, and with doubtful issue, till the arrival of the artillery decided the action in favour of the government forces under General Cavaignac, who had been nominated dictator by the Assembly. The lives lost during the insurrection amounted to at least 15,000, and the sums paid by the city to compensate for the destruction of property amounted to L.223,945 sterling. In the canvass for the presidency of the new republic, Louis Napoleon Bonaparte proved the successful candidate. During his term of office no outbreak occurred; but Paris and France were agitated by the intrigues of all the parties and factions that had lately believed themselves entitled to a share in the administration. Towards the close of 1851 an attempt was made in the Chambers to encroach on the powers of the president, who had made himself highly popular with the army and the mass of the peasantry. Accordingly, on the 2d December Louis Napoleon declared Paris in a state of siege, dissolved the Legislative Assembly, and restored universal suffrage. He then appealed to the people, offering himself as candidate for a ten years' presidency. He was appointed by a majority of about seven millions and a half of affirmative votes. On the anniversary of the *coup d'étât*, which had been effected with much less bloodshed than usually attends such changes of government in France, he was promoted, or promoted himself, to the higher dignity of emperor of the French, under the title of Napoleon III. The public works that mark his reign far surpass in number and splendour all the achievements of his predecessors. The Louvre has been completed on a style of almost unparalleled grandeur, and joined to the Tuilleries; the Rue de Rivoli has been prolonged to the Hôtel de Ville; many new streets, some of them hardly inferior to it in point of splendour, have been opened up; the tomb of Napoleon I., in the Hôtel des Invalides, has been finished, and the Ste. Chapelle restored; a railway has been formed, encircling the city, and connecting all the lines that issue from it; the Champs Elysées and the Bois de Boulogne have been splendidly embellished. Other works are either contemplated or are already in progress, which, when carried out, will have remodelled to a great extent the entire aspect of the city.

The circumference of Paris is now 25,978 yards, or upwards of $14\frac{1}{2}$ miles. Its area at different times is shown in the subjoined table:—

Under Julius Cæsar	B.C.	56	37 acres.
„ Philippe Auguste	A.D	1211	625 „
„ Charles VI.	„	1383	1084 „
„ Henri III.	„	1581	1193 „
„ Louis XIII.	„	1634	1403 „
„ Louis XIV.	„	1686	2728 „
„ Louis XV.	„	1717	2809 „
„ Louis Philippe	„	1848	8708 „

The last official measurement gives the area of the city as 35,240,000 square mètres, equal to 42,150,640 square yards, or 8710 acres.

The plain in which Paris stands is about 60 mètres above the level of the sea, and is surrounded in its entire circumference by a range of low hills. The heights inclosing the northern and more considerable part of the town skirt the shore of the Marne above its junction with the Seine, sink between Rosny and Montreuil, rise again in the plateau of Belleville, disappear altogether in the plain of St Denis, attain in the hill of Monmartre, one of their most elevated points, an altitude of 295 feet above the river, cross the plain of the Batignolles, and terminate in the slopes of Passy and Chaillot. The southern, like the northern portion of the city, is pretty nearly semicircular. The hills that screen the southern portion of the city are less high than those which inclose the northern. Almost level at the eastern extremity of Paris, the ground rises with a gentle slope into the plateau of Ivry and the hill of Cailles, where it is intersected by the Bièvre. Passing that little stream, the first eminence to be seen is the Mont Ste. Geneviève, behind which extends the plateau of Montrouge, from the western end of which rise the slight elevations commanding the barriers of Maine and Mont Parnasse. Between Vaugirard and the river lies the level plain of Grenelle. Beyond these rising grounds, and at a distance of from 3 to 5 miles S. and W. of the city is a ridge of hills with several points of considerable height. Of these may be mentioned, Villejuif, Meudon, St Cloud, and Mont Valérien. The inner range of hills, encircling the southern part of the city, furnished the stone from which much of Paris was built. These old quarries are now built over, the excavations serving as catacombs, into which, when the intramural cemeteries were cleared in 1786, the bones of at least three millions of persons were thrown. The Seine enters the city at Bercy, and leaves it at Passy, the distance between these points by the river-course being nearly five English miles. About half-way the river flows round the two islands of St Louis and La Cité, the three other islets which formerly existed at this spot being now incorporated with one or other of these, or with the mainland. From Bercy to Passy there is an unbroken line of quais on both sides of the stream. The breadth of the Seine at the Pont d'Austerlitz is about 182 yards; at the Pont Neuf, 288 yards; and at the Pont de Jéna, 149 yards. The mean velocity of the water is 20 inches a second. In summer it is sometimes so low as to be fordable; in winter it rises high, has a very rapid current, and sometimes does great damage by overflowing its banks. Numerous barges, laden with firewood, coals, &c., unload at the wharves; and small steamboats for the local traffic, and occasionally a sea-going vessel or two, are to be seen plying on the Seine. No impurities are allowed to pollute its waters, the sewerage of the city being otherwise disposed of. Floating wash-houses, and

bathing and swimming schools, stud the surface in great numbers. The river communicates with the Loire by the canals of Briare and Orleans, with the Somme and Scheldt by the canal of St Quentin, and with the Saône by that of Bourgogne.

It was long a favourite scheme of the French kings to fortify the capital; and in 1841 a grant of 140 millions of francs was voted to Louis Philippe for the purpose. The fortifications, as they now stand, consist of two parts,—1*st*, A continuous enceinte, bastioned and terraced with 10 mètres revetment; and, 2*d*, Seventeen detached forts, besides occasional detached trenches. The ditch has an average depth of 20 feet, and a breadth of from 60 to 165 feet. The crest of the parapet is 14 mètres above the bottom of the ditch. Military roads connect all the forts with Paris and with each other. The enceinte embraces within its sweep the whole of the capital and its faubourgs. The seventeen detached forts are,—Fort Charenton, Nogent, Rosny, Noisy, Romainville, d'Aubervilliers, De l'Est, Couronne du Nord, Fort de la Briche, Fort du Mont Valérien (with strong bomb-proof casemates and large barracks), Fort de Vanvres, D'Issy, Montrouge, Bicêtre, Ivry, Lunette de Stains, and Fort de Rouvray. The inner wall of Paris is quite unconnected with the defence of the city. It is pierced by fifty-six gates or barrières, at which the octroi, or local dues on taxable articles entering the capital are levied. Of these barriers, the handsomest are those of Neuilly, Du Trône, St Martin, Fontainebleau, Chartres, and Passy. A series of broad roads, planted with fine rows of trees, runs round the outside of this wall, and forms the external boulevards. The wall itself, begun in 1787, but not completed till the time of Napoleon I., comprises the majority of those quarters or suburbs which, from lying beyond what was at the time the city proper, are called faubourgs. Of the faubourgs embraced within the octroi wall, the chief are, on the north side of the river, those of St Honoré and the Roûle on the N.W.; Chaussée d'Antin, Montmartre, Poissonnière, St Denis, and St Martin on the N.; the Temple on the N.E.; and St Antoine on the E. On the other side of the river are those of St Victor on the S.E.; St Marcel, St Jacques, and St Michel on the S.; St Germain and Gros Caillou on the S.W. Beyond the sweep of the octroi wall are the faubourgs of Auteuil, Passy, the Batignolles, La Villette, Belleville, Ménilmontant, Charonne, Bercy, Montrouge, Vaugirard and Grenelle.

Paris is bisected by the Seine. In the northern, which is the newest and most important part of the city, the streets run for the most part either parallel with the river or at right angles to it. The great arteries are the quais, the Rue St Honoré, and the Boulevards. In the Cité no plan seems to have been observed in laying out the streets and houses. But the changes of the last ten years have swept away or greatly altered the Cité of the middle ages, which had survived till that time. The houses, as in every part of Paris, were built of stone, and were generally from five to eight storeys in height. The streets were so narrow that a person walking in the middle of them, with arms outstretched, could in many cases touch the houses on either side at once. At night they were either not lighted at all, or were illuminated by the dingy *réverbères*, which, during the revolutions, were so often used as a gallows. Most of these old streets have in late years been pulled down. Wherever practicable, foot pavements have been laid, gas introduced, and the gutter transferred from the centre to the sides of the streets. Similar improvements have been effected, where required, in the streets of less ancient date on both sides of the river. The lighting of Paris is now effected by 1595 oil and 14,000 gas lamps, fed by 1,464,236 feet of pipes, and supplying nearly 560,000 cubic feet of gas. During six months all the lamps are lighted every night; and during the remainder of the year a certain number for part of the night. The northern boulevards, occupying the site of the fortifications demolished by Louis XIV., are now planted on both sides of the way with rows of trees, and constitute the most brilliant part of the city, from the size and elegance of the houses and the splendour of the shops and restaurants, which adorn them in a continuous line from the Madeleine to the Place de la Bastille. The stone used in building the houses is the marine limestone (*calcaire grossier*), found abundantly in the Paris basin; and as the inhabitants are bound by law to scrape, paint, or whitewash their houses once every two years, the general aspect of the city is always clean and gay. The sweeping of the streets costs the city a million and a half of francs yearly, and is effected by 2500 scavengers of either sex. More than L.120,000 sterling are annually spent in repairing the streets and pavements; and during the last fifty-five years more than L.8,000,000 sterling have been spent in widening them.

Except the Place de la Concorde, none of the "places," or public squares of Paris, are memorable for their size, though several of them are remarkable for their beauty. The Place de la Concorde connects the garden of the Tuilleries with the Champs Elysées. The centre of it is believed to furnish the finest *coup d'œil* in Europe. Looking towards the east, the eye falls first on the palace of the Tuilleries, facing which, at a distance of about three-fourths of a mile, stands the noble Arc de Triomphe de l'Etoile; another vista discloses the magnificent church of the Madeleine, confronted by the hall of the Chamber of Deputies. The "Place" itself is splendidly decorated. Eight thrones, supporting eight figures, representing the principal cities of France, besides numerous groups of statuary, encircle it. In the centre stands the famous obelisk of Luxor, marking the site of the guillotine during the first revolution. Two of the largest and finest fountains in the world play during the greater part of each day. The most noteworthy of the other places are the Place des Victoires, with its fine statue of Louis XIV., the Place Royale, the Place du Trône, and the Place Vendôme. In the last-named of these stands the Colonne Vendôme, erected by Napoleon to commemorate his victories in the German campaign of 1805. The pillar is an imitation of Trajan's Column at Rome, and is 135 feet high, with a diameter of 12 feet. The bas-reliefs of the shaft, cast out of 1200 pieces of Austrian and Russian cannon, comprise 2000 figures, in a spiral scroll 840 feet long. The pillar is now surmounted by a bronze statue of the first Napoleon, 11 feet high. The total cost of it was L.60,000 sterling.

The public buildings of Paris are so numerous and so interesting that to dwell upon or even enumerate all that deserve, and in fact require notice, is impossible. Perhaps the most important in the history of Paris, especially during the last seventy years, is the palace of the Tuilleries, the official residence of the reigning monarch. It takes its name from the tile-fields on the site of which it stands, and was founded by Catherine de Medici in 1564. It was enlarged by Henri IV., and again by Louis XIII., who left it externally very much in the condition in which it now stands. The façade is 330 yards in length, and 36 in breadth. The columns of the lower storey of the central façade are Ionic; those of the second, Corinthian; of the third, composite. Though not a beautiful building, its size and its peculiar lofty roof and chimneys, are very impressive. The internal decorations are in a style of splendour which it is difficult for any who has not seen to conceive. Both the galleries connecting the Tuilleries with the Louvre are now complete; that on the south is nearly 1500 feet in length, and contains a magnificent collection of paintings of the French, Dutch, German, and Italian schools. The Louvre itself, once a royal residence, is now used as a repository for the art treasures of the National

Museum, and contains vast and well-arranged collections of Greek, Roman, Egyptian, and Assyrian antiquities; many masterpieces of the leading painters and sculptors of most ages and countries; and a museum, in which are preserved models of the most important arsenals, ships, and forts, and everything, in short, connected with the maritime defences of the country. It consists of two parts—the old Louvre, designed by Claude Perrault, and the new Louvre, by Visconti. The old Louvre is nearly a square, 576 feet in length by 538 in breadth, and inclosing a quadrangle of 394 feet square. Its eastern façade, looking towards the church of St Germain l'Auxerrois, is a colonnade of twenty-eight coupled Corinthian columns, and is justly reckoned one of the finest pieces of architecture of any age. The new Louvre consists of two vast lateral piles of buildings, projecting at right angles from the two parallel galleries which join the old Louvre with the Tuilleries, and forming the eastern boundary of the Place du Carrousel. Turning into the Place Napoleon III., they present on each side a frontage of 590 feet, intersected by three sumptuous pavilions. These vast structures are intended to accommodate the minister of state, the minister of the interior, and the library of the Louvre. Some of the galleries on the upper storeys are to be set apart for permanent and annual exhibitions of the works of living artists. The Tuilleries and the Louvre, both now completed and harmonized, may be regarded as forming together a single palace, of a magnitude and splendour to which a parallel can nowhere be shown. The total space covered or inclosed by the entire structure amounts to nearly 60 English acres. The money expended on the new works already exceeds a million and three-quarters sterling; and large additional sums will be required for the decorations that remain to be introduced.

The Palais du Luxembourg, now the Palais du Sénat, in the southern portion of the city, was built in 1612 for Marie de Medici, on the model of the Pitti Palace in Florence. It is a handsome edifice, consisting of a centre and two wings, connected by terraced arcades. At the revolution of 1789 it was converted into a prison, and afterwards was called successively Palais du Directorie, Palais du Consulat, and Palais du Sénat. At the restoration it became the Chambre des Paires, and since 1852 for the second time Palais du Sénat. A fine collection of the masterpieces of modern artists adorns one of the galleries of the Luxembourg. The gardens attached to the palace are extensive and beautiful. A broad avenue of great length leads from the Luxembourg to the Observatory. A bronze statue, erected in 1854, marks the exact spot in this avenue where Marshal Ney was shot on the 7th December 1815. The Hôtel des Invalides also, on the southern side of the Seine, was founded by Louis XIV., in 1670, for old or disabled soldiers and sailors. Additions have been made to it from time to time, till it now covers 16 acres of ground, inclosing 15 courts, and is capable of accommodating 5000 inmates. The ordinary number of inhabitants is between 3000 and 4000. Attached to the hotel is the church, with its beautiful double dome, 173 feet high, surmounted by a graceful lantern-globe and cross. The height to the top of this cross is 323 feet. Under the dome is the tomb of the Emperor Napoleon I. This, the most superb mausoleum in the world, was designed by Visconti, and cost from first to last about L.360,000 sterling. A little further down the river is the Champs de Mars, oblong in form, and 2952 feet long by 1476 broad. It was in this plain that the Fête de la Fédération was held on the 14th July 1790. Here, too, Napoleon held the famous Champ de Mai before the battle of Waterloo. The Champ de Mars is now used for reviews and races. At its southern extremity stands the École Militaire, now a barrack.

At the southern end of the bridge connecting the Place de la Concorde with the Faubourg St Germain stands the Palace of the Legislative Body, formerly the Chamber of Deputies, the façade of which, built in 1804, consisting of twelve Corinthian columns that rest on a broad flight of twenty-nine steps, and support a triangular pediment, measuring 95 feet at the base and 17 feet high, is much admired. A little way up the river stands the Palais du Quai d'Orsay, a magnificent structure begun by Napoleon I., but not completed till the time of Louis Philippe. It was designed as a palace for the exhibition of the products of French industry, but is now used by the Council of State. Separated from the Palais d'Orsay by an intervening street, is the Palais de la Légion d'Honneur, also a fine building, though externally somewhat insignificant. Still higher up the river, and on the quai opposite the Louvre, stands the Palais de l'Institut, occupying the site of a college founded by Cardinal Mazarin, and containing two valuable libraries—the Bibliothèque Mazarine, with 150,000 printed books and 3700 MSS.; and the Bibliothèque de l'Institut, with about 100,000 printed books. The latter library is especially rich in scientific books, both French and foreign, and possesses the transactions and periodicals of almost every scientific association in the world. East from the Palais de l'Institut, and close beside it, is the Hôtel des Monnaies, or Mint. The façade of this edifice fronting the Quai Conti is 360 feet long, with an elevation of 76 feet; that towards the Rue Guénégaud is 348 feet in length. The Mint is far from handsome externally, but is interesting for its extensive and admirably arranged collection of coins and medals. The coining-machines, eleven in number, are singularly ingenious in their structure, and when worked all at once, produce coin to the value of a million and a half sterling a day. Still further east, on the opposite bank of the river, stands the Hôtel de Ville, the residence of the Prefect of the Seine, and the meeting-place of the municipality of Paris. This handsome edifice was founded in 1533, but not completed till many years later. During the revolution of 1789 it suffered great damage. In 1837 it was restored and extended to about four times its previous size. As it now stands, it is a rectangle, with a handsome pavilion at each angle, and two more in the eastern and western facades, the latter of which, as the principal façade of the building, is adorned besides with an elegant belfry over the great central doorway. The reception-rooms of the Hôtel de Ville are decorated with a taste and brilliancy unsurpassed in any even of the imperial residences of France. They form a circuit of about half a mile, and require for their complete illumination 9714 tapers and 2389 gas-burners. They can accommodate 7000 visitors at once without discomfort.

The ecclesiastical edifices of Paris are, in magnitude and splendour, worthy of the general palatial aspect of the city. Conspicuous among them in point of architectural beauty, as well as of historic interest, is the cathedral of Nôtre Dame on the Ile de la Cité. This superb temple was begun about the year 1000, and completed in 1312, and exemplifies the Gothic architecture of the intervening centuries in its noblest form. It is a regular cruciform, with an octagonal eastern end. The western façade is flanked by two lofty square towers, intended for spires, which, however, have never been built. The interior consists of a nave and choir, with double aisles and lateral chapels between the outer buttresses. The building is 390 feet in length, 144 feet wide at the transepts, and 102 feet from the floor to the vaulting of the roof. The towers are 204 feet high, and the western front is 128 feet in length. The nave is 255 feet long by 39 broad; the roof, made of chesnut timber, is 356 feet in length, and rises 30 feet above the internal vaulting. The chapels are adorned with many impressive pictures; and the sculptures, both external and internal, are quaint and striking. Totally different

in kind, but equally splendid with Nôtre Dame, is the church of the Madeleine, at the extreme western end of the northern boulevards. It was begun in 1764. The works were slowly progressing, when, after the Prussian campaign, Napoleon determined to convert it into a Temple of Glory to commemorate the exploits of his armies. His abdication frustrated this design; and in 1815 Louis XVIII. restored it to its original destination. It was completed in the reign of Louis Philippe at a total cost of L.523,160 sterling. The Madeleine is the finest reproduction in modern times of any ancient model. Its archetype was the Parthenon at Athens, which, however, it greatly surpasses in size. The Parthenon was only 228 feet long by 100 broad. The Madeleine stands on an elevated platform 418 feet in length, and is 328 feet long by 138 broad. It is reached by a flight of 28 steps, and is surrounded by a colonnade of 52 Corinthian columns, 15 on each side; 14 on the southern portico, and 8 in the northern. The entablature, ceiling, and pediment of the colonnade are lavishly adorned with sculpture. The decorations of the interior are very splendid, but their effect is better suited for an opera-house or a picture gallery than a Christian temple. In a totally different style of architecture is the Panthéon, which, a few days after the *coup d'étât* of 1851, Louis Napoleon restored to ecclesiastical uses and to its original name of the church of Ste. Géneviève. The Panthéon is cruciform, and from the centre of the cross springs a lofty circular drum surrounded by a peristyle of 32 Corinthian columns. Above rises a splendid dome, the highest point of which is 268 feet above the pavement. The portico is composed of 22 fluted Corinthian columns 60 feet high, supporting a pediment 120 feet long and 24 in height. The sculpture in the pediment, by David, represents the genius of France surrounded by the great men of the nation. On the frieze beneath is inscribed in gold letters—"Aux grands hommes la Patrie reconnaissante." The total length of the building, including the portico, is 352 feet; interior length from east to west, 295; length of the transept, 265 feet; uniform breadth, 104 feet. The remains of Voltaire and Rousseau were removed to the Panthéon in 1791, but were secretly taken away during the Restoration. Among the illustrious dead buried in the vaults are Lagrange the mathematician, Bougainville the navigator, the Dutch Admiral de Winter, Soufflot the architect of the church, and Marshal Lannes. Mirabeau and Marat were also interred here, but their remains were afterwards removed. The Panthéon was begun in 1764 by Louis XV. and afterwards restored by Louis XVIII. It has cost in all about a million and a quarter sterling. Close to the Panthéon is the church of St Etienne du Mont, with a very beautiful interior. Of the other Parisian churches, the handsomest are St Sulpice near the Luxembourg, the two towers of which are used as telegraphic stations; St Vincent de Paul, in the N.E. corner of Paris, one of the finest churches in the city; St Eustache, lately restored with great splendour; and St Roch, both noted for their musical services; Nôtre Dame de Lorette; St Germain des Près; and St Germain l'Auxerrois, opposite the eastern front of the old Louvre, interesting for its curious frescoed portico, and as the church from the belfry of which the signal was given for the massacre of St Bartholomew, August 23, 1572.

The hospitals and benevolent institutions of Paris are very numerous. The hospitals are of two kinds—general and special; and besides these there are hospices, analogous to the English alms-houses. The total number of beds in these establishments is at present 17,469. The oldest and most important of the hospitals is the Hôtel Dieu, on the Ile de la Cité, close to Nôtre Dame. It is known to have been in existence in the twelfth century, and was subsequently much enlarged in the reigns of Henri IV. and Louis XVI. At present it contains 850 beds, and gives relief to about 12,000 patients annually. The mortality is 1 in 18. The next in importance are the hôpitals Lariboisière, de la Pitié, de la Charité, Beaujon, St Antoine, Necker, and Cochin. Of the hospices, the most important are those des Ménages, des Enfants Trouvés, des Orphelins, des Incurables, and the Bicêtre. The civil hospitals are managed by the Administration of Public Assistance; the military, three in number, are under the control of the staff of the garrison of Paris. The incomes of the civil hospitals are derived from legacies and donations, from the tax of 10 per cent. of the sums received at theatres and other places of amusement, a tax on cemeteries, a portion of the octrois of the city of Paris, and of the profits of the Mont de Piété. In 1856 the number of patients treated in the hospitals amounted to 94,774; of those treated at their own homes, 32,584. Relief in money was given to 40,474 sick persons, and in kind to 172,842. In that same year the revenue of the hospitals and hospices amounted to L.625,133, and the expenditure to L.662,463. The average of the mortality in the general hospitals was 1 in 10·82, and in the special 1 in 13·25; in the hospices, 1 in 7·99. Two hospitals have lately been founded by Napoleon III. for workmen disabled at the great public works. Besides the hospices and hospitals, there is a vast number of charities, both lay and clerical. There are also 13 asylums and houses of retreat for the blind and for deaf-mutes. Crêches or public nurseries are established in different parts of Paris. Poor women who work in factories or out of doors deposit their children in the crêche as they go to their work in the morning, return to feed them at certain hours of the day, and carry them home at night. There are 18 such institutions in Paris.

Of the public commercial establishments of Paris, the handsomest is the Bourse, begun in 1808, and completed in 1826, at a cost of L.325,960 sterling. It is a parallelogram of 212 feet by 126, surrounded by a peristyle of 66 Corinthian columns, the effect of which is exceedingly graceful. The Banque de France is a very plain building; (for its administration and history see article MONEY, section x.) The Halle au Blé, or corn-market, is a vast circular building, begun in 1763, and finished in 1767. The Halle aux Vins is an immense inclosure on the S. bank of the Seine, with an area of 31,100 square yards. The warehouses and vaults have room for 400,000 casks. The other wholesale markets are the Halle aux Draps and the Halle au Cuir. The Mont de Piété was created in 1777 for the benefit of the hospitals, and has the exclusive right of lending money on moveable effects, at the rate of 9 per cent. a year. There are 45 branches of the establishment in France. In 1857 the number of pledges was 3,400,087, representing a value of L.1,956,890. The savings-bank (Casse d'Epargne et de Prévoyance), was founded in 1818. In 1855 the number of depositors amounted to 228,985, the receipts to L.981,595, and the payments to L.934,036.

There are 24 retail markets in Paris, and the number of the merchants who trade in them is about 9000. The finest are the Marché St Germain, the Marché des Innocents, with its beautiful fountain, and the new markets beside the church of St Eustache. The excellent abattoirs of Paris are 5 in number, and were finished in 1818 at an expense of L.660,720. Three of them are on the N. side of the river, those, namely, of Montmartre, Popincourt, and the Roule; on the southern side are those of Villejuif and Grenelle. The first two have 64 slaughter-houses each; that of Grenelle 48; the other two, each 32.

The population of Paris was estimated in 1798, at 640,000; in 1802, at 672,000; in 1806 it was 580,609; in 1817, 713,966; in 1827, 890,431; in 1836, 909,126; in 1846, 945,721; in 1856, 1,174,346. In 1856, the date of the last census, the number of births for that year was

37,697, of which 19,110 were male, and 18,587 female; 25,948 were legitimate, and 11,749 illegitimate. Of the latter class, 2522 were legitimized after birth. The number of marriages that took place in 1856 was 12,493; in 10,177 of which neither party had been previously married; in 1268 the male, and in 597 the female; and in 461 both had been previously married. The total number of deaths was 29,950, of which 14,755 were males, and 15,195 females; 11,072 died in the various hospitals, 152 in the prisons, 361 were deposited in the morgue, and one was executed. Of the males, 9522 were unmarried, 3772 married, and 1150 widowers; of the females, 8672 were unmarried, 3737 married, and 2736 widows.

The ordinary revenue of Paris for 1858, derived from the octroi, the markets, abattoirs, ground-rents, &c. amounted to L.2,781,537; the extraordinary to L.65,000; making a total of L.2,846,537. The ordinary expenditure for the same year amounted to L.1,675,902; the extraordinary to L.1,208,484; making a total of L.2,884,386. The largest item in the expenditure is for the interest of the municipal debt, L.656,268; the next largest is for the prefecture of police, L.516,645. The municipal debt amounted in 1855 to L.5,137,719.

The details of the principal articles of consumption in Paris, as furnished by the last official returns (for 1856) are as follows:—Wine, 22,986,828 gallons; brandy, spirits, and liquors, 1,675,511 gallons; cider, 421,180 gallons; vinegar, 500,000 gallons; beer, 6,396,305 gallons; olive oil, 140,229 gallons; other kinds of oil, 2,546,025 gallons. The weight in pounds of the food consumed during the same year was as follows:—Beef and mutton, 151,943,094; veal, 4,023,774; pork, 20,688,447; hams and sausages, 2,940,702; charcuterie, 2,182,832; suet, 4,306,576; salt, 15,228,064; cheese, 3,974,804; poultry, game, rabbits, &c., 2,633,685; butter, 6,926,262; eggs, 3,787,243; fish of all kinds, 161,236; grapes, 7,745,526. The total value of these articles is estimated at about L.14,000,000 sterling. The wine represents a value of about L.2,000,000 sterling; milk, rather more than L.750,000; groceries, upwards of L.3,000,000; bread, L.1,520,000; meat, L.1,600,000; vegetables, about L.600,000. The number of bakers, as fixed by law, is 601; of butchers, 500; of restaurateurs, 1720; and of wine and spirit dealers, 3182.

The trade of Paris is very extensive. In the variety and importance of its productions it is surpassed by few cities in the world. The special exports of the city were valued in 1837 at L.3,760,000; in 1847, at L.6,742,887; in 1848 (a year of revolutions), at L.6,120,000; in 1851, at L.8,800,000; and in 1852, at L.8,860,000. The average, calculated on the last sixteen years, gives a yearly value of L.4,640,888. The number of trades in the city is 325, carried on by 65,000 masters, 205,000 workmen, 112,800 women, 16,600 boys, and 7700 girls. The trades connected with dress produce nearly 10 millions sterling a-year; those with food about 9 millions; those with building about 6 millions; furniture about 5½ millions; jewellery about 4 millions; bronze about a million; basket-making, &c., nearly as much; hats three-quarters of a million; and gloves more than half a million. The looms engaged in the shawl trade are 752 in number; the manufactories of haberdashery are 999; there are 879 millinery shops, 225 ready-made clothes shops, 653 stay-makers, 644 hatters, 1915 cabinetmakers, 222 carvers, 519 upholsterers, 141 paper-stainers, 120 mirror-makers, and 450 decorators.

The history and statistics of the university of Paris are given in the articles FRANCE and UNIVERSITIES. The students attending the various faculties number about 6500. Of the schools and lycées, the most important are,—The Collége Impérial de France, with a staff of 28 professors; the Musée Impérial d'Histoire Naturelle, with 17 professors; the Conservatoire des Arts et Métiers, for the technical education of artizans, with 14 professors; the École Normale, with 18 professors and 80 students; the Lycée Louis-le-Grand, with 42 professors, 370 boarders, and 500 day scholars; the Lycée Napoleon, 18 professors and 350 boarders; the Lycée St Louis, 45 professors, 340 boarders, and 500 day scholars; the Lycée Charlemagne, 40 professors and 800 day scholars; the Lycée Bonaparte, 33 professors and 1100 day scholars; the Collége Stanislas, with 10 professors and 200 boarders; and the Collége Ste. Barbe, with 80 professors and 1000 boarders and day pupils. Besides these, there are special schools, for the most part belonging to government. The principal of these are the three military schools,—the École Polytechnique, with 300 pupils; the École des Ponts et Chaussées, with 15 professors and 100 students; and the École de l'Étât Major: the École des Mines, for the study of geology, mining, &c.; the École des Chartes, for the study of the ancient manuscripts in the various public libraries of France; the Ecole des Beaux Arts, for painting and sculpture, and architecture, with 20 professors; the Conservatoire de Musique, with 10 bursaries of L.40 each, and 600 pupils. The three colléges municipaux of Rollin, Chaptal, and Turgot, belonging to the city of Paris, give a good commercial education at a very moderate cost. The private "institutions" and "pensions" are under government control. There are 50 institutions, and 240 pensions for boys; and 180 institutions, and 123 pensions for girls. There are 22 adult schools, attended by 2700 pupils. Of the écoles primaires, there are, for boys, 33 écoles mutuelles, and 30 écoles simultanées; for girls, 35 of the former class, and 32 of the latter. The écoles mutuelles have 13,700 pupils of both sexes; the écoles simultanées, 15,600. The expense of these primary schools to the municipality is about L.54,800 annually.

The prisons of Paris are eight in number,—the Prison Modèle or Nouvelle Force, a model prison with accommodation for 1260 inmates, and costing annually about L.4000; the Maison d'Arrét des Madelonnettes, with about 600 inmates, and costing annually about L.1500; the Dépôt de la Prefecture de Police, a place of temporary confinement, where accused persons are kept for twenty-four hours, after which they are either liberated or removed to some of the other jails; the Conciergerie in the Palais de Justice, in which prisoners are kept during their trial; the debtors' prison, holding 300 to 400 inmates, and costing about L.1200 a year; Ste. Pélagie, with an average population of about 550 persons, and costing about L.1600 annually; St Lazare, with an average population of from 900 to 1100, and costing about L.3000 annually; the Dépôt des Condamnés, with an average of 400 inmates, and an annual cost of L.1400; and the Maison Centrale d'Education Correctionnelle, or Prison des Jeunes Détenus, with an average of 500 inmates, and an annual cost of L.1280.

The number of theatres in Paris is at present twenty-three, with about 34,000 seats, and a nightly average of about 20,000 spectators. The principal theatres, such as the Italian Opera, the Français, and the Opera-Comique, besides others, are subsidized by government. The Grand or French Opera is now managed by government altogether. The secondary theatres are the Odéon, the Théatre Lyrique, the Vaudeville, Gymnase, Variétés, Porte St Martin, &c. There is also an equestrian circus in the Champs Elysées, besides two hippodromes, one at the east and the other at the west end of the city, capable of accommodating each about 10,000 spectators. The annual receipts of these places of amusement average now about half a million sterling, 10 per cent. of which is claimed by government for the maintenance of the hospitals and charitable institutions. The public gardens, concerts, and balls, which are very numerous, are frequented by crowds of pleasure-seekers both in summer and winter

Paris is the seat of the imperial government of the executive and legislative authorities, of the Cour de Cassation (supreme court of appeal), and of an archbishop whose suffragans are the bishops of Meaux, Versailles, Chartres, Orléans, and Blois. It is the head-quarters of the first military division which comprises the departments of Seine, Seine-et-Oise, Oise, Seine-et-Marne, Aube, Yonne, Loiret, and Eure-et-Loire. For municipal purposes it is divided into twelve arrondissements, each of which is subdivided into four quarters. Each arrondissement has a separate municipality, presided over by a mayor and two deputy-mayors. The prefect of the Seine is the chief municipal authority of the capital. Under him is a council of prefecture, composed of five members and a secretary-general, with a municipal and departmental commission consisting of 36 members. The members of this commission are also members of the council-general of the department, which comprises eight additional members for the arrondissements of Sceaux and St Denis. (Galignani's *Paris Guide;* Malte-Brun; Balbi; Theophile Lavallée's *Histoire de Paris;* MacCulloch's *Geographical Dictionary*; *Annuaire de l'Economie Politique;* &c. (J. C—L.)

PARIS, surnamed *Alexander*, was the second son of Priam and Hecuba, the King and Queen of Troy. His birth was attended by the most singular circumstances. Immediately before he was born, his mother dreamed that she brought forth a torch, which set fire to the whole city. This dream was interpreted to mean that the coming infant would bring destruction upon Troy. Accordingly, no sooner had the child come into the world than his terrified parents, devoting him to death, exposed him on the neighbouring mountain of Ida. There he was suckled by a she-bear, until, at the end of five days, a shepherd found him, took him home, and adopted him. As the youthful Paris grew up, his princely endowments, shining forth from under his humble peasant-garb, began to exercise their legitimate influence. His graceful and refined comeliness won the heart of Œnone, the beautiful daughter of a river-god. He became the champion of the shepherds in their conflicts with the wild beasts of the forest, and was honoured with the surname of Alexander, "the defender of men." The fame of his exquisite taste and accomplishments even reached the ears of the immortals, and procured for him a notable honour. A golden apple, bearing the inscription "for the fairest," was brought to him from the gods; he was commanded to award it; and Juno, Minerva, and Venus presented themselves before him in the vale of Ida as the claimants. Besides dazzling his eyes with the uncovered brilliancy of their celestial charms, the goddesses tempted his judgment with bribes. Juno promised him a kingdom, Minerva military glory, and Venus the fairest woman in the world. The last offer won the partiality of the susceptible judge, and he awarded the prize to the goddess of love.

This decision led Paris into a course of action which brought ruin upon his native country. Having been discovered and recognised to be the son of Priam, he was placed in a position in which he resolved to avail himself of the promise which Venus had given to him. Hearing, therefore, of the surpassing beauty of Helen, the wife of Menelaus, King of Sparta, he fitted out a fleet, repaired to her husband's court under the guise of friendship, carried her off, and brought her home to his father's palace. The Greek chieftains soon arrived at the head of their forces to exact the restoration of the seduced queen; and thus the Trojan war, which ended in the destruction of Troy, was begun. During this famous struggle Paris did not show his usual valour. It is true that he twice advanced to meet his injured foe Menelaus; but on the first occasion he fled ignominiously before the Spartan hero, and on the second he would have been slain had not Venus interposed to save him. It is also true that he slew Mnesthius, and wounded Diomede and other Greek heroes; but he was fonder of passing the day in idle dalliance than of fighting before the walls of the city. The death of Paris is said to have been caused by one of the arrows of Hercules shot from the bow of Philoctetes. Apollo is reported to have assumed his form in order to slay Achilles.

PARIS, *Matthew*, one of the earliest of English chroniclers, flourished in the thirteenth century, and is supposed (as his surname seems to imply) to have been born or educated in the capital of France. Although a poor Benedictine monk in the monastery of St Albans, he appears to have attained to note in public life. Henry III. held him in great favour and esteem; and the Pope employed him on a mission of reformation to the monasteries of Norway. Still higher was his position as a man of varied acquirements. He was well versed in history, theology, and the general learning of his age; and he was adorned with the accomplishments of an architect, a painter, an orator, and a poet. But it was in the character of a historian that his greatest fame was achieved. Indefatigable in his search after the fullest historical accounts, he embodied in a condensed form all the substance of former chroniclers, and was careful to add all the possible information regarding his own time. His principal work, entitled *Historia Major*, consists of an emended copy of Roger of Wendover's *Flowers of History*, carrying the narrative as far as 1235, and a supplement continuing the story down to 1273. It was first printed by Archbishop Parker in 1571, and it has been frequently reprinted both in London and Paris. An English translation, by the Rev. J. A. Giles, forms 3 vols. of Bohn's *Antiquarian Library*.

To his chief work Matthew Paris wrote an abridgment, entitled *Historia Minor*, and a supplement containing *Lives of the Two Offas, Kings of Mercia, and of Twenty-three Abbots of St Albans*, and *Additamenta*. The former exists only in manuscript, the latter is printed in the edition of the *Historia Magna* by Dr William Watts, fol., London, 1640.

PARIS, *John Ayrton*, an eminent physician, was born at Cambridge in 1785. His educational career was marked by uncommon devotion to learning. At an age as early as fourteen he began the study of medicine under Dr Bradley of London. Entering Caius College in his native town in 1803, he made himself familiar with the classics, and dipped into chemistry and botany. Then he studied medicine at Edinburgh, and took his degree of M.D. at Cambridge, with so much credit, that in his twenty-third year he was appointed physician to the Westminster Hospital. After staying for a short time in London, Dr Paris settled at Penzance in Cornwall; and there a new field of study was opened up before his active mind. The physical character of the county induced him to devote his leisure hours to the pursuits of the geologist. He published several papers on geology, wrote a geological *Guide to Mount's Bay and Land's End*, and founded the Royal Geological Society of Cornwall, one of the earliest societies of the kind in the kingdom. He also invented the "tamping-bar," an iron implement covered with copper, which miners can use without incurring the danger of striking fire from the rock, and igniting gunpowder or inflammable gas. In 1810 Dr Paris, returning to London, entered upon a long career of professional and scientific industry. His duties as a physician were performed with all the cheerful ardour of one who loves his calling for its own sake. At the same time, he laboured with the pen to promote medical science. His *Pharmacologia*, his *Treatise on Diet*, his *Elements of Medical Chemistry*, and his *Elements of Medical Jurisprudence*, written in conjunction with Fonblanque, were all produced amid the hurry of numerous engagements. The great eminence of Dr Paris was recognised with the high-

est honours. He was a D.C.L. of Oxford, and a fellow of the Royal Society and other learned societies in London. He was also president of the London College of Physicians, a position which he held from 1844 till his death in December 1856. Dr Paris was the author of an anonymous work entitled *Philosophy in Sport made Science in Earnest*, and of an excellent biography of his friend Sir Humphry Davy.

PARISH, the precinct of a parochial church, or a circuit of ground inhabited by people who belong to one church, and are under the particular charge of its minister. The word comes from the Latin *parochia*, and the Greek παροικια, *habitation*, compounded of παρα, *near*, and οἰκος, *house*. Accordingly, Du Cange observes, that the name παροικια was anciently applied to the whole territory of a bishop, because the primitive Christians, not daring to assemble openly in cities, were forced to meet secretly in the neighbouring houses. In the ancient church there was one large edifice in each city for the people to meet in, and this they called *parochia*, or parish. But the signification of the word was afterwards enlarged, and by a parish was meant a diocese, or the extent of the jurisdiction of a bishop, consisting of several churches; unless we suppose, as some do, that those bishops were only pastors of single churches. Dupin observes, that country parishes were unknown before the fourth century; but those of cities are more ancient. The city of Alexandria is said to have been the first which was divided into parishes. Of the first division of parishes there is no certain information; for in the early ages of Christianity in this island, parishes were unknown, or at least signified the same thing as diocese. There was then no appropriation of ecclesiastical dues to any particular church; but every man was at liberty to contribute his tithes to any priest or church that he pleased; or if he made no special appropriation of them, they were paid to the bishop, whose duty it was to distribute them amongst the clergy, and for other pious purposes, according to his own discretion. Camden says (*Britannia*, p. 160) that England was divided into parishes by Archbishop Honorius about the year 630. Sir Henry Hobart maintains that parishes were first erected by the council of Lateran, held in the year 1179. But Selden (*History of Tithes*, chap. ix.) proves that the clergy lived in common, without any division of parishes, long after the time mentioned by Camden; and it appears from the Saxon law that parishes were in being long before the Council of Lateran in 1179. The distinction of parishes first occurs in the laws of Edgar about the year 970. It seems pretty certain, says Justice Blackstone (*Com.*, vol. i., p. 112), that the boundaries of parishes were first ascertained by those of a manor or manors; because it very seldom happens that a manor extends itself over more than one parish, although there are often many manors in one parish. As Christianity spread, the lords began to build churches upon their own demesnes or wastes, in order to accommodate their tenants in one or two adjoining lordships; and, that they might have divine service regularly performed therein, they obliged all their tenants to appropriate their tithes to the maintenance of the one officiating minister, instead of leaving them at liberty to distribute them amongst the clergy of the diocese in general. The tract of land, the tithes of which were thus appropriated, formed a distinct parish; a circumstance which accounts for the frequent intermixture of parishes one with another. For if a lord had a parcel of land detached from the main part of his estate, but not sufficient to form a parish of itself, it was natural for him to endow his newly-erected church with the tithes of such lands. Since 1818 important improvements have taken place in the parochial divisions of England through the appointment of "The Ecclesiastical Commissioners." (See Stephen's *Comm.*, vol. iii., p. 102, &c.)

PARISH-CLERK, a person in every parish whose duty it is to assist the parson in the rites and ceremonies of the church. Parish-clerks were formerly clerks in orders, and their business at first was to officiate at the altar, for which they had a competent maintenance by offerings; but they are now generally laymen, and have certain fees at christenings, marriages, and burials, besides wages for their maintenance. The parish-clerk is generally appointed by the incumbent, but by custom may be chosen by the inhabitants. By the common law, parish-clerks have freeholds in their offices, but may (by statute 7 and 8 Vict., c. 59) be suspended by the archdeacon for misconduct or neglect.

PARK, MUNGO, a celebrated traveller, was born at Fowlshiels, near Selkirk, on the 10th of September 1771. His father occupied the farm of Fowlshiels under the Duke of Buccleuch. He appears to have bestowed uncommon attention on the education of his children; and he even employed a tutor to reside in his house, an expense which was then supposed to exceed the resources of an ordinary farmer. Young Park made a good figure at school. His general demeanour was reserved and thoughtful; yet occasional sparks of ambition broke forth, indicative of that adventurous spirit which lay concealed under a somewhat cold exterior. This thoughtful disposition led his friends to consider the church as the profession best suited to his character; but as he himself preferred physic to theology, his wishes were acquiesced in; and he spent three years at the university of Edinburgh in the studies necessary to qualify him for that profession.

At Edinburgh, Park studied with ardour and success; and in particular he imbibed a fondness for botany, which served to give a strong colour to his future life. It strengthened his natural connection with his brother-in-law, Mr James Dickson, who, notwithstanding many disadvantages, attained such skill in that science, that, on going as a gardener to Hammersmith, he obtained a large share of the patronage and favour of Sir Joseph Banks. This connection induced Mr Park to repair to London. He was introduced to Sir Joseph, who was so much pleased with him that he obtained for him the appointment of assistant-surgeon to the Worcester East Indiaman. In this capacity Mr Park performed a voyage to Bencoolen, where he made some collections and observations in botany and natural history, which were submitted to the Linnæan Society, and an account of them printed in the third volume of their Transactions.

The African Association were now anxiously looking out for a successor to Major Houghton, their unfortunate missionary, who had perished in the attempt to penetrate to the Niger and Timbuctoo. This opening, although foreign to any of Mr Park's former pursuits except that of natural history, was immediately embraced by him with an ardour which showed how congenial it was to the character of his mind. Without hesitation, he offered himself for this arduous and perilous service, and, being supported by the recommendation of Sir Joseph Banks, he was at once accepted.

Park spent about two years in and near London, acquiring the qualifications necessary for his mission. In May 1795 he set sail; and on the 21st of June following arrived at Jillifree, near the mouth of the Gambia. After spending some months with Dr Laidley at Pisania in acquiring the Mandingo language, he, on the 2d of December 1795, departed on his grand expedition. By what route he reached the river, how much of its country he explored, and by what track he returned, is described under NIGER. He arrived, after the length of his absence and the want of intelligence respecting him had nearly extinguished all hopes of his safety. Reaching London early in the morning of Christmas 1797, he went to pass the time before breakfast in the gardens of the British Museum, where, by

a singular chance he met Mr Dickson, who embraced his friend as one returned from the grave. An extraordinary interest in his adventures was immediately excited amongst the African Institution, its friends, and the public in general. Major Rennell drew up an important memoir, showing the new light thrown by his journey upon African geography, which, with an abstract of his narrative by Mr Bryan Edwards, was speedily offered, to satisfy the curiosity of the public. In the spring of 1799 Mr Park presented the public with a full narrative from his own pen. Major Rennell's memoir was appended, and a considerable part of Mr Edwards' abstract was incorporated verbatim; upon which circumstance alone seems to have been built the rumour of that gentleman having been the actual writer of the volume. The work was read with an avidity proportioned to the novelty and importance of the information contained in it, and to the interesting and agreeable manner in which the events were narrated.

Having finished this task, Mr Park seems to have resolved to retire into domestic and professional life. In 1799 he married Miss Anderson of Selkirk, daughter of the gentleman with whom he had served his apprenticeship as a surgeon. In October 1801 he embraced a professional career at Peebles, and soon found himself in respectable practice. He now seemed sufficiently comfortable, being happy in domestic life, possessed of a competence, and surrounded by respectable society; yet his active mind was secretly panting after a higher sphere of exertion.

Important as were his discoveries, their effect had been, not to satisfy, but to excite still farther, the public curiosity. The course of the Niger through the unknown and central parts of the continent could not fail to excite peculiar interest. This was strongly felt, not only by the scientific world, but by some intelligent members of administration, who, on the conclusion of the peace in 1801, determined to fit out an expedition on a great scale, to effect the discovery of the termination of this great river. In autumn 1803, Lord Hobart, afterwards Earl of Buckinghamshire, who was then colonial secretary, offered the command of it to Mr Park, who, though he asked a short interval to consult his friends, seems never in his own mind to have hesitated as to its acceptance. To those who represented to him the dangers that were to be incurred, he urged, that the hardships attendant on the exercise of his profession, his journeys to distant patients, his long and solitary rides over "cold and lonely heaths," and over "gloomy hills, assailed by the wintry tempest," would tend as effectually to shorten life as the journey now in contemplation.

Accordingly he set sail from Portsmouth on the 30th January 1805. The melancholy history of this second expedition is well known. With what equipments he departed from Pisania on the 4th May 1805, how his forty-four European companions dwindled down to four, and how he was at last drowned at Boussa, is related under NIGER.[1]

Park has been pronounced by some the first of modern travellers. Without altogether adopting this opinion, we may observe, that the problem of the course of the Niger, which he had the fortune partially to solve, was one which had involved in error almost all former geographical systems on Africa. D'Anville, indeed, had stated it correctly; but as he had not communicated the grounds upon which his conclusion rested, the opposite opinion, which represented the Niger as flowing westward, and joining the ocean by the channel of the Senegal, continued still prevalent. This point, finally decided, fixed the geographical character of the continent. In Bambarra, also, a name as yet scarcely heard of by Europeans, Park found a kingdom much farther advanced in civilization than had yet been supposed to exist in the heart of Africa.

Mr Park's literary, though not equal to his active qualifications, were nevertheless respectable. But notwithstanding his knowledge of botany, he cannot be considered as a scientific traveller. We see not in him that varied and splendid science which, in Humboldt, illustrates and adorns, though it sometimes overlays, the main subject. But with regard to the general aspect of nature, and the forms of human society, his observations are careful, accurate, and judicious. Nothing can be more lively than the idea which we receive from him of the African forests and deserts, the cities of Bambarra, the stream of the Niger or Joliba, and the regions watered by that river. The spirit, joined to the simplicity of his narrative, has rendered his work one of the most popular of its kind in the English language.

Mr Park's bodily frame was well fitted for the arduous enterprises in which he engaged. He was six feet in height, his limbs were well proportioned, and his whole frame was active and robust. His countenance was prepossessing, and his manners always retained their native plainness and simplicity. But this was combined with a natural coldness and reserve, which rendered his conversation less interesting than was expected by those who considered his general talents and extensive opportunities of observation. His conduct in all the relations of private life was highly exemplary. He left a widow, three sons, and a daughter. (H. M.)

PARKER, MATTHEW, the second Protestant Archbishop of Canterbury, was born at Norwich in 1504, and entered the university of Cambridge in 1520 as a student of Corpus Christi College. His studies were prosecuted with distinction. In 1523 he took a bachelor's degree; in 1527 he was ordained, created a Master of Arts, and chosen a fellow; and by this time he had become so eminent for his theological attainments that he received an offer, which was not, however, accepted, of a chair in Wolsey's newly-founded college at Oxford. This successful career as a scholar was followed by a still more successful career as a priest. Having received a preaching license from Archbishop Cranmer in 1533, he was often appointed to preach at court. In a short time his learning, piety, and attachment to the Reforming party in the Church, recommended him to the favour of the royal family; and a succession of preferments was the result. Anne Boleyn made him her chaplain in 1534; Henry VIII. appointed him one of the king's chaplains in 1537; and Edward VI. presented him to the deanery of Lincoln in 1552. He was also receiving at the same time several other dignities and rich benefices. During the reign of Mary, Parker was deprived of all his honours and preferments, and was obliged to seek safety in obscurity. Scarcely grieving at the misfortune which allowed him to enjoy literary leisure and domestic intercourse, he lived in the houses of his Norfolk friends, and devoted his attention to the translation of the book of Psalms into English. Occasionally the emissaries of the bloody queen would track him to his studious retreats, and force him to flee. He continued to shift about from one place to another until the accession of Elizabeth in 1559 restored him to favour and influence. Parker was then nominated archbishop of Canterbury; and the duty of building up the Protestant church of England out of the ruins of Popery was entrusted to him. This great task he performed with rare assiduity, courage, and magnanimity. He

[1] The narrative of this journey was published in 1815 in 4to, with a very interesting biographical memoir and preface by Mr Wishaw. It may not be amiss to notice here a singular oversight in Park's Journal observed by M. Walckenaer. A 31st day is counted in April (p. 7); and as all the days before and after are accounted for, there can be no doubt that all the following dates are one day behind. This, as Mr Bowdich has shown, is not so trifling an error as at first sight it appears; for a false declination being thus taken, an error, greater or less, and sometimes not inconsiderable, is committed in the calculation of all the subsequent latitudes.

Parliament

dared to discountenance that lingering attachment to the relics of Popery which was manifested by the queen herself. His influence was constantly exerted to supply the vacant cures with men of orthodoxy, learning, and piety. Although no bigoted devotee of mere ecclesiastical formalities, he strove to preserve the unity of the church by enjoining an uniformity in habits and ceremonies. He also promoted the growth of vital religion among the community by his daily exercise of deep piety, public-spirited zeal, and active Christian benevolence. Nor did the liberal-minded primate fail to advance the cause of religion still further by advancing the cause of general enlightenment. A munificent patron of learning, he founded several schools, and presented several of the colleges at Cambridge with scholarships, fellowships, and with large bequests of plate, money, books, and manuscripts. A zealous lover also of learning, he prosecuted antiquarian and kindred studies with great success. The edition of the Scriptures called *The Bishops' Bible*, and the treatise *De Antiquitate Britannicæ Ecclesiæ*, were produced under his superintendence; and he printed the four old English historians—Matthew of Westminster, Matthew Paris, Asser, and Thomas Walsingham. The death of Archbishop Parker took place in 1575. (Strype's *Life and Acts of Matthew Parker*, in 3 vols., Oxford, 1821; and *Biographia Britannica*.)

Parkgate || Parliament

PARKGATE, a small town of Cheshire, on the right bank of the estuary of the Dee, 10 miles N. by W. of Chester. It is neatly and regularly built, and is much frequented for sea-bathing. The harbour is obstructed by a sand-bank; but it is a station for packets sailing to Ireland. A fine view of the coast of Flintshire may be obtained from the town.

PARKHURST, John, a learned lexicographer, was born at Catesby in Northamptonshire in 1728, and attended the school of Rugby. Having become a student of Clare Hall, Cambridge, he took the degree of M.A., was elected a fellow of his college, and entered into holy orders. A handsome competence which he inherited enabled him to devote all his time to literary pursuits. Accordingly, till his death in 1797, he assiduously applied himself, in spite of a weak constitution, to biblical studies. His principal works, a *Hebrew and English Lexicon, without Points*, and a *Greek and English Lexicon to the New Testament*, became very popular, and have been often reprinted. The latest edition of the former was published in 1845, that of the latter in 1851.

PARLIAMENT.

Parliament is the name of the supreme legislature of Great Britain. The immediate derivation of the word is disputed, but that it has a common etymological source with the French *parler*, to speak, cannot be doubted. The term is not confined to Britain. It long designated in France a set of institutions which performed some administrative functions, but were properly the chief provincial courts of justice. The body, which for some time in France was the parallel of the English Parliament, and appeared to be marching on to the same high destinies, was called the States-General, or the three estates. These had many formidable contests with the Crown before they were suppressed, or rather dropped out of the rank of French national institutions. Their last ordinary meeting was in 1614, under Louis XIII., and much interest subsequently bore on the proceedings of that assemblage, as they formed the latest precedents for the guidance of that memorable re-assemblage of the states-general, which ushered in the dawn of the great Revolution. The Cortès of Spain were a parliament powerful and free, and at one time also promising a noble rivalry with that of England. In other countries the institution has been more or less developed, but the true object will best be served by adhering entirely, under the article Parliament, to an account of the supreme legislature of the United Kingdom, the most illustrious development of representative government, and the model on which all other sound constitutions must necessarily be framed in spirit if not in detail, as being the great storehouse of legislative wisdom, in which all that has been ever devised by political philosophy, has been put to the test of practical application. This notice will therefore be confined, after a rapid history of its rise in the three kingdoms, to a statement of the existing constitution and practice of the Parliament of the United Kingdom.

History of the Parliament of England.

It has hitherto been an idle task to endeavour to prove that Parliament belongs either to "the institutions of our Saxon ancestors," or the feudal system. In its present state, it is as much the creation of a high social development, and perfected political science, as the railway and the electric telegraph are the developments of mechanical and chemical science. Whatever glimpses we have of the early progress of the institution, must be considered as the efforts of a practical people, making use of such established institutions as fell to their lot, towards the perfection of a free and strong system of representative government. It is far safer, in tracing the history of this progress, to take such palpable facts as occur from time to time, showing stages in the development, than to rely on theoretic views. It may perhaps be true, that the spirit of the institutions of our Saxon ancestors influenced the subsequent progress of Parliament, but very little satisfaction has come out of any attempts to show that the Saxons possessed an institution practically resembling our Parliament. The practices which are among the earliest, and are among the present characteristics of Parliament, cannot be traced into the Saxon period; because we cannot find there the royal summoning, the hereditary principle, and the representative principle; while the institution of slavery, which made a large portion of the community not only the inferiors, but the absolute property of the other, was antagonistic to the spirit of feudal gradation, which gave to the great lords individual power as legislators, and to the smaller people collective power as the choosers of representatives.

We know that the earliest Norman kings not only acted on the advice and consent of certain persons eminently powerful among their subjects, but stated the concurrence of such persons in the official promulgations of the royal will, as giving it strength and validity from their constitutional authority. Antiquaries have been much puzzled to identify the common or general council consulted by these early kings; but there is no doubt that there has been much confusion about the meaning of the word *concilium* or *consilium*, as employed in old documents; and thus it has been supposed to indicate a council or body of persons, when it meant in reality the advice or counsel given by those persons whether assembled or not. (See Municipal Corporation.) Sometimes, too, the act of a sovereign, or even so important a thing as the succession of a sovereign, does not profess to be merely sanctioned by the advice or by the consent of any limited assemblage of persons, however important, but bears to be by the assent or choice of the whole community; and, as in modern times, the universality of the assent or choice was often the more strongly asserted the farther it was from the truth. Whatever were the qualifications of the advisers who surrounded the early Norman kings, they must have been expected to be numerous,

since Westminster Hall was built by Rufus for their reception. Their duties were as much judicial and administrative as they were legislative. The supreme courts, the privy council, and other institutions, by degrees branched off from this great council, carrying with them the judicial and ministerial functions; and the appellate jurisdiction of the House of Lords, along with the general etiquette that all members of that House are among the sovereign's councillors, remain to us as relics of the judicial and ministerial functions of these early Parliaments. The term Parliament was first used towards them in the reign of Henry III. In the mean time traces are found of an important distinction. Whatever was the rank of the persons attending the Parliament or great council, they were all tenants-in-chief of the king,—all immediately attached to him, and not under any mediate superior in the feudal hierarchy. In the charter of King John a difference was made according to their rank in the method of requiring their attendance. The great barons were to be individually required to attend by special writ addressed to each; the other tenants-in-chief, not called barons, were called by a general summons—seeming to imply, that such of them as thought fit, or were delegated by their brethren, might attend. It is here that we have the germ of a House of Lords, consisting of men who are legislators by individual right, and of a House of Commons, consisting of chosen respresentatives. The marks of another significant distinction may be found in these early vestiges. The charters then so frequently issued were bargains by the monarch; among other things, assuring his subjects, that he would not take from them talliages or taxes, save such as were due. The promise not to take did not involve a promise not to ask; and the chief early function of Parliaments was to receive royal appeals for money. Now, by the great barons or tenants of royal demesnes, considerable taxes were due to the Crown by feudal law, and did not require to be asked; and we find the monarch taking his dues from them, and craving more from those tenants of knights' fees, or portions of them, who had enriched themselves with other kinds of property, and who possessed wealth, which, unlike that of the tenants of the great demesnes of the Crown, was not legally taxable. When we find these consenting to share in the burden, we have the foreshadowing of a Lower House asserting and jealously maintaining the exclusive right of dealing with all matters of supply. Another peculiar mark of distinction tends in the same direction. The ecclesiastical lords, the bishops and abbots, sat, like the first temporal lords, as the tenants of baronies or estates; and it is said that the bishops are still a living relic of this primitive system of enoblement. Like the other great barons, these ecclesiastics were liable to pay feudal dues and taxes without being specially asked for an aid. When the king, however, wished an aid from the clergy at large, irrespective of their baronies, they granted it sitting in a separate assembly or convocation of their own.

Originally, as is well known, the tenure of a baronial fief from the king made a baron or lord of Parliament. Whoever legally possessed that estate, was, in virtue of it, a lord of Parliament without any separate title. In the course of time, however, the monarch began to create higher dignities of his own special grant. The dukedom, taken from the practice of the Roman empire; the marquisate, or margravate, copied from a later institution of the empire, which appointed great lordships, partaking of the nature of monarchies, on the marches for the protection of the empire; the earldom, a revival of an old Saxon title; and the viscounty. The mere barons by tenure not unwillingly accepted of these dignities, which naturally overshadowed, and at length superseded, the humbler barony by tenure. The title of baron fell at last to be conferred in the same manner by royal writ or patent; and the peers of England came to be virtually peers by writ and not by tenure. The question, whether the old enobling by tenure still exists, though latent, has curiously enough just reappeared, as we shall presently see.

With regard to the Commons, the earliest summons of a limited number of the lesser freeholders has been assigned to the year 1213, when King John, citing his barons, required the sheriffs at the same time to cause to come to the king at Oxford four discreet knights from each shire to talk with him about the affairs of his kingdom.[1] To see, however, how the representative system was brought out, we must turn to another and not a naturally obvious source.

The municipalities which arose throughout England became part of the feudal hierarchy—they were chief tenants of the Crown. (See MUNICIPAL CORPORATION.) However its position in the hierarchy might be theoretically adjusted, there was no possibility of calling the community of a city, like an individual baron, to attend the king's court. But in the old Roman constitution of the municipality there was a remedy for the difficulty. Although a community, it had a head,—a representative of its several members for the management of its internal affairs. The idea had to be but slightly extended, and the same, or another, selected head might represent the municipality in the king's Parliament. There can be no more emphatic reproach to those who insist on founding our parliamentary system solely on Saxon, or solely on feudal usages, than thus to find that it took one of the most valuable of all hints for its development from that Roman law which was professedly so much detested in England. It is well known, that the municipalities or burghs were first called to Parliament by the renowned Simon de Montfort in 1264; and there can be little doubt that the very apt method of representation which they found to their hand immediately reduced to symmetry the vague and undefined arrangements by which a few of the freeholders appeared for themselves and their brethren in the Lower House. How Parliament from this time onward grew in strength and efficiency is matter of history, and will in some measure be explained when the functions of Parliament are treated of in this article. The juncture at which the principle was established that the assent of the two Houses is necessary to every legislative act, has been assigned by Hallam and others to the reign of Edward IV. It was very soon afterwards that they asserted the right to inquire concerning grievances, and demand their redress. The feebleness of the Crown has ever been the opportunity of Parliament. During the reign of Richard II., England, as well as Europe at large, was swept by a revolutionary outbreak of the oppressed serfs of the soil, who, in France, rendered themselves ever memorable as the *Jacquerie.* In England there was an intermediate body, powerful to keep order, but at the same time not negligent of the opportunity for augmenting its own strength; and while the cause of order and the law triumphed over Tyler's rebellion, a part of the power for their enforcement was found to have changed hands from the king to the Parliament. In this reign the Commons achieved the important function, in addition to the granting of the supplies, of assigning them to their destined uses. Soon afterwards, but not without a stubborn resistance, they accomplished a material change in the order of business. They used to present their

[1] In this and the immediately preceding statements, the best general reference that can be made is to the somewhat voluminous *Reports from the Lords' Committees appointed to search the Journals of the House, Rolls of Parliament, and other Records and Documents, for all matters touching the dignity of a Peer of the Realm,*—an enormous mine of information on matters connected with the early history of Parliament.

Parliament of England

grievances, then grant their supply and receive the redress of the grievances—not always satisfactory—at the end of the session. They now insisted that the redress should be obtained before the supply was granted. In this, and in other instances, the disputes between the English monarchs and their Parliaments, exhibit in their bald outline the one party relying on the mighty power of money, and using it in utter distrust of the honesty of the other, who, in his turn, exercises every wile to obtain possession of the money, without performing the condition of which it is the price.

The power of Parliament gradually increased through the despotic reigns of the Tudor kings. It is well known that these princes had a wise aversion to trying constitutional conclusions. It was otherwise when the Stewarts came. The lamentable conflict which then broke out, whatever we may say of its origin, became at last a struggle for entire supremacy between Charles I. and his Parliament. To this end the chief object of each was to get possession of the militia or military force of the kingdom. The question had ever before been left open, but each was determined that it should no longer remain so, by arrogating entire possession. How the conflict ended is too well known to be here stated. But it is almost necessary to remind readers that the Protectorate was still a parliamentary government, not a despotism. A succession of scattered notices of the debates and proceedings in the Parliaments held under Cromwell are preserved in the curious *Parliamentary Diary* of Thomas Burton. They show, when compared to the memorials we have of other Parliaments immediately before and after, no lack of independent discussion. They exemplify distinctly, however, the inconveniences of throwing such a body as a Parliament, by revolutionary explosions, out of its fixed routine. By the junction of the two Houses into one, and the abolition of some offensive tribunals, such as the Star Chamber, a quantity of judicial business was thrown on the Parliament to which the procedure in the House of Commons was not adapted. It would be difficult to name at any other period a measure which occupied so much time, and involved so many heavy debates, as the disposal of Naylor, the insane Quaker. At the end of each denunciatory debate came the question, whether there was any law infringed by Naylor; and if so, whether the House were the proper persons to apply it by punishment; and the perplexing debates occasioned by this subject show the wisdom of the House of Commons in having kept clear of all judicial functions both before and since that period.

On the Restoration, Parliament kept to its old traditions. There was little change in its forms until the Revolution. Some important proceedings, affecting its power and constitution, are part of the history of the period. Among these was the repeal of an act passed in 1641, which provided for the assembling of a fresh Parliament within three years after a dissolution, whether the king might call it or not. It was not, however, the failure to call Parliaments, but their too long continuance when called, that became the constitutional vice of the reign. The Parliament which met in 1661 lasted for seventeen years, becoming subservient by long continuance, as its predecessor, called the Long Parliament, had become self-willed from the same cause.

The Revolution of 1688 was, in form, a piece of parliamentary procedure, but it essentially belongs to the general history of the country. In 1694 an act was passed for limiting the duration of Parliaments to three years. The union with Scotland, which soon followed, renders it appropriate to give a sketch of the separate progress of representative government in that kingdom.

Parliament of Scotland.

In Scotland the history of all political institutions is broken in upon by the "War of Independence," in which the country successfully resisted the attempt of the Norman monarchs of England to extend their conquest northwards. Before this epoch there was a close resemblance in the institutions of the two countries, and the vestiges of early parliamentary history in each are in their character identical. There are the same convocations of his principal subjects to attend and advise the king, without any rule from which we can at this day establish the criterion on which they were selected; the same dubious use of the expressions "common assent" and "general council;" and the same professions that certain acts were done by the universal consent of the community. The functions of such assemblages like those of England, involved a mixture of the legislative, the judicial, and the administrative. There are several capitularies of laws of considerable antiquity, but it is doubtful how far they were sanctioned either by a Parliament or by any less formal assembly. After the death of Alexander III., an arrangement was made for marrying Margaret, the heiress of the Scottish throne, with Prince Edward of England. It was agreed to by a small Scottish Parliament, which, of course, assembled without any royal warrant. The place of meeting was at Brigham, on the English side of the border; and the assemblage "consisted of the four guardians, two of whom were bishops, of ten other bishops, twelve earls, twenty-three abbots, eleven priors, and forty-eight barons." (Innes's *Preface to Acts of Scotland*, § 7.) The marriage was frustrated by the shipwreck of the princess, so well known as the "Maid of Norway," on her way to Scotland. The claims of Edward, and the selection of Balliol from among the competitors to the throne, as the one most complacent, followed. We are told that "The Parliament assembled by John Balliol at Scone, on the 9th of February 1292, was probably the first of the national councils of Scotland which bore that name in the country at the time, although later historians have bestowed it freely on all assemblies of a legislative character. We have no reason to believe that any change in its constitution occasioned the adoption of the new term, which soon became in Scotland, as in England, the received designation of the great legislative council solemnly assembled." (Ib.) Balliol had afterwards a treaty with France, which, along with those of certain bishops, earls, and barons, bore the attesting seals of six burghs,—a fact which would show the admission of this order to Parliament were it certain that there was an assembling on the occasion of those who appended their seals to the treaty. "Finally, in the famous Parliament at Cambuskenneth, held on the 15th day of July 1326, when Bruce claimed from his people a revenue to meet the expenses of his glorious war, and the necessities of the state, the tenth penny of all rents, according to the old extent of King Alexander III., was granted to the monarch by the earls, barons, burgesses, and free tenants in full Parliament assembled. The change had taken place silently and perhaps gradually; but henceforth, undoubtedly, the representatives of the burghs formed the third estate, and an essential part of all Parliaments and general councils." (Ib.)

It is from this point that we find the forms and character of the Scottish Parliament gradually diverging from those of the English. But before describing the nature of these divergencies, it may be proper to mention a constitutional change copied directly from the Parliament of England, and not on that account throwing any doubt on the divergence in question, but rather establishing it by the marked and specific character of the exception. An early statute of the reign of James I. abruptly enacts, "That the small barons and free tenants need not come to Parliament nor general councils;" and these were appointed in their several counties to choose representatives,—two for every county, with the exception of a few small counties, which were to have but one. These representatives are called in the act the "speakers;" and their constituency being spared attendance, were bound to contribute to the necessary ex-

Parliament

Parliament of Scotland.

pense of sending them to Parliament. The ecclesiastical dignitaries, with "the dukes, earls, lords of Parliament, and banrents," were to continue to be summoned to Parliament by "special precept," like the special summons issued to the lords, according to the practice then old in England. It has often been said that this act, with other measures introducing English practices in the reign of James I., may be attributed to that monarch's residence in England during his youth. Whether introduced by the monarch himself or not, this measure, though it brought into Scotland an English practice, is in striking contrast to the tenor of English legislation, which avoided positive enactments on constitutional questions of this kind.

While representatives from the towns, and the lesser barons or freeholders, were thus constituent elements of the Parliament of Scotland, this body never came to be divided like the Parliament of England into two Houses. The high ecclesiastics, the lords who were there by special precept or writ, the representatives of the freeholders, and the representatives of the citizens of royal burghs,—all sat in one hall. The officers of the Crown had conspicuous places in this Parliament in virtue of their offices, but had no vote unless they were otherwise members; but they had, in general, seats as ecclesiastical or temporal lords.

What may be called the opening scene of the French Revolution was the question, whether a measure was to be carried in the three estates by a general numerical majority of the whole members, or by the approval of all the estates, carried by a majority of the members of each. This question appears to have remained undecided in Scotland (where also it became usual to call Parliament "the Three Estates"), down to the debates on the Union. Perhaps the question was avoided; for, in the instances where divisions are recorded, it is usual to find a majority—sometimes the narrowest possible—in each estate. It is certain, however, that among the many divisions on the Treaty of Union, there are some in which there is a minority in the lords or barons, though a general majority of the whole Parliament is recorded.

That revision of a measure which the English Parliament had found in its transference from one House to another, the Scottish Parliament seems to have sought through a supreme committee administering in Scotland, in some measure, the function of the House of Lords in England. This committee was called "The Lords of the Articles." It appears to have been for a long time the result of fair election, each estate choosing a certain number of its members. Subsequently, however, it gradually merged into a complicated adjustment, which made the Lords of the Articles rather the ministers of the Crown than a department of a free Parliament. Thus, in the days of the later Stewarts, the bishops began the election of Lords of the Articles by choosing eight lords. These, in their turn, chose eight bishops. The sixteen then selected eight county and eight burgh members. These thirty-two did all the work of Parliament. The Estates had scarcely any more opportunity of acting at large throughout a whole session of Parliament than in one meeting to select the Lords of the Articles, and in another meeting to pass the acts which these proposed for their acceptance. While, however, the conducting of their business through a body so small, and so equivocally constituted, brought the Scottish Estates much under the influence of the Crown, they had their own peculiar elements of independence different from those enjoyed by the English Parliament. In England two things came to be matter of very strict constitutional practice; first, that Acts of Parliament could only be passed by Parliaments summoned by the Crown; and, second, that all acts of Parliament must have the royal assent, otherwise they were not law. Neither principle was established in Scotland. The most important Parliament that ever met there—the Parliament which abolished the power of the Church of Rome, and virtually carried the Reformation—had no royal sanction. There was no solemn form for administering the royal assent to a measure. A practice had grown up of touching acts of Parliament with the sceptre, but it was often maintained that this was a mere formal courtesy, by which the sovereign acknowledged the existence of an act passed by the Estates, and announced that he had no objection to it. Some of the older acts were passed with so little deference to the sovereign's will, that it was considered immaterial whether he touched them with the sceptre or not. So lately, however, as Queen Anne's reign, when the Act of Security was passed for severing Scotland from England, it was maintained by some of the members that, if the policy then prevailing in England should continue, when the touching of the sceptre was refused, the States had the inherent right of making it law without any royal assent, and would do so.

The Union.

This was one of the events which brought on the Union. The Estates had in the meantime been freed from the Lords of the Articles, and other restraints, by the Revolution, which had at once converted them into a body possessed of all the English freedom of debate, without those rules of parliamentary action which had made the conduct of business so strict in England while debate was free. Many causes of fierce dispute arose between the two nations, among which not the least formidable were proceedings by the English Houses of Parliament for inquiry into matters which occurred in Scotland. The Scots were denied participation in the English shipping and colonial privileges; and when they endeavoured to establish a colony of their own, its promoters—members of the Scottish Estates—were called before the English Parliament to answer for an invasion of the privileges conferred on English commercial companies. The Scottish Estates threatened to form alliances and connections of their own; and it was obvious that nothing but their union with the Parliament of England could keep peace between the two countries.

A union had not only frequently been discussed, but had twice been deliberately attempted,—in 1667 and in 1703. In both instances, the insuperable impediment was, the peculiar commercial fanaticism long peculiar to England. The Scots were by the Navigation Act as incapable of participating in the trading privileges of the English as any other foreign nation, and Parliament refused to admit them to advantages for which it was alleged that they could give no equivalent. The necessity, however, of making both nations one in all respects was now felt, and the leaders of the English Parliament were prepared, with reluctance, to remove the great impediment to a fusion. The terms of a treaty were first adjusted by commissioners appointed for either country by the Crown. When their labours were ended, the far more difficult process began of passing two acts of union which should be identically the same,—one in the Parliament of each country. A process so thoroughly constitutional, and so indicative of the flexibility as well as power of representative government, was never attempted or conceived in any other country. The matter was first taken up in the Parliament of Scotland; and it was some gratification to the national pride to be in a manner laying down the terms of the joint measure to England. In Scotland it is well known that the measure was passed only after a long and stormy contest; in England it was carried more rapidly and easily.

The first Parliament of Great Britain met on October 23, 1707. The members for Scotland, who had been accustomed to rule in a smaller assembly, suffered from a consciousness of insignificance, which naturally merged into a suspicion that they and their nation were subject to the contempt of their great partner. The government and the English members were neither skilful nor successful in removing this impression, and the united Parliament be-

Parliament

gan with evil auspices The Scots, however, soon discovered that they could wield a power readily revealed to parliamentary groups, however small, when they are compact. They learned the art of throwing themselves into one of the scales of nicely-balanced parties; and no ministry could safely venture to rouse the united enmity of the members from the north.

Parliament of Britain.

Two events in parliamentary history followed quickly on the Union. The high Tory government of Harley and St John, being weak in the House of Lords, got a sufficient number of peers created to afford them a preponderance; twelve were created at once, and, in the year 1711, nineteen in all. The effect of this operation was little anticipated. It was remembered as a precedent in 1831; and a threat to repeat it is believed to have carried the Reform Act. The other great constitutional measure was the passing of the Septennial Act. It immediately followed the rebellion of 1715, and its avowed object was, to keep in power the party and the Parliament which had steadily supported the Hanover interest. When the seventh session of that Parliament was near its end there were serious proposals still to prolong its existence, but they were fortunately abandoned.

We now come to a period when the British legislature stands charged in history with the weight of heavy accusations of corruption. But it is, at the same time, the period when parliamentary government made its greatest and its steadiest progress. The House of Commons is indebted for its transcendant power to no one man so much as to Walpole. He encouraged no attempts to grasp at functions which were not constitutionally its own. The prerogatives of the Crown were scrupulously respected, and so were the special functions of the Upper House. But year by year throughout his long administration the representative portion of the constitution increased in importance and power. This increase of influence naturally gave much temptation to corruption. Both the Crown and the aristocracy found it of more avail to wield an influence in the House of Commons than to exercise what remained of their own legitimate authority. Decaying corporations had been wont listlessly to drop the privilege of representation as too heavy for their custody, but now any village or ruined wall, around which the shadow of old electoral rights continued to cling, was sedulously looked after and protected in its franchise by powerful hands. Soon after the middle of the century the influences thus created were loudly condemned, and parliamentary reform was demanded by a large body of statesmen, foremost among whom was Chatham's ambitious son. How the French revolution frightened them from the field, and postponed the question, are matters well known in history.

Parliament of Ireland.

Meanwhile the position of Ireland, as a separate country, with a separate legislature, created uneasiness. It is unnecessary to trace the constitutional progress of the Parliament of Ireland, as it was shaped on the model of the Parliament of England. Having shown a strong partiality for the cause of the White Rose, the Irish Parliament was, on the accession of Henry VII., subjected to a condition of humiliation and dependence by the act called Payning's Law, or the statute of Drogheda. It provides, among many minor restraints, that no legislative proposals could be brought before the Irish Parliament unless they had previously received the approval of the king and his council in England. While this restraint on independent legislation was in full force, the English Parliament claimed and carried into effect the right of legislation for Ireland within the walls of St Stephens. These tests of dependence lasted until they were swept away by the organized force of the Irish volunteers. The independent Irish legislature became then a very formidable body. It was adorned by the eloquence of several men, whose high genius only served to raise party ferocity, and the stormy debates of the evening were often concluded by bloody duels in the morning. A spark from continental conflagrations, among such materials, might at any moment be fatal; and the Irish leaders, taking example by the tactics which had been so effective in Scotland, spoke of regulating the succession to the crown of Ireland, and about separate alliances with powers hostile to England. All the energy of the government of the day, both in England and Ireland, was brought to bear on the emergency. A union was carried amid a storm more formidable than that of 1707, and the United Parliament of Great Britain and Ireland began with the nineteenth century.

The Reform Act.

The next great epoch in parliamentary progress is that of the Reform Act. The substance of the measure will be dealt with in the pages which follow; and the events connected with its passing enter too largely into the general history of the period to be recorded here. The principal portion of the measure—the bill to amend the representation of the people in England and Wales—received the Royal assent on the 7th of June 1832. It is not becoming to indulge in political discussion in a work of reference, but the Reform Act is no longer a matter of politics but of history. It receives the acquiescence and homage of all parties, and therefore there is nothing invidious in saying of it, that no one legislative measure ever did so much to secure good government, official honesty, general freedom, and national prosperity.

Parliament of the United Kingdom.

The Parliament of the United Kingdom of Great Britain and Ireland consists of the Sovereign,—king or queen,—the House of Lords, and the House of Commons. Sometimes these are called the Three Estates of the Realm; but it is more usual, as it used to be in France and in Scotland, to speak of the Bishops or Ecclesiastical Estate, the Lords, and the Commons, as the Three Estates. Each of the three departments of the parliamentary constitution has, as will be more specially explained, separate rights and powers. The Sovereign has his prerogative; the House of Lords has its judicial power; the House of Commons —the least endowed with any authority separate from its legislative combination with the others—has, as the House of Lords also has, powers for the maintenance of its privileges, for compelling the appearance before it of persons whom it desires to examine, and, generally, for extracting the information necessary for conducting the national business. In the functions which are purely legislative, however, all the three powers must act together.

House of Lords.

The House of Lords is usually divided into lords spiritual and lords temporal, and both again are divided into lords who sit there by absolute right, and lords who are selected. The English bishops, though called lords spiritual, are believed to sit in virtue of their temporal baronies; and one of them, the Bishop of Sodor and Mann, whose see was beyond the bounds of the old Norman baronies, has hence no seat in the House. Four bishops are selected to represent the Church of Ireland, in terms of a rotation established at the Union. The temporal lords who sit by their own right are the peers of England, the peers of Great Britain, created since the union with Scotland, and the peers of the United Kingdom, created since the union with Ireland. There is no limit to the royal prerogative in the creation of hereditary peers of the United Kingdom. It has been, however, questioned whether the Crown can create a peerage merely for life, and the question created so grave a controversy when that honour was conferred on Lord Wensleydale, that the patent was altered to the usual form.

We have seen that the first members of the House of Lords sat by tenure of their lands. The question of the right to sit by tenure alone, is still in one sense undecided. It is true that since the peerage came virtually to consist of titles

Parliament House of Lords.

by writ, no claim to membership has been admitted on the ground of tenure. But it is equally true, that there is no law or solemn decision declaring that tenure forms no title. It is a popular belief that certain great feudal domains—as Arundel and Berkeley—still possess the virtue of conferring peerage on their owners. The question has slept, owing in many instances to this obvious cause, that the person who would be baron by tenure, is an earl, or something still higher, by writ. Various accidents, not unaided by design, have prevented the question from demanding a decision in some special cases. In the instance of one family—the Berkeley's—it appeared to draw to an issue more than once, but has always been incidentally checked; and it has been just again opened by the owner of the ancient domains of that family, who has presented a petition claiming his right to sit as a baron by tenure. The elder children of the last lord who held the title were found to be in law illegitimate, and incapable of succession to the peerage by writ. He, however, bequeathed to the eldest and the second of these children successively the castle and domains. The exclusion of the elder children of course opened the succession of the peerage to the eldest son born in wedlock; but, from an honourable homage to the memory of his parents, that son, holding, it would seem, that the decision which illegitimated his elder brothers was unjust, has refused to assume the title. When the eldest son succeeded to the domain, the question whether he could sit as baron by tenure might have arisen, but was obviated by his being raised by patent to the peerage as Earl Fitzhardinge. On his death this title became extinct. The second son succeeded to the estates, and the family title by writ still remained unclaimed. In these circumstances, the owner of the estates demands to be admitted as a baron by tenure. The claim involves the principle of territorial nobility in its simplest form; for the conditions which deprive him of succession to the earldom of Berkeley by writ, would also disqualify him as the representative of the previous owners; and the title by which he holds the estate is not more hereditary in its legal character than that of any stranger obtaining it by bequest or purchase might be. In this case the applicant has stated to the Committee of Privileges of the House of Lords, that the lordships of Berkeley could be traced as a tenure by barony to the reign of Henry I.; and that the muniments of the lordships were so well preserved, "that he should be able to bring before the House almost every one of the barons of Berkeley, and make them declare that they held their titles by tenure; and it was by tenure they were entitled to sit as lords of Parliament." He has offered to prove that, before passing into the present family, the estates had been appropriated by the Crown; that, consequently, those who had possessed them then ceased to be lords of Parliament; and that there were lords of Berkeley in Parliament at all times when those lands were in the possession of a subject, and none when the lands were in the hands of the Crown. He was farther prepared to show that, during the Tudor dynasty, the estates having been entailed, went to an heir of entail who was not the lineal descendant of the former holders; and that, by reason of the possession of the property, that heir of entail sat in the House of Lords as owner of the barony. If this case be brought to its legitimate conclusion, it will settle the question whether lordship by tenure is an existing right under the British constitution.

The old peerage of Scotland is represented by sixteen of that body, chosen for each Parliament. The peers entitled to elect them are those who, whatever other dignities they may enjoy, are in the possession of titles acknowledged in "the Union Roll" made up at the time of the union with England. The Irish peerage sends to the House twenty-eight representatives, chosen for life.

Parliament House of Commons.

The House of Commons consists, besides the representatives of the universities, of the members for counties and the members for towns. In England and Ireland the former are technically called knights of the shire, and the latter burgesses. In Scotland both classes were, by old custom, called "commissioners;" but the peculiarity has been, in practice, dropped.

The following short statement of the several kinds of franchise throughout the empire is intended not so much to furnish a technical legal definition of the different qualifications to vote, as to convey a general notion of the classes who possess the franchise.

The franchise in England.

In the English counties the forty-shilling freeholders are the foundation of the constituency. Freehold estates, as distinct from other kinds of landed property, are those held directly of the Crown. The expansive character of this qualification was limited by the Reform Act, which requires occupancy if the freehold interest be only for life, unless it has come by marriage or settlement, or is attached to an office. The absolute freeholds which confer the franchise are called freeholds of inheritance. The virtual meaning of this is, that they have either descended as property to the holder, or that they are absolutely vested in himself and his heirs—in short, that he is owner of the freehold; for although, technically, that is not a freehold of inheritance which does not go to the heir, of course the conveyancer who completes the title for a purchaser will see that it is so adjusted as to convey to him an available freehold. Those who were in possession of life freeholds at the time of the passing of the Reform Act retained the franchise, but their number must now be much reduced, and gradually becoming extinct. Of the large class specially enfranchised by the Reform Act, the more important are, the possessors of land worth L.10 a year on any title not freehold, such as copyhold, or on lease for sixty years; and the possession of leases for twenty years of lands worth L.50 a year. The franchise derived from the possession of lands of the annual value of L.10 and L.50 respectively must be an actual interest to that extent, and therefore must be clear of all rents and charges; such are the qualifications by ownership not necessarily inferring occupancy. Another large class consists of those who are the tenants and occupants of lands paying a rent of L.50. No one can hold a county vote on the freehold of a tenement, which would give him a right to vote in a town whether he exercise that right or not; and no one can vote for a county on property other than freehold, if it give the right of voting in a town.

In the English towns the right of voting was infinitely varied—in some instances comprising a closely limited body, in others indefinitely expansive, and sometimes comprehending a great part of the least educated and least orderly classes of the community. The most comprehensive class of these electors has been well known by the name of freemen. (See MUNICIPAL CORPORATION.) In those towns which were not disfranchised by the Reform Act, the freemen on the list immediately before the passing of the act were, under certain restrictions, allowed to retain their right to vote. None could afterwards acquire the right to vote as freeholders unless through birth or servitude; and no one can derive it by birth unless his predecessor held it before the passing of the Reform Act, or acquired it by servitude. Another class of voters in the English towns were the holders of freeholds and burgage tenements; a class capable, like the freemen and the county freeholders, of being sometimes fictitiously extended. This class of voters was retained under conditions for preventing the creation of fictitious votes. These required that the voter should be in receipt of rents and profits for a year, unless when the property had come by descent or settlement, and likewise that he should reside for six months in the town or its neighbourhood. To these a

Parliament

large distinct class of voters was added by the Reform Act, who, while they form the majority in many of the old constituencies, are the entire constituency of the newly enfranchised towns. They are the now well-known ten-pound householders—the occupants, whether as owners or tenants, of premises worth L.10 a year. There are provisions requiring that the qualification shall have been enjoyed for a whole year before it is acted on, and for residence for six months in the town or its neighbourhood.

The franchise in Scotland.

The constituency of Scotland is far more a fundamental creation of the Reform Act than that of England. It is hence naturally much more simple. Of the old county constituencies of freeholders, those only who had the qualification when the act passed are now entitled to vote on their freeholds; and of course their number must be much reduced. The fresh constituency consists of—1*st*, Owners of heritable or landed property worth L.10 a-year, clear of charges. Every kind of title, implying ownership of land, or its profits, is, by the spirit of the definitions in the act, capable of conferring a qualification, with the exception of those rights which, though nominally of a proprietary nature, are in reality only securities over the property for debt. 2*d*, Tenants on leases not shorter than the old customary period of "three nineteen years," or fifty-seven years—who have a proprietary interest in the lease worth L.10 a-year. Though the law of Scotland strictly separates this class of holders from feudal proprietors, in relation to whom they are mere tenants, yet their position has a virtual analogy with that of some of the English yeomen or peasant-proprietor class, and, like them, the Scottish tenants on long leases are qualified without occupancy. 3*d*, Tenants in occupancy, paying a rent of L.50, or who may have paid the sum of L.300 in the shape of "a grassum"—nearly equivalent to a "fine" in England—as the consideration apart from any rent. The town constituencies of Scotland were entirely framed by the Reform Act, as the old arrangement was not a system of direct representation—the elections being made by the corporations, as a sort of electoral colleges, representing the citizens. There is but one source of qualification—an urban tenement worth L.10 a-year, whether it be a dwelling-house or place of business. Such a tenement gives a qualification, either on occupancy as proprietor or tenant, or on ownership without occupancy. There are conditions of a year's possession, and a half year's residence in the town or its neighbourhood, similar to those in England. One peculiarity has been retained from the old system, which, though it does not affect the qualifications of the electors, makes the Scottish burghal representation differ materially from the English and the Irish. The small towns are grouped together in districts;—for instance, the St Andrews district embraces seven small towns,—an arrangement which obviated the two alternatives of giving an undue preponderance to small burghal constituencies on the one hand, and on the other absorbing them in the counties.

The franchise in Ireland.

In Ireland, the forty-shilling freehold system having been a means by which a landlord could give a vote to all his adult male tenants, was restrained as a condition of the Catholic Emancipation Act; and, saving some existing rights to the individual holders, the qualification was then raised to a ten-pound freehold. The Reform Act added to this constituency a similar amount of property held by copyhold, a ten-pound interest in a lease for a term of sixty years, or a twenty-pound interest in a lease for fourteen years if terminable on a life, a ten-pound interest in an absolute lease of twenty years, and the occupancy of such a tenement by sub-lease. In the Irish towns, a residue of freemen and voters holding under other consuetudinary franchises, had to be curtailed by the Reform Act, and the staple of the qualification for voting became the ten-pound occupancy.

Qualification of voters.

There are arrangements in the several divisions of the United Kingdom for preserving an authentic register of those entitled to vote. An explanation of these arrangements would lead to technical details. It need only be stated that the establishment of certainty in this matter, with the requisite expedition, has been attended with great difficulty. If analogy had been taken from the law of private rights, the voter claiming a disputed interest in property, might be dragged through a litigation as long as any that is necessary for establishing a disputed title. On the other hand, so long as a patrimonial interest is counted the proper foundation for a vote, it could never be permitted to every one to claim the right without becoming liable to challenge. To accomplish a practical medium suitable to the purpose, the lists are made up on the statements of each applicant, supported by ordinary documents, such as leases, receipts, &c., which give a colour to his claim, and, if it be objected to, there is a summary judicial settlement or revisal. While professional judges have been employed in this function, care has been taken to bar all cases of disputed qualification from entering the courts as regular litigations. Party zeal is generally sufficient to make this ordeal pretty stringent, and the purgations of the roll have in some measure the aspect of a litigation between two sides, to which the rights of individual claimants of the franchise are in the position of items in accounting, which are struck off or kept on, on either side respectively, according to the success of the attack or the defence.

It need scarcely be said that none are qualified to hold the franchise but males twenty-one years old. Insanity and idiotcy are good grounds of objection to claims for enrolment, and so are convictions of perjury or bribery. A large body of persons in the government employment—chiefly embracing those connected with the revenue—are disqualified by Act of Parliament, and so are the holders of government contracts. The official persons connected with the metropolitan police force are likewise excluded from voting within the metropolitan districts. In the cases not thus specially provided for, government employment is no disqualification. No alien can vote for a member of Parliament, at least in England or Ireland. Practically the same exclusion extends to Scotland, but it has been questioned whether there is anything in the law of Scotland to support it.

Qualification of members.

As to the qualifications of candidates: In the first place, no member of the House of Lords is eligible to the House of Commons. The representative peers of Scotland and Ireland are of course excluded. No peer of Scotland can, however, be elected; and it may be said that a Scottish peer, not one of the representatives in the House of Lords, belongs to the only class of men in the British empire who are ineligible to the House of Commons. Their heirs were formerly excluded, but this disqualification was removed by the Reform Act. The judges of the supreme courts are ineligible. In England their exclusion is attributed to their restricted privilege of presence in the House of Lords. The Scottish judges are excluded by a statute passed by Walpole to keep out of Parliament a judge of the Court of Session, the notorious Erskine of Grange, whom he expected to be troublesome to the government. The holders of all government offices created since the year 1705, are by statute ineligible. The great offices of the ministry which date from before that year are of course not within the exclusion, but their holders, if in Parliament when they take office, require to be re-elected. When the war department was lately re-constructed, a special act was necessary to enable the under-secretary-at-war to sit in the House. The clergy of the Church of England and Ireland are excluded in a body. The absolute character of this exclusion was tested in a resolute contest by Horne Tooke,

Parliament

whose commentary on the result was, that a man once admitted to orders could only get admission to the Commons by leading a life which might procure his degradation from the priesthood. There prevails a sort of traditional doctrine that the clergy are excluded from Parliament as the lay council of the kingdom, because they are represented in convocation—the clerical council. The exclusion does not, of course, apply to the clergy of Protestant dissenting bodies. Whether there could be any ground for preventing a clergyman of the Established Church of Scotland from sitting in the House of Commons, is a question which does not appear to have been put to a practical test. There would perhaps be no opportunity of deciding it in the case of a minister ordained to a charge, because his removal to such a foreign field of duty as the legislature would doubtless be a ground of deposition. But a licentiate or a retired beneficed clergyman would be excluded were the strictness of the English rule applicable to the Presbyterian Establishment. By the Catholic Emancipation Act, no Roman Catholic priest is capable of being elected a member.

The disqualifications which operated formerly against lay Roman Catholics, and till lately against Jews, were of a different kind. There was nothing to render them ineligible, but certain oaths which they required to take before sitting and acting stood in their way after they were elected. The Emancipation Act removed this barrier from the Roman Catholics, by repealing the provisions which required members of Parliament to abjure some of the fundamental principles of that church. The oath of fidelity, which required to be taken on the faith of a Christian, had still the effect of restraining honest members of the Jewish persuasion from sitting. The removal of this impediment has been the object of a long and arduous contest, in which it was maintained on the one hand, that if the legislature meant to exclude Jews from Parliament they should so enact specifically, instead of leaving them to suffer from the accidental effect of a provision not directed against them; while those who thought that Jews ought to be excluded from the legislature were not of course inclined to give up the practical hold which the accidental effect of the clause gave to them. Repeated measures of relief, in various shapes, were passed by the Commons and rejected by the Lords. At length the friends of Jewish emancipation followed the example which the sagacity of O'Connell had set in the battle of Catholic emancipation, when he got himself returned for Parliament for the county of Clare, and was excluded by the oaths. For several years an eminent member of the Jewish persuasion has been one of the members elect for the city of London. A large constituency deficient in its full complement of representatives through the working of a law which can be altered, would naturally be the most powerful method of bringing home a great principle to the practical mind of British statesmen. It prevented the question from ever falling asleep. Various efforts were made, virtually to effect relief within the House of Commons itself, as a question between the House at large and an individual member. These brought out some curious points in the constitutional practice of the House, but did not effect their object. The House got so far as to permit the Jewish member to take the oath on the Old Testament, as being more binding on his conscience than the whole Bible; but no means were found for safely dispensing with the terms of the oath which were laid down in an act of Parliament. Had the way through other legal difficulties been quite clear, the sitting and acting without having taken the oath involved legal penalties which the courts of law could enforce, and from which the House of Commons could give no protection. In the summer of 1858, the House of Lords submitted to a compromise of a peculiar character on this point. The restraining clause in the oath was not removed, but power was given by statute to the House of Commons to dispense with it by resolution in those cases where it thought fit so to do. The same act gave the House of Lords the same privilege towards Jews raised to the peerage. This act came into operation in July 1858.

Under the head of qualification, it may be stated that there are arrangements for vacating the seats of members who are convicted of crimes, or become insane, or come under the bankruptcy acts. The method of procedure in disqualification by bankruptcy is carefully laid down by statute. Any power assumed by the House itself to exclude the member whom a constituency choose to have as their representative, has always been contemplated outside the walls of Parliament with a jealousy which has been responded to by a corresponding caution within. However offensive any member may become in the House, to deprive a constituency of their representative, duly elected and legally qualified, is a far more serious arrogation of independent power than the refusal to repeal a law which may prevent him from acting. The last instance in which a member was expelled, on account of the general disgust felt towards him by the members, was the notorious case of Wilkes, and the proceeding was vitiated as a precedent by its subsequent revocation, and the admission of its object to the House. Formerly in England and Ireland a candidate required to qualify himself by declaring, if he stood for a county, that he had an estate of L.600 a year, and if for a town, that he had an estate of L.300 a year. This part of the statute was repealed in 1858.

Number of the Commons; proportions to population.

The number of members at present eligible to the House of Commons is 654. It need scarcely be remarked that, from the pressure to obtain seats, vacancies are seldom allowed to remain longer than the time necessary for filling them, and that, whatever the attendance may be, the House is always, with brief and limited exceptions, complete. The numbers are thus distributed:—In England, including Wales, there are 159 members for the counties, 4 for the universities, and 333 for the towns. These last, until lately, amounted to 337, but the disfranchisement of Sudbury and St Albans by statute, for corruption, has reduced the number. In Scotland there are 30 members for counties, and 23 for towns. In Ireland there are 64 members for counties, 2 for the University of Dublin, and 39 for the towns.

It was one of the objects of the Reform Act to render the proportion of representatives to population in the different constituencies of the empire less unequal than it had been. Still, it is not professed that either the extent of population, or the number of electors, has been made an absolute criterion in the distribution of representation. That there should be a closer proportion between population and representation; that the proportion should be rendered practically absolute by a flexible plan for adjusting the representation from time to time to the relative changes in the population; these are among the political questions of the day. As such it would be inappropriate to deal with them in a work of reference, farther than by the statement of any facts which may show the extent of ground covered by the controversy. The greatest inequalities are in the town department. In England, Harwich, Knaresborough, Marlborough, Ludlow, Thetford, and Totness, with fewer than 6000 inhabitants, have each two members; while Glasgow, with a population of 350,000, has also two members. London, though divided into seven electoral districts, one of them with four representatives, sends only 16 members to Parliament from a population exceeding two millions. In fact, nowhere else in the United Kingdom is there an area containing within it so large a population with so narrow a representation; for while Scotland is on the whole not so fully represented for its numbers as England, yet for a population not quite three millions there are 53

Parliament

representatives. The area making the nearest approach to London for greatness and density of population is perhaps the manufacturing district of Lancashire. The population of that county (including the trifling rural population on its moorlands) just exceeds two millions, and for these there are, including the four county members, twenty-six representatives. In England, indeed, it will be found that where the proportions of the populations of towns to each other would be indicated by an enlargement according to geometrical progression, the increase of representation would have a nearer ratio to arithmetical progression, and among the small English boroughs a population of 50,000 might be found returning as many members as the metropolis. The inequality in the English counties is not nearly so great. It is true that none of the large counties, Yorkshire excepted, has more than four members, but the smallest county returning two members has a population exceeding 20,000. The relative proportions of electors and of members to population in the three kingdoms, as compared with each other, having sometimes been an object of discussion, the following general results may be stated in round numbers:—In the English counties there is 1 elector for each 20, and 1 member for each 66,012 inhabitants; in the counties of Scotland there is 1 elector for each 34, and 1 member for each 57,554; in Ireland there is 1 elector for each 40, and 1 member for each 93,127 of the population. Taking the town constituencies, we find in England 1 elector for each 17, and 1 member for each 22,088; in Scotland 1 elector to each 23, and 1 member to each 49,397; and in Ireland, 1 elector for each 30, and 1 member for each 21,425. Even when the exclusion of the fractions is granted, this statement can only be taken as a general estimate of proportions, since the populations are taken from the census of 1851, and the numbers of members and electors are taken from a return ordered by the House of Commons to be printed in February 1858.

Summoning Parliament—General elections.

The summoning and the dissolution of a Parliament, as well as the calling and adjournment of it from time to time, are among the undoubted prerogatives of the Crown. When a new Parliament is to be summoned, the lord chancellor receives a written command from the sovereign in council to that effect, and directs the clerk of the Crown in Chancery to issue writs to the several electoral districts. The writs, whether for county or town elections, used to be issued to the sheriff of the county. In England the return of the person elected in a town is generally made by some municipal officer, and by a late act the writs are immediately transmitted to that officer. There is necessarily some variation in the time within which elections must be completed in the different parts of the empire; but the general rule of late has been to abbreviate the time. In England, in counties, the returning officer must, within two days, fix a day, not less than ten, or more than sixteen, for the election. In boroughs it must be within six days, and on three days' notice. The day being fixed, the writ is read in public by the returning officer, and candidates are proposed and seconded by qualified electors. A show of hands is taken, and the returning officer declares the apparent result, without of course knowing whether those who have held up their hands are electors or not. If the parties are satisfied with this declaration the election is at an end; but if the partisans of any candidate proposed are determined on a contest, they crave a poll, and the return is not declared or made until this is over. Formerly the operation of polling used in England to be spread over a period which might amount to fifteen days. Opportunities were thus afforded for deadly contests and very corrupting practices. The opinion that has ruled the later legislation on election practice is, that when the operation is short and simultaneous, the chances of undue influence and violence are reduced, and those of a fair uninfluenced majority in numbers increased. The polling period was abbreviated by the Reform Act, and it is now in the general case limited to one day. There are, at the same time, arrangements for the multiplication of polling booths and stations, to the effect that all electors may give their votes in a free and orderly manner, without requiring to press forward in crowds. The qualifications of voters used in the days of long elections to be subjected to inquiries and discussions, which created small law suits at the polling places. The matters which may be inquired into and discussed, before a tendered vote can be recorded by the poll-clerk, are now strictly limited to the identity of the person voting as a voter on the roll, and his still possessing the qualification on which he was enrolled. A person who generally belongs to some legal body presides at the polling booth, where he is assisted by a recording clerk. If overpowered by a mob, the polling officer adjourns the polling, and resumes it when it can be carried on without disturbance. In pursuance of an old constitutional principle, any military force that may happen to be stationed in a town where there is an election must be removed till it is concluded. At the end of the polling the books are brought sealed to the returning officer, who sums them up. It rarely happens, however, that through the vigilant attention of the supporters of the candidates the result fails to be known to the public with perfect accuracy; and it is usual to post up the numbers in conspicuous places from time to time as the contest draws on. The result is declared at the hustings by the returning officer; and it is usual for the candidates, and sometimes their friends, to make speeches on the occasion. The election is returned to Chancery, but the candidate is considered to be a member of Parliament from the moment of the declaration, although he does not act as a legislator until he has taken the oaths.

The Speaker.

The first important business of a new Parliament, as distinct from the opening of a new session of an existing Parliament, is the choice of the Speaker of the House of Commons. A commission, with the lord chancellor at its head, announces that the sovereign will state the cause of the calling of the Parliament, when the members are sworn in, and requests that the gentlemen of the House of Commons will proceed to the appointment of some proper person to be their speaker, and present him for the royal approval. The selection and confirmation of a speaker used to be attended with many ceremonious professions of urgency on the one part, and reluctance on the other; and it was even usual to place him in the chair by gentle compulsion, he all the while professing his unworthiness of the office conferred on him. Some faint vestiges of these practices still continue. The speaker elect goes to the House of Lords, where he receives the royal approval, making profession of his unworthiness, and stating that the faithful Commons are ready to make another choice if he be not approved of. It is still an undecided question whether this is a mere ceremonial of courtesy, or implies a real veto in the Crown on the election of a speaker. It is a question fortunately never likely to be decided, because like many others between the Crown and Parliament it is not likely to be tried. During the reign of Charles II. a memorable dispute occurred on this matter. On the opening of Parliament in 1679, the Court had one of its own followers to offer as speaker; but the Commons selected Sir Edward Seymour, a man of the first rank in their order, who professed to look down upon the Duke of Somerset as a cadet of his family,—pompous, haughty, and extremely jealous of the privileges and powers of the untitled aristocracy who were then, as now, to be found in the House of Commons. He was rejected by the Crown. There is more than one version of the shape in which he reported his election.

The Parliamentary history gives it thus:—"May it please your Majesty, the knights, citizens, and burgesses, in Parliament assembled, in obedience to your Majesty's command, have made choice of a speaker, and have unanimously chosen me; and now I have come hither for your Majesty's approbation, which, if your Majesty please to grant, I shall do them and you the best service I can." By other accounts, however, he is said to have anticipated the courteous declinature of his services by saying,—"That he was unanimously chosen by the suffrages of all the Commons of England to be their speaker; and that he was resolved to serve his Majesty in that station to the utmost of his power." The chancellor who had prepared a speech for the occasion was, it is said, somewhat discomfited by this device, and without the courtesy due to the solemn occasion, after some hesitation and hints from others to remind him of his duty, informed Seymour that his Majesty had other occasions for his service, and the House of Commons must make another choice, and attend next day to report it. The House was then entering on the impeachment of Danby, and this affair added to the prevailing excitement. There was a hot debate on it for a week, followed by a prorogation; and the House, content probably with having loudly asserted its rights, having again to make a choice, selected Mr Serjeant Gregory, who, whether he were really acceptable there or not, was not the person who had been pointed out by the court for their choice.

In the seventeenth century, when the House of Commons had so many contests with the Crown, it was essential that the man who was set by them in front of the battle should not only be possessed of learning, sagacity, and integrity, but of great firmness and courage. Not only as the representative of the House, but within its walls, he had many opportunities either of compromising or of promoting the principles of representative government; for it is evident from Clarendon's admissions, and the general tenor of parliamentary history, that the nature of the House's proceedings could be much influenced by the man who, for the time, occupied the chair. In the present century the utmost that could be said about the influence of a speaker was, that he might occasionally let his eye be caught by a weak member of the opposite party, when there was a speech by a strong member of his own party to be answered. In the peculiar circumstances, however, in which the Whig party were placed by their abrupt and still not fully explained dismissal from office in 1834, they deemed the crisis so important, that it was essential for them to have a speaker from among themselves. They therefore fought the first division of the session on this point, although it was not their strongest, and they had many difficulties to contend with in the position of the government candidate, who had long filled the chair with approval, and had many warm friends. The result of an extremely exciting contest was, that Mr Abercromby was chosen by a majority of ten.

The proper position and functions of a speaker of the House of Commons could not be more emphatically told than in the words of Lenthal, when Charles I., supported by some armed followers, entered the House of Commons, and demanded that "the five members" should be given up. Lenthal, to whom he addressed himself, bent on his knees, and said, "May it please your Majesty,—I have neither eye to see, nor tongue to speak in this place, but as the House, whose servant I am, is pleased to direct me." In adjusting the proceedings and in preserving order, the speaker issues his own directions and commands, but they are in reality those of the House. He is the great depository of the precedents which have been established in former Parliaments; and armed with these, he is prepared to state what the House, in the natural order of things, will require to be done. In the enforcement of his authority, he looks to the support of the House; and if on any point a majority of those present should be against him, his own personal voice would be ineffective. In practice, however, such discussions never arise; and as no man is ever chosen speaker who is not endowed with temper, firmness, and a knowledge of the practice of the House, the speaker's directions are taken as law. The speaker naming a member to the House, is an old established form of censure for disorderly conduct. The only light which Hatsell, in his great work on the precedents of Parliament, can throw on the effect of this mysterious punishment is rather ludicrous. He says,—"A story used to be told by Mr Onslow, which those who ridiculed his strict observance of forms were fond of repeating; that as he often, upon a member's not attending to him, but persisting in any disorder, threatened to name him ('Sir, Sir, I must name you'), on being asked, what would be the consequence of putting that threat into execution, and naming a member, he answered,—'The Lord in Heaven knows,' from whence they collected that it was merely a threatening expression of his own, that would have no consequence at all. He might have referred them to the journal of the 5th of May 1641, or of the 22d of January 1693, where they would have found, 'that if the speaker is compelled to name a member, such member will thereby incur the displeasure and censure of the House." (P. 237.) The last occasion on which this ceremony was performed, was when Fergus O'Connor, having become insane, grew disorderly, and struck the member sitting beside him; but it does not appear to have had much effect.

The necessity of the speaker's presence at the opening and at the conclusion of all pieces of business counted as proceedings of the House, has been observed with an almost superstitious pertinacity until a very few years ago. The immense accumulation of detail business in the House had, in the meantime, rendered necessary the responsible office of permanent chairman of committees. In the year 1853 the chairman of committees was made a sort of deputy-speaker, and it was only then that the country was free from the risk of the public business being interrupted by the illness of one man. How seldom this occurred during the long period when the speaker had no substitute is very remarkable. We read the histories of political movements developed in the parliamentary policy of great statesmen, and in the exciting debates of great orators, without ever being reminded by a sudden pause in the progress of events that their continuance depends on one man's health. The thoroughly practical character of parliamentary proceedings has indeed, from an early time, relieved the speaker of a considerable portion of his attendance. The committees have carried off the greater proportion of the increased business, and even when it is necessary that matters should be transacted by the whole House and their speaker, this officer may be relieved from the greater portion of his attendance, by the House resolving itself into a committee, which reports its proceedings for general adoption.

The House of Lords has no speaker, in the sense in which the term is used in the Commons, as the representative of the corporate existence of the House, whose presence is necessary to the validity of the business accomplished. By a standing order of the House, the lord chancellor, or lord keeper, acts as speaker or chairman when present. When the great seal is in commission, a speaker is appointed by the Crown, generally from the heads of the courts of law; but, in the absence of the regular speaker, the House may appoint a member to that function. It is a curious fact that the speaker does not require to be a member of the House, and that he may be, and on occasion has been, a commoner. He has few duties but those connected with the putting of questions to the House, and he has no

Parliament right to enforce order,—such a function not being deemed necessary in the decorous assembly over which he presides. A chairman of committees is appointed for each session. He is a highly responsible and generally laborious officer, having the superintendence of all the procedure in private bills, and the function of checking all irregularities and undue practices by their promoters.

Annual meeting of Parliament. Parliament meets annually, generally in the month of February, but sometimes for a short session, if emergencies render it necessary, before the close of the year. This annual assemblage of Parliament used to be frequently demanded without success, but it is now as firmly established as any human institution can be. The army exists only from year to year through the annual passing of the Mutiny Act, without which there would be no power of military discipline, and soldiers would no more be subject to command than the rest of the community. The funds for the army, as well as for the administration of justice, and the whole civil service of the country, are voted in Parliament annually. In short, unless the whole complicated structure of our national institutions and our civilization were first to disappear, it is impossible to suppose the assembling of Parliament in any year not absolutely necessary.

Its powers. To the two Houses, and especially to the House of Commons, there is a general responsibility on the part of every authority in the country. It would be difficult now to point out any method of exercising power over the subject, on which responsibility may not be exacted in Parliament. It is long since the sovereign has been represented by a cabinet of ministerial officers, all of them members of one or other House, and the channels through which their subordinate officers are made responsible. The hereditary revenues of the Crown are now accounted for as public property. The "civil list," which used to be a large sum placed in the hands of the Crown for the expenses of the civil institutions of the country, is appropriated to its several purposes. While Parliament has power over the existence of the army, as supplying the funds by which it is maintained, the Crown has hitherto kept the command of the forces. This is exercised through a commander-in-chief, who is not a member of the cabinet, and is not considered to be responsible to Parliament in the same manner as a cabinet minister. It has sometimes, indeed, happened that the commander-in-chief belongs to the party opposed to the existing government. Gradually, however, this authority has lately been coming more and more within the sanction of ordinary parliamentary responsibility, and this process has been greatly quickened by the appointment, in 1855, of a principal secretary of state for war as a member of the cabinet, with an under-secretary, who finds a seat in Parliament. The navy is nominally entirely in the hands of the Crown, and its discipline is conducted, not under a temporary act annually passed, but under a permanent act of the reign of Charles II. Its administration, however, has long been under parliamentary control, by being vested in a commission, the chief, and generally other members of which, are in Parliament.

On the other hand, the power of the Crown has nominally been enlarged in various directions, with the ultimate effect of increasing the responsibility to Parliament. Almost all the public boards, and other minor administrational departments, are responsible to the Secretary of State for the Home Department, who may be called upon to make explanations regarding their conduct in his place in Parliament. Where the functions of any public department have become very important, it has been found expedient to place at its head a minister of the Crown, who has a seat in Parliament. This course was adopted, for instance, towards the English Poor Law Board, and the Board of Health. The British empire in Hindustan arose under the auspices of an irresponsible trading company. It was connected with the general government by the appointment of a Board of Control, and recent events have brought it still more within the nominal power of the Crown, and the real influence of Parliament.

The increase of parliamentary power, during the last half century at least, has almost entirely fallen to the House of Commons. It is there that administrations are annihilated or confirmed, and all great measures are tried. The House of Lords never was the natural birth-place of great popular questions, but it has of late been gradually assuming, to an increasing extent, the characteristics of a committee of revisal on the measures passed by the Commons. It has, in this capacity, to perform the unpopular function of rejection. The long and formidable resistance of the Lords to the passing of the Reform Bill called forth a deal of acrimonious criticism, and the various instances in which it rejected measures passed by the Commons were remembered against it. Since that event, if the Lords have not in any way abdicated their function of revisal, they have come less prominently forward as the rival of the House of Commons. Great debates have become less frequent; and large measures, which the House of Commons and the country eagerly promoted, have not been resisted with the old party determination. The Lords who transact the business of that House are generally veteran statesmen, who have acquired legislative experience by a long career in the House of Commons, and their procedure has become more that of a deliberative council of patriarchs or ancients, than of a legislative body divided into two parties, who are bound to conduct a perpetual contest against each other.

Forms of procedure. The forms of procedure in the British Parliament have not received, as a matter of constitutional study, the attention due to them. Instead of involving mere matters of technical and unimportant detail, they are found, when looked at in their general bearings, to be a machinery bringing to wonderful perfection the art of obtaining collective judgment on any matters, however vague and general on the one hand, and however complex in their practical details on the other. It is remarkable that, while the forms of procedure in the law courts have often been acknowledged on all hands to be foul with abuses, and have been assailed as cumbrous and imperfect after the most accomplished practical jurists have reconstructed them,—the procedure of Parliament has gone on unassailed, but ever silently tending towards perfection, by the application to every difficulty as it occurs of the best practical means of overcoming it. One reason for this curious contrast is, that in the courts of law the opposing and contending parties—the litigants and their lawyers—who have no concern in the making of the forms, are yet entitled to take advantage of every flaw and dubiety in their interpretation, and to plead every available quibble; while Parliament makes its forms solely for the use of its own members, the minority as well as the majority; and both are content to fight their battles on their own numerical strength, without founding on technicalities or quibbles. Still, with all this advantage over the practice of the law courts, the forms of Parliament are a wonderful triumph of the practical genius of the nation. In their substantial features they have long remained unaltered. They appear, indeed, to have been brought almost to their present perfection in the great contest of the Long Parliament, where a larger number of able practical men were engaged than perhaps in any other arena known to history. The people of this country are familiar with the forms of Parliament, because they are adopted or imitated in every corporation or collective body, among whom they appear to be the natural way in which collective bodies of men must necessarily transact their business. Their true aptitude can only be estimated by a comparison with the efforts from time to time made by popular assemblages on the European continent to transact legislative business.

Parliament

Forms of procedure.

The great leading principle in the transaction of business in the British Parliament, and the one which most other assemblies have flagrantly missed, is, that there shall be but one question at a time before the House, and that that question shall simply be yea or nay. However hot and confused may be the debate; however seemingly inextricable the views and the projects of the numerous speakers; yet all resolves itself, through a skilful arrangement, into a simple question of affirmative and negative. Thus, at the conclusion of that memorable debate in which the Reform Bill was carried in the House of Commons, on the 22d of September 1831, the conclusion is recorded in the following brief but very distinct terms in the journals of the House:—

"The question being put 'that the bill do pass,' the House divided—

"The yeas went forth—

Tellers for the yeas...	Mr Kennedy Mr John Wood	345
Tellers for the nays........	Mr Croaker Sir George Clerk	236

"So it was resolved in the affirmative. *Ordered*—That Lord John Russell do carry the bill to the Lords, and desire their concurrence." Although the division-lists of the members are now published, the taking and recording of their votes are still in the same simple form. Before this point was reached, there were of course many previous divisions, and a still greater number of debates, in which resolutions were adopted by concession without division. But, however complex may be the measure or the series of motions before the House, every clearing away of its portions is on a question of affirmative or negative, and can be accomplished in no other form. Although it may sometimes appear, from the tenor of a debate, that one substantive motion is pitted against another, or that an amendment competes with a motion, yet this can never be so in reality. If it were so, it might in-involve the necessity of members voting for a resolution as at all events preferable to its competitor, when they would not vote for it if it stood before them on its own naked merits. As there cannot be two questions voted on, so, of course, there cannot be three or more, although in the debate any number of amendments may be brought up against the original motion. These are disposed of one by one on the vote, if a vote be come to, whether such and such words are to stand part of the question. If there be a majority for any words standing part of a question to be put to the House, then a vote of yea or nay is taken on the question with these words in it. If the amendments are all lost by negatives on their being part of the question, then the original proposal, whatever it be—motion or bill—is stripped of all the counter proposals and variations which the debate has called forth, and a vote of yea or nay can be taken on it. No member can thus be driven to vote for what he does not approve of; for down to the last he may start any other proposition that may please him, and take a vote on it, and he may in the end vote against the original proposal.

A memorable incident in a foreign political assembly may perhaps illustrate the value of this method. In the French revolutionary Convention, each member, when there was a question before the House, stood up and stated in his own words, with or without an oration, what view he took, and what resolution he would vote for, and the officers of the House made up the votes and stated the motion carried, according to the best of their judgment. After the trial of Louis XVI., the sense of the House was thus taken on the sentence to be pronounced, and the voting occupied forty hours. As all the world knows, the decision was death, carried by a large majority. It was often maintained, however, that the votes of many members were recorded for death who did not explicitly pronounce that doom, but were prevented by timidity from expressly declaring against it. In English practice there could have been no such dubiety. A proposition would have been laid before the House, and a vote taken of simple affirmative or negative. The timid might have abstained from voting, but never could have recorded equivocal votes.

The records of Parliament show that this method did not always prevail, and that it was deliberately adopted to remedy the evils of a more slovenly practice. It was probably an improvement on the custom of gathering the resolutions of Parliament from the tenor of the debates after they were over. A practice thus arose, as Hatsell tells us, "for the speaker to collect the sense of the House from the debate, and from thence to form a question on which to take the opinion of the House." So early as 1571, however, it was resolved, as an improvement on this plan, "that from henceforth men making motions shall bring them in writing."

It is essential to the pure working of such a procedure, and is at the same time one of the most important distinctive features of the authority of Parliament, that no piece of composition adopted by a vote of either House can afterwards be subjected to even a verbal alteration. To carry out this rule in the case of bills, the House of Commons stood a protracted contest. In form, a bill always was, and still is, a petition by Parliament, and the act into which it resolves itself is the granting of the petition by the sovereign. Nothing was more natural, therefore, than that an official statement should be made by the sovereign of the nature and tenor of those petitions which he granted. In the fifteenth century there were many complaints by the Commons, to the effect that they had petitioned by bill for such and such enactments, and had been informed that their petitions were acceded to; but when they saw the statute for the session as drawn up and recorded, it contained totally different and sometimes adverse enactments. Nor are such discrepancies wonderful when it is known that the method of adjusting the statutes of a session was for the judges to take the petitions and the deliverances of the monarch, and make the acts of Parliament out of both. The remedy devised for this defect is so old, that Sir Matthew Hale, writing in the seventeenth century, is not sure of the reign in which it was adopted, but says "because sometimes difficulties and troubles arose by this extracting out of the petition and answer, about the latter end of Henry VI. and beginning of Edward IV., they took a course to reduce them, even in the first instance, into the full and complete form."

In pursuance of this policy, at the present day a bill, which has passed both Houses, contains all the sentences, and all the words to be found in the act of Parliament into which the royal assent converts it. The bill may contain a few words which are not in the act, but the act does not contain a word which is not in the bill. In its jealousy of any tampering with the precise tenor of its resolutions, Parliament has been indifferent to the illogical character of the form of an ordinary bill, which begins as a petition, and converts the substance of it into the shape of peremptory enactments.

There are some peculiarities of parliamentary procedure, partly embodied in rules, and partly enforced from a sense of courtesy and propriety, which tend materially to the fairness, and, at the same time, to the practical conclusiveness of parliamentary procedure. Desultory and incidental debates are obviated by the necessity, that when a member speaks, it must be to some question before the House, or his speech must introduce a question. Motions upon public questions require to be seconded—a good rule against interruption and annoyance from eccentric and impracticable members, which is followed in every public assemblage in this country. The mover of a motion is per-

Parliament. Forms of procedure.

mitted to reply to those who have supported any amendment on it before it is put to the vote, but otherwise no one is entitled to more than one opportunity of speaking on a question, except when the House is in committee on a bill.

This is not the place for a discussion on parliamentary orators; but it seems appropriate to remark, that the tendency of the parliamentary, and perhaps of the public taste, has been to discountenance rhetorical efforts, and to listen only to facts, and close reasoning on them. For speeches, such as were delivered a century ago, the pressure of real business leaves no time. On the other hand, it has been said that the entire publicity now given to debates has had a tendency to make many members of the Commons address themselves rather to their constituents than to the House. There are some little peculiarities of old standing in parliamentary speaking which are supposed to be favourable to good order and calm discussion. For instance, no member is to call another by his name; if it is desired to call personal attention to him, he must be individualized by the place he represents. Naming the antagonist in the heat of debate is apt to foster irritation on both sides; and the very necessity for recollecting the constituency which the adversary represents, has a momentary tendency to allay excitement. The views of the proceedings taken by the other members of the constitution, as by the monarch or the House of Lords, must not be referred to; nor can a discussion be opened on a reported debate at a previous sitting.

In the House of Lords there is of course precedence, but in the Commons all are on an official equality. There is a purposed jealousy of etiquettes, as if these were likely to lead to inequalities inconsistent with the character ever held by the Commons of Britain. For the sake of convenience, certain parties—ministerial, opposition, or any other—group themselves on benches which they appropriate to themselves; but this arrangement is carried out entirely by personal choice. There is no tribune such as that which used to be occupied by a member addressing the House in the French Chambers. The ministers of the Crown hold in Parliament a position which foreigners cannot easily understand. They have no special rights, but the conducting of the public business requires that, to a considerable extent, they should dictate the proceedings of the House. This they do through the influence of that majority which places and keeps them in power. The opposition sanction it, for it is not their object to upset the business of the country, but to get it conducted in their own way; and therefore they strive not to interrupt the operations of the majority, but to become the majority, and so conduct the business of the country themselves.

But what is still more characteristic of the British Parliament, when compared with popular assemblies in other countries,—the minority has its privileges as well as the governing majority, and fortunately they have always been deemed impregnable. The standing orders which require measures to pass through certain stages for the purpose of securing deliberation, and giving an opportunity for opposition, have sometimes, it is true, been suspended. On some occasions they have been so for the purpose of strengthening the hands of a government, and even conferring on it arbitrary powers, when it has professed to deal with dire emergencies, and made terror the excuse of precipitation. Such events are now looked back upon as the historical vestiges of evil times. In late years suspensions have rarely occurred, except with the view of mitigating or obviating some calamity, and conferring a boon appreciated by the minority as well as the majority, or else for the purpose of correcting some legislative blunder.

It is fortunate for the country that not only the privileges of weak parties in the House of Commons, but the privileges of individual members are preserved, not only in the letter, but in the spirit. Onslow, one of the most sagacious of the eminent men who have filled the speaker's chair, used to hold that a punctilious observance of the rules of the House was the great protection of the weak from the strong, and hence one of the safeguards of the constitution. Following the spirit of this rule, an individual member is never borne down in the exercise of his acknowledged privileges, though all the rest of the House may be against him, and may feel that he is only using them to their annoyance, and to the interruption of the public business. When the privilege of speaking is conceded, the duty of listening does not always follow. Members who are determined to speak when they have little to say worth hearing, or who continue to promulgate crotchets and hobbies in which their fellows have no sympathy, will empty the House, or even be made inaudible by the ebullitions of general impatience; but this never happens when a member, however little esteemed, has any important cause in his hands, or represents any considerable body of the people. On many occasions it has happened that the views or interests of a large portion of the population have had only one or two promulgators in the House of Commons; but these have hardly ever failed to command attention.

No bill is converted into a law unless it has received three readings—that is, has been at three stated intervals brought under consideration—in each House, has passed each House after the three readings, and has received the royal assent. There are some kinds of business peculiar to either House. The judicial function of Parliament is confined to the House of Lords, which alone has the inherent right to examine witnesses on oath. (See Appeal.) The supplies for the expense of conducting the business of the country are, on the other hand, exclusively the affair of the Commons. There are some kinds of legislation which it is the peculiar function of one of the Houses to originate. Measures affecting dignity and personal condition must, it is said, always begin in the Peers. All bills which affect taxes or duties, to the most trifling amount, can only begin with the Commons; and no peer's name must even be mentioned in them as connected with the raising of the duties.

Acts of Parliament are of two kinds, public and private. The former are laws which it is the judge's function to enforce, whether they are brought before him or not; the latter are like private deeds, which must be pleaded by those benefited by them ere the court is bound to give them effect. The bills, before they pass, are also divided into public and private. But it is important to remember that the difference between a public and private bill and a public and private act are not quite parallel. The acts, in fact, are of three kinds—*1st*, The public general statutes, which apply to the whole kingdom, or one of its departments; *2d*, The public local acts, such as police or railway acts; and *3d*, Private acts. It has been the practice, however, to speak of the second class of measures, which, when passed, would become public local acts, as private bills. There are three kinds of measures which in the House of Commons can only be brought in by committees of the whole House,—those affecting matters of religion, matters of trade, and the granting of money. The House does not always profess to know what was intended by these restrictions; but as an error in their application might vitiate a measure in any stage, a pretty wide interpretation is given to them. The Roman Catholic and Jews Relief bills, and a bill for punishing persons disturbing Roman Catholic congregations, were brought in by committee. It was decided in 1852 that a bill for establishing a registration of fees of ballast-heavers, with regulations as to the mode of hiring and paying them, is a bill relating to trade. It was found that a bill relating to dogs employed in drawing vehicles is not a measure of trade requiring to be brought in by committee.

The functions of Parliament in the passing of what are

Parliament

Forms of procedure.

termed private bills, according to the above definition, are peculiar and not easily explained. It has been said that they bear an analogy to the procedure in a court of justice; but they are in reality as distinct from these as they are from the proper functions of a legislature. In its purely public legislative capacity, Parliament enacts such laws as in its own knowledge it deems fit for the public, without waiting, so far as the proceedings bear, for any one to plead that they should be done, or any one to give evidence for or against them. In private business, Parliament lends its power for the fulfilment of objects desired by individual persons or by sections of the community, taking precautions for the assurance that such measures are just and proper. The promoters of a private bill appear as suitors for it, and may bring evidence and plead by council in its favour, as in a court of justice. Those who are opposed to it have the same privileges. So personal are the interests in a measure of this kind deemed, that when it is abandoned by its promoters it falls, however well it may have recommended itself as a just and useful measure to the good opinion of the legislature. "The solicitation of a bill in Parliament has been regarded by courts of equity so completely in the same light as an ordinary suit, that the promoters have been restrained by injunction from proceeding with a bill, the object of which was held to be to set aside a covenant; and parties have been restrained in the same manner from appearing against a private bill pending in the House of Lords. Such injunctions have been justified on the ground that they act upon the person of the suitor, and not upon the jurisdiction of Parliament." (May's *Parl. Proc.*, pp. 513-14.)

On the other hand, however, there are fundamental distinctions entirely separating the proceedings of Parliament in passing private bills from those of a court of justice proper. The litigant who goes to a court points to some established public law, and demands that it may be enforced in his favour. The promoter of a private bill goes to a body which is above the law, and asks a special law to be made for the accomplishment of his own objects, or even desires that the fixed course of law shall be suspended, and that he shall obtain something which the law expressly denies to him.

It is true, however, that, by applying uniform principles of action to the several groups of cases which the multiplicity of this kind of business has brought before them, the legislature has done all that perhaps could be done to give their procedure the uniform, undeviating tenor of judicial operations, and to circumscribe the extent of their own discretionary powers. They have brought into operation a large machinery of conditions which are absolutely necessary to the passing of a private bill, and which, consequently, in a great measure define the legal conditions under which a private bill to obtain any object can be carried through, as the law of the land prescribes the legal conditions under which the courts of justice will grant what the litigant asks. The greater part of this machinery is known as "the standing orders." They have of late been continually varied, through repeated efforts to bring them to perfection; and although they are now in a highly improved condition, it would be to no purpose to offer any statement of their purport suited for practical guidance, as they are liable to be altered every session; and the practitioner is never safe in taking any guide but the latest standing orders as issued by authority. The standing orders of the two Houses were formerly prepared without any reference to each other. They are now nearly, but not quite, identical; and the trouble caused by their partial divergence is greatly modified by a late arrangement, through which both Houses choose examiners to report on the compliance with the standing orders; and the same persons were selected for that duty by each House.

There are of course wide differences in the character and importance of private bills. One perhaps affects a population of half a million in matters so important as the local administration of justice, the organization of the police, and the paving, lighting, and sewering of the streets; while another is intended for the reconstruction of a bridge, the passing of the drainage from one private estate into another, or the sale of an entailed estate for public purposes. Hence, for the purpose of preparatory arrangements, the standing orders divide private bills into classes. The general objects of the standing orders are, notices to persons specially interested, advertisements to the public at large, plans, specifications, estimates, and deposits of money. In general, it is necessary that these injunctions should be carried out, and the way cleared for legislative proceedings in the coming session, before the end of December. About ten years ago an opinion was entertained that much of the legislative time devoted to investigations connected with private bills, and consequently much of the expense attending on them, might be saved by substituting preliminary inquiries under authorized officers for a portion of the evidence taken in Parliament. Accordingly, a system of preliminary inquiries was devised as a preparation for private bills in which public interests were concerned. In one large class of cases the inquiry was committed to the Board of Works, whose function it was to send a commissioner to the spot to hear evidence. Where the works to be authorized by the measure were likely to affect any tidal harbour, a similar function was confided to the Admiralty. The commissioners were to hear parties, summon witnesses, and call for plans and documents, like a court of justice. It must be presumed that this arrangement was found in some respects to be a failure, since in 1851 it was abolished in the class of bills for which the Board of Works acted, but was retained in those affecting the interests of the Admiralty.

Some general legislative measures, which may be divided into two different classes, have of late years had a very material effect in reducing the amount of private bill business which would have been necessary to carry into effect the arrangements to which they refer. One class of these acts contains provisions which are to be incorporated in particular classes of private bills. This device promotes uniformity, and by absolutely settling beforehand a certain portion at least of the measure which is to be discussed in Parliament, obviates a portion of the discussion, with the accompanying delay and expense. It seems to have suggested itself in one class of cases so early as the year 1801, when an act was passed containing clauses to be inserted in all subsequent inclosure acts. It does not seem, however, to have occurred to the legislature to extend this expedient to other classes of cases until a much later period. In the year 1845 several acts were passed, the object and function of which are explained by their titles, as, for instance, "An act for consolidating into one act certain provisions usually inserted in acts with respect to the constitution of companies incorporated for carrying on undertakings of a public nature;" "An act for consolidating in one act certain provisions usually inserted in acts authorizing the making of railways (8 and 9 Vic., caps. 16 and 20)." In this shape the legislature has, as it were, done once for all a certain proportion of its private bill legislation, affecting railways, canals, cemeteries, water supply, gas supply, and public companies generally. In 1847 an addition was made to this department of legislation by an act for the constitution and regulation of all bodies of commissioners appointed for public undertakings.

The other acts above alluded to as having abbreviated the amount of private bill legislation are of a different kind, since within their sphere they supersede legislation altogether, and organize another method of securing the objects

Parma.

in view. Here, too, the inclosure of land system seems to have pointed the way. In 1848 the passing of private bills containing certain assigned clauses, as already referred to, was superseded in this department, and a tribunal was appointed, called the Board of Commissioners of Inclosure, for definitively carrying out measures of inclosure. This method was applied, on a larger scale, in the creation of the Board of Health in 1848. The board, on certain requisitions, might institute a local inquiry in any town, and bring it within the provisions of the Public Health Act, which is a general embodiment of the sanitary department of a system of town police. The board was not absolute in the matter. The provisional orders which it issued were brought before Parliament in the ensuing session, and required to be confirmed by a general public act before they became law. In the session following that in which the board was established, an act was passed for the confirmation of such provisional orders applicable to fifteen towns in England.

There is a complex arrangement for the purpose of insuring impartiality in the appointment of committees to act on private bills. A committee of selection, consisting of five members, is appointed at the commencement of each session. It nominates a general committee on railway and canal bills. When the bill does not belong to either of these classes, the committee of selection chooses the committee who are to try it. The general committee on railway and canal bills choose the committees for trying these. The chairman is a member of the general committee; the number of members is five, and they must have no local connection with the measure. The Lords, in a manner nearly similar, select committees of five for the trial of opposed bills. Attendance is enforced, in order that none may judge without having heard the evidence; and the duties are often very arduous. It is now no longer practicable, as it used to be, for members of committee who had not heard the testimony or the pleadings, but who had some point of their own to carry, to rush in suddenly and swell a division. (J. H. B.)

PARMA, Duchy of, a state of Northern Italy, lying between N. Lat. 44. 19. and 45. 8., E. Long. 9. 23. and 10. 40. It is bounded on the N. by Austrian Italy, E. by the duchy of Modena, S. by Tuscany and the kingdom of Sardinia, and W. by the kingdom of Sardinia. Its length from E. to W. is about 50 miles; its breadth varies from 40 to 50; and its area is 2392 sq. miles. About a third of the country is mountainous, being occupied by the slopes and offsets of the Apennines; and several of the summits rise to a great height,—such as the Alpe di Succiso, 6807 feet high; Orsaio, 6180 feet, &c. The mountains are rugged and bleak, but their sides are covered with forests of chestnut, oak, ash, and beech. In the glens of the Apennines several affluents of the Po take their rise, and flow northwards, watering the lower regions. Most of these are small: the Tidone, Trebbia, Nura, Taro, and Parma are of some size, but none of them are navigable. Among the mountains lie many small lakes. The lowlands consist of fertile plains and hills. The most of the duchy belongs to the chalk formation, the loftier regions being entirely of this structure, while in the more level parts sandstone, calcareous tufa, and marls are also found. The mineral riches of the country are not very great: the principal is salt, of which there are several rich springs; iron is worked to some extent; copper in one place; and marble, alabaster, crystals, stones for lithography, &c., are obtained. The climate is generally temperate, and except near the Po, where unhealthy vapours prevail, salubrious. The people of the low country are chiefly employed in farming; and maize, wheat, pulse, tobacco, hemp, wine, and fruit are raised. Cattle of a good breed, sheep, poultry, silk, and bees are also produced. Large herds of hogs live in the forests; game of various kinds is plentiful; and the rivers abound in fish. The inhabitants of the mountains are, from the sterility of the soil, very inadequately supplied with food. They live chiefly on chestnuts, milk, and cheese. Many of them leave their homes in summer to seek employment in Lombardy or Tuscany; and large numbers annually emigrate to more distant countries. Parma contains few large manufactories; those of silk, which are the most important, exist in all the chief towns. Linen and cotton fabrics, paper, gunpowder, earthenware, and other articles, are likewise manufactured. The trade is not extensive, the principal articles imported being linen cloth, colonial produce, and articles of luxury; and the exports consisting of cattle, hogs, corn, wine, oil, &c. The government is an unlimited monarchy, hereditary in the male line. There are five superior courts; and the laws, established in 1820, resemble the Code Napoléon, with some modifications. The established religion is the Roman Catholic, to which most of the people belong; but toleration is extended to other sects. The duchy has primary schools, where the instruction is gratuitous; secondary schools; and superior academies at Parma and Piacenza. The military forces amounted in 1857 to 4130, which might be raised to 6139 in time of war. The revenue and the expenditure for 1857 were each estimated at L.381,332. The duchy is divided into five provinces. Pop. (1856) 495,840. In ancient times what now forms the duchy of Parma was a part of Gallia Cisalpina. After the fall of the Roman empire it was included in Lombardy; and Charlemagne, on conquering that kingdom, transferred Parma to the Papal See. In 1543 Paul III. conferred on his son Luigi Farnese the duchy of Parma and Piacenza. By the treaty of Aix-la-Chapelle in 1748, it was given to Philip, a son of Philip V. and Elizabeth Farnese. In 1801 Parma was conquered by Napoleon; but the Congress of Vienna decided that, after the death of the ex-Empress Maria Louisa, the duchy should fall to the Duke of Lucca. This took place in 1847, when Lucca was annexed to Tuscany.

Parma, the capital of the above duchy, stands in a beautiful plain, on the river of the same name, which is crossed by three bridges, 12 miles S. of the Po, and 72 S.W. of Milan. It is of an oval form, more than 4 miles in circumference, and is surrounded with walls and ditches. The streets are straight and regular, the principal being the old Roman Via Æmilia, running from E. to W. Many of the buildings are very handsome. The cathedral, consecrated in 1106, though in a mixed Lombard and Gothic style, is a noble edifice; and contains in the interior of its octagonal cupola a magnificent fresco by Coreggio, representing the Assumption of the Virgin. Parma contains one of the most splendid baptisteries in Italy, built of marble, and adorned with numerous paintings and statues. There are many other churches adorned with works of art, chiefly by Coreggio. The Farnese or ducal palace is an immense pile of building, and contains the great Farnese theatre, a library of 100,000 volumes, a picture gallery, and a museum of antiquities. Several of the other palaces of the nobility are fine buildings. The town has also an academy attended by about 400, an episcopal seminary, some inferior schools, a new theatre, and several charitable institutions. It is the residence of the duke, the see of a bishop, and the seat of the government and supreme court of law. There are here manufactories of silk, leather, carpets, cotton and woollen goods, paper, glass, earthenware, saltpetre, and other articles; and a ducal printing-press, which has issued some of the finest specimens of typography in Europe. Hardly any remains have been preserved of the ancient Parma, which occupied the same site. Pop. (1854) 41,091.

PARMENIDES, an eminent Greek philosopher of the Eleatic school, was born at Elea in Magna Græcia in the latter half of the sixth century B.C. The history of his education is not very well ascertained. Report speaks of two Pythagoreans, Ameinias and Diochætes, as his instructors. He is also said, with less verisimilitude, to have been a disciple of Xenophanes, the founder of the school of Elea. At all events, it is certain that he studied with great success, and rose to a high place in the estimation of his countrymen. He was honoured to be the instructor of Empedocles and Zeno; Plato surnamed him "the Great," and likened him to Homer; Aristotle considered him the chief of the Eleatics; and his own fellow-citizens were wont every year to swear obedience to a code of laws which he had laid down. The main philosophical opinions of Parmenides have come down to us in some fragments of a hexameter poem, entitled *On Nature*. They may be represented in the following short outline:—Assuming that sense and intellect are the only two sources of knowledge, he holds that these furnish the mind with two kinds of ideas entirely distinct. Sense is dependent on the variable organization of the individual; and therefore its evidence is changeable, false, and nothing else but a mere appearance. Intellect is the same in all individuals; and therefore its evidence is constant, true, and a complete reality. The subject is thus divided into two branches—physics and metaphysics; the former inquiring, What is the character of appearance? and the latter, What is the character of reality or being? Metaphysics, or the science of being, is discussed in the first of the two books of the poem. Being, it is asserted, is eternal. For if it be non-eternal, it must either have sprung out of being or non-being. It cannot have sprung out of being, since it cannot precede itself; and it cannot have sprung out of non-being, since non-being is utterly inconceivable. It is therefore eternal. Being is also identical with thought. For as it is eternal, it must be unchangeable, identical, unique, unity itself. Since it is unity, it must embrace all objects, and consequently all the thoughts that are occasioned by these objects. Being is therefore identical with thought. After the first book of the poem has thus evolved an ideal system of metaphysics, the second book proceeds to treat of the science of appearances or physics. A fanciful theory of the physical world is then laid down in accordance with the principles of the natural philosophy of that day. The most complete collection of the fragments of Parmenides is that of S. Karsten in the *Philosophorum Græcorum Veterum Operum Reliquiæ*, 8vo, Amsterdam, 1835.

PARMENIO, a distinguished Macedonian general, was born about 400 B.C. He had attained a mature age when he began to play a prominent part in the service of Philip of Macedon. At that time the king received him into his confidence as his favourite counsellor both in peace and war. Several important enterprises were also conducted by him in the course of the reign. In 356 B.C. he routed the Illyrians in a great battle; in 342 B.C. he successfully upheld, at the head of an army, the Macedonian influence in Eubœa; and in 336 B.C. he was appointed one of the commanders of the force that was sent to secure a footing in Asia, and to prepare for the future reduction of that country. Still greater was the importance of Parmenio after the death of Philip, and the accession of Alexander, in 336 B.C. At the council table the advice of the veteran general, though sometimes too tame for the wild genius of the young conqueror, was always heard with deference. In the field he was virtually second in command. He led on the left wing of the army at the battles of the Granicus, Issus, and Arbela; and he was entrusted with the important task of completing the subjugation of Media, while the king himself continued the pursuit of Darius into the wastes of Parthia and Hyrcania. This was the last appointment that Parmenio received. The faithful general, after he had grown gray in the service of Alexander and his father, and had lost two sons in this same expedition, was now to be rewarded with the most cruel ingratitude. His only surviving son Philotas, who had gone forward in the division of the army under Alexander, was arraigned for conspiring against the king's life. For lack of evidence, torture was applied; and a confession was wrung from him which implicated his father. Alexander, on this slight ground, and in a spirit of selfish policy, resolved to rid himself of Parmenio. Accordingly a message was despatched to Media; and the unsuspecting old man, while conversing with his officers, was stabbed by Cleander, in 330 B.C.

PARMIGIANO, or PARMIGIANINO, the name which Francesco Mazzuoli, the eminent painter, received from his native town of Parma. He was born in 1503; and being early left an orphan, he was brought up by two uncles who were painters. The boy soon began to show himself a prodigy of genius. While still a mere child, he astonished his writing-master by the sketches which he drew with his pen; in his sixteenth year, he painted the "Baptism of our Saviour" with all the skill and execution of a master; and before the age of twenty he had executed several public works, and risen to a high place in the profession. The style of Parmigiano, however, did not begin to be formed until, in 1523, he removed to Rome, and commenced to practise his art under the patronage of Pope Clement VII. The composition of his pictures then became grand and simple, the execution decided, the colouring well tempered, and the general effect full of the most exquisite grace. He was also characterized by a happy faculty of imitating Raphael, so that he acquired the surname of Il Raffaellino. Equipped with all these accomplishments, Parmigiano now executed some of those masterpieces which have immortalized his name. While still at Rome, he painted the "Vision of St Jerome," a picture which is now in the National Gallery. At Bologna, to which he repaired on the capture of Rome in 1527, he executed the figure of "St Rochus," still seen in the church of St Petronius in that city, and the Madonna della Rosa, now in the gallery of Dresden. On his return to Parma, that admired picture was painted which hangs at the present day in the Bridgewater Gallery, and represents Cupid fashioning his bow, while two boys sit at his feet, the one crying and the other laughing. From such great masterpieces Parmigiano would probably have proceeded to others still greater, and risen to rival Raphael and Michael Angelo, had not a fever cut short his career at Casal Maggiore in 1540. This painter was also eminent for his skill in etching.

PARNAHIBA, a town of Brazil, province of Piauhi, stands on the E. bank of the River Parnahiba, about 15 miles above its mouth, and 300 N. of Oeiras. It has broad unpaved streets. It is the only seaport in the province; but is not capable of admitting vessels of above 150 tons burden. Some trade is carried on in hides and cotton. The court-house and custom-house are the chief public buildings. Pop. of the district, about 10,000.

PARNAHIBA, a river of Brazil, rises near the 10th degree of S. Lat., and flows northward to the Atlantic, separating the provinces of Piauhi and Maranhão. Its whole length is more than 700 miles, for a great part of which it is navigable. It falls into the sea by several mouths, forming a delta about 5 miles broad. Its chief affluents are the Gorguea from the E., and the Balsas from the W.

PARNASSUS (modern *Liakura*), a mountain of Phocis, was celebrated in ancient mythology for its sacred character. Delphi, the oracle of Apollo, stood at its foot; the Corycian cave, sacred to Pan and the Nymphs, was situated on its slope; and Castalia, the stream which furnished the holy water for the Delphian temple, sprung up between its two summits. There also was the spot where

the Muses held their assemblies, and whence they took their flight through the midnight air.

PARNELL, Sir Henry, *Lord Congleton*, second son of Sir John Parnell, chancellor of the Irish exchequer, was born June 3, 1776, educated at Eton and at Cambridge, and afterwards travelled on the Continent. He first appeared in public life in 1802, when he sat for a few months as member of Parliament for Portarlington; but after the dissolution of Parliament he was not again a member until 1806, when he was returned for Queen's County, which he represented until 1832. During this period he was distinguished as a liberal and consistent Whig. His speeches were among the best of that period. Five of them he corrected for publication:—1*st*, On the "Irish Currency," in 1809; 2*d*, On "Tithes in Ireland," 1810; 3*d*, "The Bullion Report," in 1811; 4*th*, On the "State of Ireland," in 1824; 5*th*, On "Unlawful Societies in Ireland," in 1825. He was also the author of several interesting treatises or pamphlets, among which may be mentioned one on *Financial Reform*, in 1830, and a *Treatise on Roads*, which appeared in 1833. In 1830 a motion brought forward by him led to the dissolution of the Wellington cabinet; and he was chairman of the Finance Committee of the House of Commons in 1828. On the accession of his party to power, he was appointed one of the government commission to inquire into the excise laws, and became secretary at war, but resigned his appointments in 1832. In 1833 Sir Henry Parnell was returned to Parliament for Dundee, and for the same place in 1835, and again in 1837. On the formation of the Melbourne cabinet in 1835, he was appointed to the conjoined offices of paymaster of the forces and treasurer of the navy and ordnance, which he filled until the dissolution of that ministry in 1841, when he was called to the Upper House by the title of Baron Congleton of Congleton in Cheshire. In 1842 Lord Congleton's health became impaired; and, in a fit of temporary insanity, he put a period to his existence on 8th June in that year.

Parnell, *Thomas*, D.D., an elegant poet, was the son of an English landed proprietor who had emigrated to Ireland, and was born at Dublin in 1679. His progress through the several stages of his education was rapid. At the age of thirteen he entered the university of his native town; in 1700 he took the degree of M.A.; and in the same year, although under the canonical age, he was ordained a deacon. It was not, however, until after he had been appointed to the archdeaconry of Clogher, in 1705, that Parnell became known in the literary world. He then began to compose those poems which attracted attention by their easy versification, refined sentiment, and successful imitation of the manner of Pope. Escaping also from his solitary parsonage, he frequently visited London, to cultivate the friendship of the leading wits of both political parties. His generous heart, cultivated understanding, and social qualifications, made him a favourite with both Whigs and Tories. Addison and Steele admitted his papers into the *Spectator* and *Guardian*; and Pope, Gay, and Arbuthnot received him into the famous "Scriblerus Club." The closing years of the short career of Parnell were clouded with sorrow. The loss of his wife in 1712 inflicted a severe blow on his sensitive nature. His preferment, through the interest of Swift, to the vicarage of Finglass, in the diocese of Dublin, in 1716, did not relieve his melancholy. He became more and more averse to the solitude of home and the labours of the study, and more and more addicted to the excitement of London society and the oblivious influences of the bottle. These habits, it is said, undermined his constitution; and while returning to Ireland from a visit to the capital, he died at Chester in July 1718.

Parnell left behind him many compositions both in prose and verse. A selection from his poems, which has been frequently reprinted, was published after his death by Pope. Of these, *The Rise of Woman*, *The Fairy Tale*, *The Night-piece on Death*, and *The Allegory on Man*, deserve to be still remembered. But his most popular poem is *The Hermit*, a tale not more pleasing for its easy rhythm than for its novel plan and its picturesque incidents. A Life of Parnell, by Goldsmith, is published in Goldsmith's *Works*, in Murray's "British Classics."

PARNY, Evariste-Désiré Desforges, *Vicomte de*, the French Tibullus, was born in the island of Bourbon in 1753, and was sent to France to be educated at the age of nine. His devotion to literature did not appear in the early part of his life. At the college of Rennes he showed a listless dislike for the subjects of scholastic study. A spirit of religious fanaticism next possessed him, and led him to the very eve of entering upon a monastic life. Then rushing into the very opposite extreme of sentiment, he plunged into the midst of the pleasures of the world, enlisted in the army, and drank in with avidity the Epicurean maxims of the barracks. It was not until, at the age of twenty, he paid a visit to his native island, that an event occurred which awakened his poetical genius. He was there smitten with a passion for a young Creole maiden called Eleanor: she was soon after wedded to another; and the jilted lover returned disconsolate to France. His mind then resolved to vent its burden through the channel of verse. Accordingly, in a collection of elegies published in 1775 he described, with a fresh simplicity, easy grace, and deep pathos, the delights of a requited attachment, and the regrets, jealousies, and alternations between hope and fear, of a disprized love. The fair reputation which Parny gained by these poems was soon tarnished by a flagrant indiscretion. Losing all his fortune during the troublous days of the Revolution, and being driven to earn a livelihood by his own exertions, he was tempted to pander to the immoral tastes of the times. He commenced an attack upon decency and religion in his *Guerre des Dieux*; and he persisted in following up his odious attempt in his *Paradis Perdu* and *Galanteries de la Bible*. A piece on the culture of flowers, and another entitled *Journée Champêtre*, were almost the only productions of his latter years which were at the same time imbued with the genius of poetry and untainted by profaneness and obscenity. The consequence was, that the more respectable part of the community cherished towards him an aversion which had not passed away at the time of his death, in 1814. The select works of Parny were published by Didot, in 5 vols. 18mo, Paris, 1808, and reprinted in the *Collection de Classiques Français* of Lefevre, Paris, 1827. His *Poésies Inédites*, preceded by a notice on his life and works, were published by Tissot, 18mo, Paris, 1827.

PARODY (παρῳδία, literally *a song sung beside*,—*i.e.*, sung with certain changes, especially with the design of burlesquing the original) is a species of poetical pleasantry, produced by turning into ridicule what was intended for a serious composition. This humorous design is accomplished by preserving the form but changing the matter of the piece. This change of matter may be effected either directly or indirectly: directly, by the alteration of a letter, a word, or words, of the original, or by re-casting the whole piece, and at the same time preserving the peculiar style and form of the original; indirectly, by applying the original in its entirety, and without modification, to some subject quite foreign to the intention of the author. Parody is generally used in the same sense as *travestie*. The Greeks, from whom the word is borrowed, have the credit of originating this species of composition. Scholars assign the merit of the invention to Archilochus, but wrongly, if we are to regard the *Batrachomyomachia*, ascribed to Homer, as a species of parody. Perhaps the most successful Eng-

lish parodies of modern times are to be found in the well-known *Rejected Addresses* of the brothers Smith. *Punch* also occasionally furnishes a good parody.

PAROL is the Norman-French "word," and is employed in English law to denote oral as distinguished from written proceedings. Thus a parol contract is an agreement by word of mouth; parol evidence is the oral testimony of witnesses. In the strict acceptation of the term, however, everything is parol, even in writing, which is not under seal.

PAROLE, in a military sense, the promise (*parole d'honneur*) made by a prisoner of war, when he has leave of absence, to return at an appointed time, if not previously discharged.

PAROS, one of the largest of the islands of the Cyclades, is situated in the Ægean Sea, about 6 miles W. from Naxos, and consists of a circular mountain sloping down on all sides to a maritime plain. It was colonized at an early period by the Ionians. The island in course of time attained a high degree of prosperity. It planted colonies in Thasus (*Thaso*), at Parium on the Propontis, and at Pharos on the Illyrian coast. Its two harbours became the seats of an extensive maritime trade, and its chief town, Paros (*Parichia*), became a well-fortified city. It was strong enough to repel the attack of Miltiades by force, and wealthy enough to avert the attack of Themistocles by bribes. Shortly afterwards, however, Paros became tributary to Athens, and from that period it continued to be subject to those nations who held in succession the dominion of the Cyclades. It consequently lost all historical importance, and was chiefly famous for that beautiful Parian marble which was so extensively employed in the architecture and sculpture of the ancients. At the present time Paros belongs to the kingdom of Greece, and contains about 6000 inhabitants.

PARR, CATHARINE, Queen of England, was the eldest daughter of Sir Thomas Parr of Kendal Castle in Westmoreland, and was born at some date shortly before 1513. Her experience of the trials and vicissitudes of life began early. She was scarcely out of her childhood when her hand was given to Edward, Lord Borough of Gainsborough. Before a few years had passed, her husband died; and she became a widow in her fifteenth year. In a short time afterwards she was again married to John Neville, Lord Latimer; and at the age of twenty she was again left in solitary widowhood. It was this experience which assisted Catharine Parr in playing the difficult part which fell to her lot, when on the 12th July 1543 she was wedded to the royal wife-slayer Henry VIII. How prudently and successfully she played that part is described under ENGLAND. In 1547, the same year in which her husband the king died, Queen Catharine gave her hand to her former lover, Sir Thomas Seymour, lord-admiral of England. She died in child-bed in 1548, at the age of thirty-five.

PARR, *Samuel*, a very distinguished scholar and an acute thinker, was born at Harrow-on-the-Hill on the 15th of January 1747. At Easter 1752 he was admitted on the foundation of Harrow School, at that time conducted by the Rev. Dr Thackeray, and by the time he had attained the age of fourteen, he had, by his diligence and talents, gained the approbation of his successive teachers, and become the head boy of the school. In 1761 Parr, having completed the course of study pursued at Harrow, left school, and was for two or three subsequent years employed by his father in his own profession of apothecary and surgeon. He continued, however, to occupy all his leisure in the study of Greek and Roman literature; and his father, after considerable hesitation, entered him in 1765 at Emanuel College, Cambridge. Here his application to study was enthusiastic, incessant, and severe. His father's death, however, gave a temporary check to his hopes; and he was induced by Dr Sumner to accept of a first assistantship in Harrow school.

At Christmas 1769 Parr was ordained to the curacies of Willsden and Kingsbury in Middlesex, the duties of which, in conjunction with those proper to the situation which he held in the school, he continued to discharge till the death of Dr Sumner in 1771, when he opened a school on his own account at Stanmore. Not succeeding to his mind in this undertaking, he became master of Colchester school in 1777. During his residence there he took priest's orders, and his curacies were Hythe and Trinity Church. In 1778 he obtained the appointment of head-master of Norwich school, and early in 1779 entered upon the duties of his office. In the following year he published his two sermons *On the Truth and Usefulness of Christianity*, and *On the Education of the Poor*. He afterwards, in 1785, resumed the subject of the latter at great length in his *Discourse on Education, and on the Plans pursued in Charity Schools*. This was the most popular of all his writings, and is a fine monument of its gifted author's enlarged views, pure benevolence, and deep insight into human character.

In 1781 Parr took his degree of Doctor of Laws in the university of Cambridge, after supporting two theses, which were regarded as compositions of superior excellence and merit. In 1783 Bishop Lowth appointed him one of the prebends of St Paul's Cathedral; and during the same year he was presented to the perpetual curacy of Hatton, Warwickshire, to which, after resigning the school at Norwich, he went to reside in 1786. In 1787 appeared the justly-celebrated preface to Bellendenus, which, despite its fulsome flattery of Burke, North, and Fox, to whom it was dedicated, and its virulent political rancour, is undeniably one of the most successful modern imitations of Ciceronian Latin. But while this performance raised his fame, it did not add to his happiness, for it alienated friends, and made foes of those formerly indifferent. In 1790 Dr Parr got involved in an obscure and intricate controversy respecting the authorship of the *Bampton Lectures* published by Dr White, who seems, together with his coadjutors, to have been guilty of plagiarism.

The *Tracts by Warburton and a Warburtonian, not admitted into the collection of their respective works*, appeared in 1789, with a dedication addressed by the editor to a learned critic, containing some excellent critical remarks, and abounding at the same time in forcible expression and happy illustration. Of this composition, which it is to be feared was written more with the design of annoying Bishop Hurd, the editor of Warburton, than with any higher motive, Warton is reported to have said, that if he were called upon to point out some of the finest sentences in English prose, he would quote Parr's preface and dedication of the Warburtonian Tracts.

The Birmingham riots of 1791 called forth the *Sequel to the printed Paper lately circulated in Warwickshire by the Rev. Charles Curtis, brother of Alderman Curtis, a Birmingham Rector*, London, 1792; and *A Letter from Irenopolis to the Inhabitants of Eleutheropolis, or a Serious Address to the Dissenters of Birmingham;* both admirable specimens of the author's spirited and elegant style. In 1793 a violent pamphlet by Dr Combe occasioned *Remarks on the Statement of Dr Charles Combe, by an occasional writer in the British Critic*, 1795, written in a temporate, calm, and guarded tone. Parr's famous Spital Sermon of 1800 brought him into collision with Godwin and others of the opposite school of morals.

In 1802 Sir Francis Burdett presented him to the rectory of Graffham in Huntingdonshire. His last publication that is entitled to particular notice is, *Characters of the late Charles James Fox, selected, and in part written, by Philopatris Varvicensis*, which appeared in 1809. It con-

sists partly of extracts from the various public journals, and is partly of an original character, addressed in the form of an epistle to Mr Coke, with an additional volume of notes.

In 1823 Parr's strength began visibly to decline; and on the 6th of March 1825 he died, having completed the seventy-eighth year of his age. Notwithstanding his pre-eminent talents and great learning, Dr Parr left no work behind him destined to live. His natural benevolence and kindliness of feeling seems to have been too much cast into the shade by a vain, arrogant, and overbearing temper. When engaged in a polemic, as he too often was, he seemed actuated too much by a fierce party spirit, which led him not unfrequently to forget alike the claims of truth and the courtesies of controversy. He seems to have surpassed all men of his time in his uncommon powers of conversation. In addition to his published writings, Dr Parr left behind him a vast mass of papers, epistolary, historical, critical, and metaphysical. (See his *Works, with Memoirs of his Life and Writings, and a Selection from his Correspondence*, by John Johnstone, M.D., 8 vols. 8vo, London, 1828.)

PARRHASIUS, one of the most celebrated of Greek painters, was a native of Ephesus, and flourished towards the close of the fifth century B.C. Coming to Athens after he had studied under his father Evenor, he soon achieved the highest renown. The Athenians held him in great honour, and conferred upon him the privileges of a citizen. He painted many admirable pictures, which elicited from succeeding authors the most enthusiastic encomiums; and he established a canon of proportion which procured for him from Quintilian the title of "Legislator" of his art. How valuable his productions were, both in a practical and theoretical point of view, is described under the article PAINTING. There is even a story, that he foiled the great master Zeuxis in a contest of skill, in which he painted a curtain, and his rival painted a cluster of grapes. But while Parrhasius was thus proving himself to be one of the greatest of painters, he was also showing himself to be one of the weakest of men. He assumed the title of "Prince of Painters," and, in accordance with this character, exhibited himself to the citizens arrayed in purple and crowned with a golden garland. He dubbed himself Ἁβροδίαιτος ("The Elegant"); and he addressed to himself an epigram, dwelling with complacency upon his personal history, and congratulating himself for having brought painting to the very pitch of perfection. He had even higher moods of vanity, in which nothing less than a relationship with the immortals would satisfy him. Apollo was declared to be his ancestor, Hercules was said to visit him frequently in a vision of the night, and his own portrait was hung up in a temple to call forth adoration from the multitude. Two of the most celebrated works of Parrhasius were,—an allegorical representation of the Athenian people, which is said by Pliny to have indicated all the qualities, both good and bad, of the mob; and a picture of Theseus, which was afterwards removed to the Capitol at Rome.

PARRY, SIR WILLIAM EDWARD, *Knight*, the arctic navigator, was born at Bath, December 19, 1790. His father, Dr Caleb Hillier Parry, was a physician of considerable celebrity; his mother, the daughter of John Rigby, Esq., of Lancaster. The subject of this notice, their fourth son, had been originally intended for the medical profession, but circumstances occurred to alter this view; and in June 1803 he was appointed to the Ville de Paris, Admiral Cornwallis' flag-ship, of the Channel fleet, as a volunteer of the first class. He remained on board this ship for nearly three years, and was once engaged in action during this time off Brest harbour. Admiral Cornwallis thus recorded his opinion of the young sailor when he left his ship: —"Parry is a fine steady lad; I never knew any one so generally approved of. He will receive civility and kindness from all while he continues to conduct himself as he has done, which, I dare believe, will be as long as he lives." His next appointments were, successively, to the Tribune frigate, and Vanguard, 74. The latter was frequently engaged with Danish gunboats in the Baltic, on which occasions Parry commanded one of the Vanguard's boats.

Obtaining his lieutenant's commission in 1810, he joined the Alexandria frigate, in which vessel Parry made his first acquaintance with Polar ice between North Cape and Bear Island, after which he joined the La Hogue at Halifax. In 1814 he took part in a successful boat expedition up the River Connecticut, and was himself in command of one of the boats. For this service a medal was afterwards awarded. In 1817 he was recalled to England by his father's illness. He had for some time past almost despaired of promotion, when an opening unexpectedly occurred which threw a gleam of encouragement over his professional prospects, and finally proved the forerunner of success and renown. Towards the close of this same year he wrote to a friend on the subject of an expedition in contemplation for exploring the River Congo. The letter was written, but not posted, when his eye fell on a paragraph in the newspapers relative to an expedition about to be fitted out to the northern regions. He seized his pen, and added to his letter, by way of postscript, that, as far as he was concerned, "hot or cold was all one to him, Africa or the Pole." The friend to whom the letter was addressed showed it to Mr Barrow, secretary of the Admiralty, and the well-known patron of arctic discovery. In a few days, Parry, still a lieutenant, was appointed to the command of the Alexander discovery ship, under the orders of Commander John Ross in the Isabella, "for the purpose of exploring Baffin's Bay, and ascertaining the probabilities of a N.W. passage to the Pacific." This expedition, as is well known, ended in nothing. The ships entered Lancaster Sound, on the western side of Baffin's Bay; but the lively imagination of Ross conjured up a range of mountains barring all advance, and the ships returned home. The next year (1819), Lieutenant Parry, whose opinion as to the practicability of a N.W. passage had become known, was appointed to the command of the Hecla,—the Griper, Lieutenant Liddon, being also placed under his orders. Entering Lancaster Sound in the summer of 1819, Parry sailed *over* the supposed Croker Mountains of Ross, and naming, as he advanced, Barrow's Straits, Wellington Channel, and Melville Island, was compelled to winter at the latter place. The most difficult part of Parry's task now began. Hitherto, while the necessity of active exertion remained, and constant watchfulness of eye and hand were requisite in the prosecution of the dangerous voyage, it was comparatively easy for the commander of the expedition to preserve the health and cheerfulness of the crews. Now, however, it needed all the resources of a fertile mind and an active example to prevent the evil consequences likely to arise from want of regular employment during the dreary hours of a northern winter. But Parry was fully equal to the emergency. Theatrical entertainments were set on foot, Parry himself turning author for the time being; a weekly newspaper, the *North Georgian Gazette*, was started in the officers' mess-room; and every precaution taken to promote amusement and exercise among all. After ten months of confinement in Winter Harbour, the ships were set free; but the state of the ice rendering further progress to the westward hopeless, Parry was compelled to retrace his course to England. On his return, he was promoted to the rank of commander, was presented with the freedom of Bath and Norwich, and elected a member of the Royal Society. The narrative of this voyage to Melville Island was published by order of the Admiralty. "No one," it was said of this work at the time, "could rise from its perusal without being im-

pressed with the fullest conviction that Commander Parry's merits as an officer and scientific navigator are of the highest order; that his talents are not confined to his professional duties; but that the resources of his mind are equal to the most arduous situations, and fertile in expedients under every circumstance, however difficult, dangerous, or unexpected." (*Quarterly Review*, vol. xxv.)

In a scientific point of view, the results of this voyage are most important. On the subject of magnetism, especially, the observations, constantly and carefully registered, were the first which had ever been made so near the magnetic pole of the earth. No opportunity was ever omitted of gathering information which the means at hand could supply, and the exertions of the commander were ably seconded by those under him. The labours of Captain Sabine, R.A., who accompanied the expedition as astronomer, speak for themselves, being arranged in a valuable appendix to the narrative.

His second and third voyages, from 1821 to 1824, and from May 1824 to October 1825, respectively, were also undertaken with a view to the discovery of the long-sought N.W. passage. The former, on his return from which he was promoted to the rank of post-captain, and appointed hydrographer to the Admiralty, resulted in the discovery of the Straits of the Hecla and Griper. The voyage of 1824, resulting in the loss of the Fury, was the last expedition in which Parry was engaged for the discovery of a N.W. passage, his next public service having a different end in view, though it led him once more into similar scenes. Still, while the great problem remained unsolved, his own exertions had not been without brilliant results. To him we owe the passage of Lancaster Sound and Barrow's Strait; on the south and north, Prince Regent's Inlet and Wellington Channel; Melville Island and Banks' Land, to the far westward. Even his failures served as landmarks to guide the steps of those who followed in his track; and the extent of his success, on ground hitherto unexplored, had in a great measure exhausted the more difficult part of the undertaking, leaving to his successors only the glory of completing the last link in the chain of discovery. He lived just long enough to see this link added, as he felt sure would eventually be the case.

After the unsuccessful termination of the recent efforts to discover the N.W. passage, it seemed useless for the present to pursue the attempt further; but this did not hinder Parry from turning his attention to another quarter, where success seemed more hopeful. The interesting experiments which had been made during the late expeditions in the neighbourhood of the magnetic pole had induced many scientific men to speculate on the possibility of carrying out similar observations at the very pole of the earth itself. Parry employed the few leisure moments he could snatch from the duties of his office in drawing up a statement respecting the practicability of effecting this object by means of sledge-boats, as had been before proposed by his friend and brother officer Captain Franklin. Of the difficulties involved in the scheme he was fully aware; but, as he remarked in a letter to Franklin, then himself absent from England on arctic discovery, "The true reply to all doubts is, go and see!" The memorial, when completed, was laid before Lord Melville and the lords of the Admiralty, supported by a recommendation from Sir Humphry Davy, the president of the Royal Society, to whom Parry, as a member of the society, had communicated his views. As might be anticipated, some opposition was at first made to the scheme; but after further discussions, the objections were overruled, and Parry was appointed to the command of an expedition "for the purpose of attempting to reach the North Pole."

In March 1827 the Hecla left England. Treurenberg Bay, in the Isle of Spitzbergen, was the spot selected for her to remain in during the absence of the exploring party; and at 5 p.m. on the 21st of June, the two boats Enterprise and Endeavour, respectively commanded by Parry and his lieutenant, James C. Ross, bade farewell to their comrades on board the ship, and, with the usual salute of three hearty cheers, set out for the northward. The boats employed on this novel service were fitted with strong runners shod with smooth steel, in the manner of a sledge, to the forepart of which the ropes for dragging the boat were attached. The crew of each consisted of two officers and twelve men, of whom two were marines. The rough nature of the ice, combined with the softness of its upper surface, rendered each day's work very tedious and laborious. Urged on, however, by the example of their commander, the men, in spite of all these discouragements, laboured with the greatest cheerfulness and good-will. All hoped, and none more confidently than Parry himself, that the rugged ice over which they were now toiling would prove but the introduction to the smooth continuous plain of the main ice which the accounts of former navigators had led them to expect to the north of Spitzbergen. Day after day, however, went on, and no signs of improvement were visible for some distance to the northward, when it became by degrees painfully evident to both the commander and his officers that another obstacle to the completion of their purpose had unexpectedly arisen. This consisted in the southerly drift of the whole body of ice over which they were laboriously tracking their way, owing to the wind, which blew steadily from the N. or N.W. The observations carefully made at the close of each day's hard work showed too clearly that often less than half the distance travelled could be regarded as progress in a northerly direction. This mortifying truth was for some time kept from the knowledge of the men, who used, however, good humouredly to remark that they were "a long time getting to this 83°!" For a few days more they persevered in the face of heavy snow-storms and torrents of rain, which Parry had never seen equalled, but the drift of the ice continuing as great as ever, he was at length compelled to confess that further labour was useless. It was now the 27th of July; the day was warm and pleasant, forming a cheerful contrast to the weather they had lately experienced. "Our ensigns and pendants," Parry writes, "were displayed during the day, and sincerely as we regretted not having been able to hoist the British flag in the highest latitude to which we had aspired, we shall perhaps be excused having felt some little pride in being the bearers of it to a parallel considerably beyond that mentioned in any well-authenticated record." The southward journey over the ice occupied a fortnight; and on the 28th August the Hecla weighed anchor for England. On the 1st November she was paid off, when, for the last time, Parry hauled down his pendant. "No successor on the path of arctic adventure has yet snatched the chaplet from the brow of this great navigator. Parry is still the champion of the North." (*Times*, January 20, 1856.) At this day, through the graceful compliment of recent navigators, the land nearest either pole on which the eye of civilized man has ever rested, bears the name of him who unfurled his country's flag at a higher latitude than any before or since have been able to reach: 82° 45′ was the latitude attained on this occasion. The Parry Mountains were discovered by Sir J. C. Ross in the antarctic regions in 1841; and the same name was given by Dr Kane in 1853 to a mountain visible to the N. of Smith Sound.

His next appointment led him into far different scenes. In consequence of the mismanagement and neglect of the agents resident on the property of the Australian Agricultural Company, the directors had for some time been anxious to secure the services of some one of sufficient ability to restore matters to a proper footing, and whose known

character and name would at the same time be a guarantee against the evils from which they had before suffered. With these views, they offered the post to Captain (now Sir Edward) Parry, for he and Franklin had, on the 29th of April 1829, received the honour of knighthood at the hands of his Majesty George IV. All professional difficulties were over-ruled by the kind assurance of Lord Melville, that his acceptance of the company's offer should in no way interfere with his future prospects. Accordingly, in the spring of 1829, he received his appointment as commissioner of the Australian Agricultural Company in New South Wales. Residing at Port Stephens, the neglected state of the settlement called for the exercise of all his energies. It was, in truth, to use his own words, "a moral wilderness;" and to the cultivation of this unpromising soil he and his wife resolved to apply all their energies. The people around them consisted of three distinct classes,—First, The officers and servants of the company; secondly, The convicts, working also in the employ of the company, or acting as domestic servants in the officers' families, that of the commissioner himself included; and lastly, The natives, whose home was in the "bush," and whose encampments were often found within a few yards of the settlement. He fitted up a carpenter's shop as a place of worship, conducting the service himself, and regarding nothing as too trivial, whether a cricket-match or a *fête*, which could tend to promote innocent enjoyment, and draw close the bond which united him to those under his charge. The task of reformation proved, indeed, no easy one. The almost total want of proper discipline which had previously existed in the settlement rendered it a matter of no small difficulty to introduce a new system of order and regularity. This, however, Parry was determined to effect; and though there was at the outset much to dishearten, his judgment and firmness by degrees triumphed over all obstacles, while the genial kindness of his disposition, and his evident desire for the general welfare, gained the respect and affection of all. The want of a regular church and minister becoming more and more felt each day, he felt, as the time for his departure approached, that he could not leave a better legacy to those over whose interests he had watched for four years than a building consecrated to the service of Him whose glory had been his constant aim. A site was accordingly determined upon at Stroud. Monday, April 29, 1833, was a day long remembered in the colony, when the first stone of the new church was laid by Sir Edward. "At Port Stephens," wrote one who visited that place some years later, "Sir E. Parry found a wilderness, but left a land of hope and promise." On his return to England in 1835, the directors of the Australian Agricultural Company invited him to a public dinner, and presented him with a handsome service of plate, "in testimony of the high sense entertained of the benefits conferred by him on the colony during his residence there."

Returning to England in 1835, Sir Edward was appointed assistant-commissioner of poor-law in the county of Norfolk. The act of 1834, passed to remedy the abuses which existed under the old poor-law administration, rendered the duties of the situation arduous and often very unpleasant, by bringing him into contact with those who were unwilling to acquiesce in the new order of things. His health shortly became impaired under the pressure of work, and after a year and a half he was compelled to tender his resignation. In accepting his resignation, the commissioners expressed their regret, "on their own account personally, but still more on account of the loss of his public services, the value of which they had learnt fully to appreciate from the many proofs they had received of the discreet, judicious, and efficient manner in which he had conducted his operations in Norfolk."

In February 1837 Sir Edward was employed for a short time by the Admiralty in the organization of the packet service between the Liverpool, Holyhead, and Dublin stations. His health was now so far improved that he was anxious to be once more actively employed. An opportunity soon presented itself. The introduction of steam-power into the navy had by that time wrought great changes in the service, and a new department being about this time formed at the Admiralty, the superintendence was offered to, and accepted by, Sir Edward, under the title of "Comptroller of Steam Machinery." For nearly nine years he held the post, which proved no sinecure. The duties of his office, at first sufficiently arduous, became each day more laborious During the time of his appointment as comptroller of steam machinery the application of steam-power in the navy became almost universal. Among the most important improvements effected was the introduction of the screw-propeller, now justly regarded as indispensable in every man-of-war. Those who took an interest in this invention, and were, consequently, able to form a judgment on the subject, acknowledge that its success in the Royal Navy (which led to its general adoption in the merchant service) was, in no small degree, owing to Sir Edward's constant and earnest advocacy. Certainly few were more sanguine in their expectations of its ultimate success, and none more energetic in the support of its claims at the Admiralty. In the autumn of 1841 he was employed by Sir Robert Peel's government in drawing up a report on the state of the Caledonian Canal, and the advantage which might result from opening its waters to larger vessels. The report drawn up by him after this survey resulted in the completion of the Caledonian Canal, which was re-opened in April 1847, and has been in operation since that time, with all the advantages of increased depth of water, and other accommodation for the transit of larger vessels. In December 1846 he received from Lord Auckland (first lord of the Admiralty) the appointment to the post of captain-superintendent of the Royal Clarence Yard and of the Naval Hospital at Haslar. The position was one in every way congenial to his tastes, as bringing him once more into immediate connection with members of his own profession. As might be supposed from his life at Port Stephens, he took an active interest in the spiritual, no less than the temporal, welfare of the patients in the hospital. With the exception of the lunatics, to whom one wing of the establishment was devoted, the same individuals seldom remained under his control for many weeks together, but the number of patients actually within the walls at one time amounted to several hundreds. Desirous of providing these with an opportunity of religious instruction, independently of the regular services conducted by the chaplain, Sir Edward, on the second or third Sunday after his arrival at Haslar, commenced, with the chaplain's consent, a series of Sunday evening lectures, which were continued during the whole time of his command. These were always well attended, upwards of a hundred patients being sometimes present. "In such repute," says a medical officer of the hospital, "were these lectures held, that numerous visitors found their way to the officers' houses in order to have the satisfaction of attending them." The organization of the dockyard battalions was first commenced during the time of Sir Edward's command at Haslar; and the labourers and artisans employed in the Clarence Yard were formed into a separate corps, of which he received his commission as colonel-commandant. While at Haslar, Sir Edward gave his full support to the different religious societies of which he was a member. At Gosport and Portsea he was continually called upon to take the chair at their provincial meetings. At the time of the well-known papal aggression in 1850 a meeting was held at Gosport for the purpose of presenting an address to her Majesty; and the resolution embodying the proposed address was moved by Sir E. Parry in an energetic speech

expressive of his own willingness to take a foremost place in resisting a movement which he felt to be opposed to "the Protestant throne, the Protestant liberties, and, above all, the Protestant faith of his country."

In the foundation of a Sailor's Home at Portsmouth Sir Edward took an active part. Of the great importance and value of these institutions he was fully convinced, and always condemned in the strongest terms the idea entertained by not a few naval officers, that the character of British seamen would be lowered in the eyes of the world by any attempts to improve their moral and social condition on shore.

In May 1852 he reached his rear-admiral's flag, and was therefore obliged to vacate his post at Haslar; but towards the close of the following year he was appointed by Lord Aberdeen to the lieutenant-governorship of Greenwich Hospital. A lecture to seamen, delivered about this time at Southampton, has since been published, and placed in the seamen's libraries of her Majesty's ships by order of the Admiralty. In the summer of 1854 London and its suburbs were severely visited with Asiatic cholera. In the hospital itself it found its victims, though its ravages there were not so great as in the surrounding localities. Towards the end of August Sir Edward was himself attacked with the premonitory symptoms, which, though soon brought under control, seemed to be the exciting cause of his suffering and fatal disorder. The malady soon evidently gained ground instead of decreasing; and in order to leave no means of alleviation untried, it was determined to remove him to Ems, for the benefit of the advice of a celebrated German doctor. The hopes of recovery at first held out soon proved delusive, and he died on the 8th of July 1855.

The remains were brought to England, and buried in the mausoleum of Greenwich Hospital. Sir Edward Parry was twice married: his first wife was a daughter of Sir John Stanley, afterwards Lord Stanley of Alderley; the second, Mrs Samuel Hoare junior, daughter of the Rev. R. Hankinson.

Besides the lecture to seamen above mentioned, and the narratives of his four polar voyages, Sir Edward Parry wrote a small volume—*The Parental Character of God.* (See *Memoirs of Rear-Admiral Sir W. E. Parry, Knt., F.R.S., &c.*, by his son the Rev. E. Parry, M.A., London, 1857.) (E. P.)

PARSON AND VICAR, in the Church of England. A parson (*persona ecclesiæ*) is, according to Blackstone, one who has full possession of all the rights of a parochial church. He is called parson (*persona*), because by his person the church, which is an invisible body, is represented; and he is in himself a body corporate, in order to protect and defend the rights of the church, which he personates, by a perpetual succession. He is sometimes called the *rector* or governor of the church; but the appellation of *parson*, however it may be depreciated by familiar and indiscriminate use, is the most legal and most honourable title that a parish priest can enjoy; because such a one, as Sir Edward Coke observes, and he alone, is said *vicem seu personam ecclesiæ gerere.* A parson has during his life the freehold in himself of the parsonage-house, the glebe, the tithes, and other dues. But these are sometimes appropriated; that is to say, the benefice is perpetually annexed to some spiritual corporation, either sole or aggregate. The appropriating corporations, or religious houses, were wont to depute one of their own body to perform divine service, and administer the sacraments, in those parishes of which the society was thus the parson. This officiating minister was in reality no more than a curate, deputy, or vicegerent of the appropriator, and was therefore called *vicarius*, or vicar. His stipend was at the discretion of the appropriator, who was, however, bound of common right to find somebody, *qui illi de temporalibus, episcopo de spiritualibus, debeat respondere.* But this was done in so scandalous a manner, and the parishes suffered so much by the neglect of the appropriators, that the legislature was forced to interpose; and accordingly it was enacted, by statute 15 Richard II., c. 6, that in all appropriations of churches the diocesan bishop should ordain, in proportion to the value of the church, a competent sum to be distributed amongst the poor parishioners annually, and to provide that the vicarage should be sufficiently endowed. It seems that the parish were frequent sufferers, not only by the want of divine service, but also by the withholding of those alms for which, amongst other purposes, the payment of tithes was originally imposed; and therefore in this act a pension was directed to be distributed amongst the poor parochians, as well as a sufficient stipend to the vicar. But he, being liable to be removed at the pleasure of the appropriator, was not likely to insist too rigidly upon the legal sufficiency of the stipend; and therefore, by statute 4 Henry IV., c. 12, it was ordained that the vicar should be a secular person, not a member of any religious house; that he should be vicar perpetual, not removeable at the caprice of the monastery; and that he should be canonically instituted and inducted, and be sufficiently endowed, at the discretion of the ordinary, to do divine service, to inform the people, and to show hospitality. In consequence of these statutes, the endowments were usually by a portion of the glebe, or land belonging to the parsonage, and a particular share of the tithes, which the appropriators found it most troublesome to collect, and which were therefore generally called *petty* or *small tithes;* the greater, or predial tithes, being reserved for their own use. But owing to the unsatisfactory footing on which tithes stood in the year 1836, by 6 and 7 Will. IV., c. 71, and succeeding statutes, "The Tithe Commissioners of England and Wales" were empowered to commute the tithes into a rent charge adjusted to the average price of corn.

The distinction between a parson and vicar is this:—The parson has for the most part the whole right to all the ecclesiastical dues in his parish; but a vicar has generally an appropriator over him, who is entitled to the best part of the profits, and to whom he is in effect perpetual curate, with a standing salary. The method of becoming a parson or vicar is much the same. To both there are four necessary requisites,—holy orders, presentation, institution, and induction. (See BENEFICE.)

PARSONSTOWN, or BIRR, a market-town of Ireland, in King's County, stands on a gentle slope near the Little Brosna, 22 miles S.W. of Tullamore, and 69 W.S.W. of Dublin. It is separated into two parts by the Birr, a small affluent of the Little Brosna; and it consists of one chief and several smaller streets. They are generally straight and clean, and are lined with well-built stone houses. At one end of the principal street is a handsome square, containing a column and statue of the Duke of Cumberland, erected in 1747 to commemorate the battle of Culloden. The parish church, built in 1815, is a fine Gothic edifice with a square tower. The only other remarkable building is a Roman Catholic church surmounted with a lofty spire. There are several other places of worship, a court-house, several schools, a reading-room, public library, savings-bank, dispensary, fever hospital, workhouse, and bridewell. In Parsonstown and its vicinity there are flour and rape mills, linen factories, breweries, and distilleries. Corn markets are held weekly, and fairs quarterly. The trade, however, is of little importance. Close upon the town stands Birr Castle, the seat of the Earl of Rosse. It is a fine castellated and embattled building of great antiquity; but it has been considerably modernized. In the lawn in front of the castle Lord Rosse's great telescope has been set up. Pop. (1852) 5540.

PARTHENON. See ATHENS, and ARCHITECTURE.

PARTHIA, a celebrated empire of antiquity, was bounded on the W. by Media, on the N. by Hyrcania, on the E. by Aria, and on the S. by Caramania and Persis. It was surrounded on every side by mountains or deserts, and its surface was hilly and rugged. According to Ptolemy, Parthia was divided into five districts,—Camisene, Parthyene, Choarene, Apavarctene, and Tabiene. The ancient geographers enumerate a great many cities in this country; Ptolemy, in particular, reckons twenty-five large ones; and it must have been very populous, since we have accounts of two thousand villages, besides several cities, which were destroyed by earthquakes. Its capital was named *Hecatompolis*, so called from the circumstance of its having a hundred gates.

The history of the ancient Parthians is involved in obscurity. All we know about them is, that they were first subject to the Medes, then to the Persians, and lastly to Alexander. After the death of the Macedonian conqueror, the province fell to Seleucus Nicator, and was held by him and his successors till the reign of Antiochus Theus, about two centuries and a half B.C. At this time the Parthians revolted, and chose Arsaces as their king. Seleucus Callinicus, the successor of Antiochus Theus, attempted to reduce Arsaces; but the latter having had time to strengthen himself, defeated his antagonist, and drove him out of the country. In a short time, however, Seleucus undertook another expedition against Arsaces, which proved still more unfortunate than the former; for being defeated in a great battle, he was taken prisoner, and died in captivity. Arsaces being thus established in his new kingdom, reduced Hyrcania and several other provinces; but he was at last killed in a battle against Ariarathes, King of Cappadocia. From this prince all the other kings of Parthia took the surname of *Arsaces*, as those of Egypt did that of *Ptolemy* from Ptolemy Soter.

Arsaces was succeeded by his son, who, having entered Media, made himself master of that country whilst Antiochus the Great was engaged in war with Ptolemy Euergetes, King of Egypt. Antiochus, however, had no sooner found himself disengaged from that war, than he marched with all his forces against Arsaces, and at first drove him completely out of Media. But the latter soon returned with an army of 100,000 foot and 20,000 horse, with which he put a stop to the progress of Antiochus; and a treaty was soon afterwards concluded, by which it was agreed that Arsaces should remain master of Parthia and Hyrcania, upon condition of assisting Antiochus in his wars with other nations.

Arsaces II. was succeeded by his son Priapatius, who reigned fifteen years, and left three sons,—Phraates, Mithridates, and Artabanus. Phraates, the elder, succeeded to the throne, and reduced the Mardians, who had never been conquered by any but Alexander. His brother Mithridates, who was next invested with the regal dignity, reduced the Bactrians, Medes, Persians, and Elymeans, and overran a great part of the East, penetrating beyond the boundaries of Alexander's conquests. Demetrius Nicator, who then reigned in Syria, endeavoured to recover these provinces; but his army was entirely destroyed, and he himself taken prisoner, in which state he remained till his death. After this victory, Mithridates made himself master of Babylonia and Mesopotamia; so that all the provinces between the Euphrates and the Ganges were now subject to his sway.

Mithridates died in the thirty-seventh year of his reign, between 138 and 130 B.C., leaving the throne to his son Phraates II. But the latter was scarcely settled in his kingdom, when Antiochus Sidetes marched against him at the head of a numerous army, on the pretence of delivering his brother Demetrius, who was still detained in captivity. Phraates was defeated in three pitched battles, in which he lost all the countries conquered by his father, and was reduced within the limits of the ancient Parthian kingdom. Antiochus, however, did not long enjoy his good fortune. His numerous army being obliged to scatter themselves over the country, were attacked at disadvantage by the inhabitants, and all the invaders, along with their monarch, were exterminated. Phraates, elated with this success, proposed to invade Syria; but happening to quarrel with the Scythians, he was cut off, with his whole army, by that people.

Phraates was succeeded by his uncle Artabanus. The new king, however, enjoyed his dignity for a very short time, being, a few days after his accession, killed in another battle with the Scythians. He was succeeded by Pacorus, who entered into an alliance with the Romans. Who was the next occupant of the throne has not been ascertained; but the next king whose reign is authenticated was Sanatroces. He died about 70 B.C., after a reign of seven years, and was succeeded by Phraates III. This monarch took under his protection Tigranes, the son of Tigranes the Great, King of Armenia, gave the young prince his daughter in marriage, and invaded the kingdom with a design to place him on the throne of Armenia; but he soon thought proper to retire, and to remain at peace with the Romans. Phraates was murdered by his children Mithridates and Orodes; and soon afterwards the former was put to death by his brother, who thus became the sole master of the Parthian empire.

In this reign happened the ever-memorable war with the Romans under Crassus. It had its origin in the spirit of rivalry which existed between the triumvirs who then presided over the destinies of Rome. Pompey had conquered Mithridates and the pirates; Cæsar had subdued Gaul; and Crassus felt the necessity of maintaining his position by the achievement of some military exploit. Accordingly, no sooner had he been elected consul in 55 B.C., and obtained Syria for his province, than he resolved to invade Parthia. This expedition, owing to the fact that it was directed against a friendly people, met with considerable opposition at its very outset. The Senate refused to sanction it. The presence of Pompey was required to save it from an attack of popular dissatisfaction as it passed through the streets of Rome. When it issued from the city, the tribune Ateius, posted at the gate, with strange and awful incantations and anathemas, devoted it and its leader to perdition. Nevertheless, Crassus persisted in his enterprise. He marched to Brundusium, and sailed to Macedonia. Continuing his route through Macedonia and Thrace, across the Hellespont, and through Galatia and the northern part of Syria, he crossed the Euphrates, and commenced hostilities. Yet scarcely had a few towns yielded to the Roman arms, than that imprudence of Crassus which led to the ruin of the expedition began to manifest itself. Instead of following up his success, pressing onwards, and attacking the enemy unprepared, he returned to Syria, and passed the winter in inactivity. It was not deemed necessary to collect information and to provide resources for the coming campaign. The soldiers were allowed to neglect their training and discipline. He himself spent his time in inquiring into the revenues of cities and weighing gold in the temple of Hierapolis. This infatuation reached a climax when the time for taking the field again, and advancing into the heart of Parthia, arrived. In vain did his ally Artavasdes, King of Armenia, advise him to direct his route along the chain of the Armenian mountains, where his march might be safe from the attacks of the enemy's cavalry. In vain did the quæstor, the famous Caius Cassius, suggest to him the expediency of marching along by the side of the Euphrates, where the army might be supplied with provisions from the ships. His ear was given unreservedly to an Arab chief, who pro-

fessed the most devoted fidelity to the Romans, but who had come expressly to betray them into the hands of the Parthian king. By the advice of this smooth-tongued barbarian, he resolved to advance right through Mesopotamia. A series of disasters, unsurpassed in ancient history for their tragic interest, was the result. The army had not advanced far before they found themselves in the midst of a waste sandy plain stretching away on all sides to the horizon. There were no trees to shield them from the burning sun, no herbs to supply fodder for their horses, no streams to slake their parched throats. Want and destruction seemed to be closing around them. At this juncture they received intelligence that the foe was at hand. Then there rushed upon their minds the reports they had formerly heard of those formidable Parthian horsemen who were clothed in impenetrable mail, who drove their arrows sheer through the shields and breast-plates of their enemies, and who, while fleeing, turned round upon their saddles and shot down their pursuers with deadly certainty. Their courage began to falter. Crassus himself was so paralysed with terror that he was at a loss how to arrange his forces for the coming onset. At first he extended them in a long line, to prevent them from being surrounded. Then he formed them into a solid square, flanked by squadrons of cavalry. In this order they were hurried on over the toilsome desert until they came in sight of the Parthians under the command of Surenas. The Parthian army appeared to be neither large nor well-equipped. But no sooner had the signal for battle been given, than up from its rear, as if from the bosom of the earth, sprung battalion after battalion of barbarian soldiers. At the same instant their coats of skin, which had aided in concealing them from the eye, were dropped off, and they stood under the summer sun a living mass of glittering steel. The order to advance was passed, and on they came, marching to the crash of kettle-drums, and exasperating their valour to the pitch of frenzy with savage yells and bellowings. With a well-directed flight of arrows, they drove the advancing battalions of the invaders back into the ranks of their densely-crowded square. Then, surrounding that mass of living beings, they began to pour in upon it a continuous shower of deadly shafts. At first the Romans expected that their assailants would lay aside their bows, and come to a hand-to-hand engagement. They therefore stood passively for a while under the winged destruction which fell upon them. When they perceived, however, that there were camel-loads of arrows, furnishing a continual supply to the quivers of the archers, their strained patience gave way. A part of the army under young Crassus charged out upon their foes, and finding that they retreated, pursued them at full speed. Yet no sooner had the Parthians drawn their pursuers to some distance away from the main body of the Roman army, than wheeling suddenly round under concealment of a cloud of dust, they caught them completely off their guard. Cutting off their retreat, and hemming them in on all sides, they brought them to bay upon a small eminence, and showered in arrows upon them till not a man was left. Then they returned with redoubled valour, and with loud shouts of victory, to renew their onslaught upon the main body of the invading army. Their heavy cavalry drove in and compressed the enemy's square with their pikes, as their light cavalry thinned it with their arrows. The approach of darkness alone put a stop to their destructive attacks. As the diminished numbers of the Romans encamped that night among their dead, they were in great perplexity about their impending fate. Crassus lay prostrate upon the earth in the stupor of despair, and could take no measures for the common safety. It became the duty of the quæstor Cassius and the lieutenant Octavius to call a council of war. The resolution was adopted of escaping immediately while the enemy was at a distance passing the night. Leaving the wounded behind to bewail their fate, they hastened away with all possible speed, and arrived at Carhæ (the *Haran* of the Bible) before they could be overtaken. The ill-fated Romans, however, were still within the toils of their artful enemy. When they would have tarried within the town for reinforcements from Armenia, they found their Parthian pursuers encamped before the walls, and ready to commence an assault. When they determined to depart from the city by night, and continue their retreat, a citizen named Andromachus plotted their destruction. He first informed Surenas of their intention. Then undertaking to guide them in their flight, he retarded their escape by leading them in a zig-zag course, and completed their bewilderment by landing them in a morass. Cassius, indeed, disentangled himself from this snare, and, at the head of five hundred horse, found his way to Syria. But day came, and showed Crassus with four cohorts still floundering in the swamp, and the Parthians close at hand. He had only time to get out of the marshes, and to station his troops on a height, when the enemy came up. Surenas now saw reason for changing his tactics. A range of mountains was near; the least delay might allow the Romans to escape thither, and there they would be secure from the onset of the Parthian cavalry. He resolved to try stratagem. Advancing from among his men to the foot of the height, with bow unbent and hand outstretched, he invited the Roman general to a peaceful conference. In obedience to the clamorous demand of his troops, Crassus went down the hill with a few attendants. "What!" exclaimed the wily barbarian; "a Roman general on foot! Let a horse be brought." A richly-caparisoned steed was led up. A significant glance from Surenas informed the Parthian attendants what they were to do. They lifted Crassus roughly on to the saddle, and began to hurry him away. The Romans who had come along with him interfered; a scuffle ensued; and the unfortunate triumvir was slain. The triumph of the Parthians was now easily completed. A part of the Romans surrendered; those who attempted to escape were pursued and cut to pieces; and King Orodes celebrated the victory by ordering molten gold to be poured into the mouth of Crassus, in mockery of the avarice of the deceased.

But Surenas did not long enjoy the pleasure of his victory; for Orodes, jealous of his power and authority amongst the Parthians, soon afterwards caused him to be put to death. Pacorus, the king's favourite son, was placed at the head of the army, and, agreeably to his father's directions, invaded Syria; but he was driven back with great loss by Cicero and by Cassius, the only general who had survived the defeat of Crassus. After this no mention is made of the Parthians till the time of the civil war between Cæsar and Pompey, when the latter sent ambassadors to solicit succour against his rivals. This Orodes was willing to grant, upon condition that Syria should be delivered up to him; but as Pompey would not consent to such a proposal, the succours were denied.

Cæsar is said to have meditated a war against the Parthians, which in all probability would have proved fatal to them. His death delivered them from this danger. But not long afterwards the eastern provinces of the Roman empire being grievously oppressed by Mark Antony, rose in arms, and invited the Parthians to join them. The latter readily accepted the invitation; and in 40 B.C. crossed the Euphrates under the command of Pacorus and Labienus, a Roman general of Pompey's party. At first they met with great success, and overran all Asia Minor, reducing the countries as far as the Hellespont and the Ægean Sea, and likewise subduing Phœnicia, Syria, and even Judea. They did not, however, long enjoy their new conquests; for, being elated with their victories, and despising

the enemy, they engaged Ventidius, Antony's lieutenant, before they had effected a junction with the forces under Labienus, and sustained a complete defeat. This so disheartened Labienus that he abandoned his men by night, and left them to be cut to pieces. Ventidius, pursuing his advantage, gained several other victories, and at last entirely defeated the Parthian army under Pacorus, slaughtering almost the whole of them, and the prince himself among the rest. He did not, however, pursue this victory as he might have done, being afraid of giving umbrage to Antony, who had already become jealous of the great honour gained by his lieutenant. He therefore contented himself with reducing those places in Syria and Phœnicia which the Parthians had taken in the beginning of the war, until Antony arrived to take the command of the army upon himself.

Orodes was almost distracted with grief on receiving the dreadful news of the loss of his army, and the death of his favourite son. When time had restored the use of his faculties, he appointed Phraates, the eldest but the most wicked of all his children, to be his colleague and successor. Phraates commenced his reign by murdering his father, his thirty brothers, and all the rest of the royal family. He did not even spare his own eldest son, lest the discontented Parthians should place him, as he was already of age, upon the throne. Many of the chief lords of Parthia, intimidated by the cruelty of the new king, retired into foreign countries. One of these, Monœses, a person of great distinction, having fled to Antony, arrived in time to aid the Roman general in planning an expedition against the Parthians. Accordingly Antony set out on his march towards the Euphrates in 36 B.C., at the head of an army of 100,000. On his arrival at the river, he found all the defiles so well guarded that he deemed it expedient to enter Media, with a design first to reduce that country, and then to penetrate into Parthia. Leaving his battering-engines to follow in the rear under the protection of two legions, he advanced by forced marches to the Median city of Praaspa or Phraata, and immediately invested it. But a long series of disasters now began to thwart the object of his enterprise. The convoy in charge of his storming-machines was attacked and cut to pieces before it could reach the place of its destination. His beleaguering forces continued to blockade the town without any success, until the growing desolation of the surrounding country, and the coming severity of winter, warned them to repair to some more hospitable clime. He then exchanged the toils of an unsuccessful siege only for the disasters of an inglorious retreat. During his march homewards, the redoubted Parthian cavalry hovered round the army, laying waste the country in front, harassing the rear, and intercepting supplies. Several defeats which he gave them did not check their pertinacity. They continued their flying attacks until he reached the borders of Armenia, and had lost more than 20,000 men, the flower of the Roman army.

Antony was no sooner gone than the kings of Media and Parthia quarrelled about the booty which they had taken; and, after various contests, Phraates reduced all Media and Armenia. Elated with his conquests, he then oppressed his subjects in such a cruel and tyrannical manner that a civil war broke out, in which the competitors for the crown were alternately driven out and restored, until the middle of the first century, when one Vologeses, the son of a former king, became the peaceable possessor of the throne. He carried on some wars agains the Romans, but with indifferent success, and at last gladly consented to a renewal of the ancient treaties with that powerful people.

From this time the Parthian history presents nothing remarkable until the reign of the Emperor Trajan, when the Parthian king, by name Chosroes, displeased the Romans by driving out the King of Armenia. Upon this, Trajan, glad of any pretence to quarrel with the Parthians, immediately hastened into Armenia. His arrival there was so unexpected that he reduced almost the whole country without opposition, and took prisoner and put to death Parthamasiris the king, who had been set up by the Parthians. After this, he entered Mesopotamia, took the city of Nisibis, and reduced to a Roman province the whole of that wealthy country.

Early in the spring of the following year, Trajan, who had withdrawn to winter quarters in Antioch, again took the field against the Parthians. Having crossed the Euphrates in the face of a continued shower of arrows from the enemy on the opposite bank, he advanced boldly into Assyria, and made himself master of Arbela. Thence he pursued his march, subduing with incredible rapidity countries where the Roman standard had never before been displayed. Babylonia voluntarily submitted to him, and Babylon itself was, after a vigorous resistance, taken by storm; so that he became master of all Chaldæa and Assyria, the two richest provinces of the Parthian empire. From Babylon he marched to Ctesiphon, the metropolis of the Parthian monarchy, which he besieged, and at last reduced. But whilst Trajan was thus making war in the heart of the enemy's country, Chosroes, having recruited his army, set out to recover Mesopotamia. On his arrival in that province, the inhabitants flocked to him from all parts; and most of the cities, having driven out the garrisons left by Trajan, opened their gates to him. The emperor, however, detached Lucius and Maximus into Mesopotamia to check the revolt. Maximus was met by Chosroes, and defeated and slain; but Lucius gained considerable advantages over the enemy, and retook Nisibis, Seleucia, and other cities. Trajan then repaired to Ctesiphon, and having assembled the chief men of the nation, he crowned one of the royal family, by name Parthamaspates, king of Parthia, obliging all those who were present to engage to pay him allegiance. Thus Parthia was at last subdued and made tributary to Rome.

But the Parthians did not long continue in this state of subjection. For no sooner had they heard of Trajan's death, which happened shortly afterwards, than they drove Parthamaspates from the throne, and, recalling Chosroes, openly revolted against Rome. Hadrian, who was then commander-in-chief of all the forces in the East, and who was soon afterwards acknowledged as emperor, did not wish to engage in any new war with such a formidable enemy. He therefore abandoned those provinces which Trajan had conquered, withdrew the Roman garrisons from Mesopotamia, and fixed the Euphrates as the boundary of the empire in those parts.

Chosroes died after a long reign, and was succeeded by his eldest son Vologeses. In the reign of the latter, the Alani, a barbarous horde, broke into Media, and could only be induced by large presents to return home. His successor, also called Vologeses, having no enemy to contend with at home, fell unexpectedly upon Armenia, cut the legions in pieces, entered Syria, defeated Cornelianus, governor of that province, and advanced without opposition to the neighbourhood of Antioch, putting everywhere the Romans, and those who favoured them, to the sword. The Emperor Verus, by the advice of his colleague, Antoninus the Philosopher, hastened into Syria, and having driven the Parthians out of that province, ordered Statius Priscus to invade Armenia, and Cassius to carry the war into the enemy's own country. Priscus made himself master of Artaxata, and in one campaign drove the Parthians out of Armenia. Cassius, on the other hand, reduced all those provinces which had formerly submitted to Trajan, sacked Seleucia and Ctesiphon, and struck terror into the most remote provinces of that empire. Not long afterwards, Antoninus the Philosopher, repairing to Syria to settle the

Partnership.

affairs of that province, was met by ambassadors from Vologeses. That prince, having by this time recovered most of the provinces subdued by Cassius, promised to hold them of the Roman emperor. To these terms Antoninus readily agreed; and a peace was accordingly concluded between the two empires.

Upon the death of Vologeses, his nephew, who bore the same name, was raised to the throne. He sent troops to the assistance of Pescennius Niger in his contest for the imperial crown. Accordingly, no sooner had Severus, the successful competitor, established his authority at home, than he advanced to punish the Parthians, and laid siege to their capital Ctesiphon. The city was at length taken by assault, and the king's treasures, with his wives and children, fell into the hands of the conquerors. Severus, however, had no sooner crossed the Euphrates than Vologeses recovered all the provinces which he had reduced, except Mesopotamia. On the death of this monarch, a contest for the crown ensued between his sons. Vologeses was at first successful; but Artabanus ultimately succeeded in establishing himself on the throne. He had scarcely settled the affairs of his kingdom when the Emperor Caracalla, desirous to signalize himself by some memorable exploit against the Parthians, sent a solemn embassy to their king, desiring his daughter in marriage. Artabanus complied with his request, and went to meet him, attended with his principal nobility and his best troops, all unarmed. But this peaceable train no sooner approached the Roman army than it was attacked and mercilessly butchered by the soldiers, the king himself escaping with very great difficulty.

This inhuman treachery Artabanus resolved to revenge. Accordingly, having raised the most numerous army that had ever been known in Parthia, he crossed the Euphrates, and ravaged Syria with fire and sword. But Caracalla being murdered before this invasion, Macrinus, who had meanwhile succeeded to the purple, met him at the head of a mighty army composed of many legions and all the auxiliaries of the states of Asia. The battle lasted two days, both nations fighting so obstinately that night only parted them, without any apparent advantage on either side. On the third day the Roman emperor sent a herald to Artabanus, acquainting him with the death of Caracalla, and proposing an alliance between the two empires. The king, understanding that his great enemy was dead, readily embraced the proposal, upon condition that all the prisoners who had been so perfidiously taken by Caracalla should be immediately restored, and a large sum of money paid to defray the expenses of the war.

Partick || Partnership

As Artabanus on this occasion had lost the flower of his army, the Persians, under the command of Artaxerxes, a man of mean descent, but of great courage and experience in war, revolted against the Parthians. They were successful in two battles, and in a third they annihilated the army of their enemies, and took the king prisoner. Artabanus was soon afterwards put to death by order of Artaxerxes; and the Parthians were forced to become the vassals of a nation which had been subject to them for the space of 475 years.

PARTICK, a village of Scotland, county of Lanark, forming a suburb of Glasgow, from which it is about 2 miles W.N.W. It stands near the confluence of the Kelvin with the Clyde, and has many fine villas in the neighbourhood. There are an Established, a Free, and two United Presbyterian churches, several schools, and a literary society. In the village and its vicinity there are large flour-mills, a cotton factory, bleachfields, and ship-building yards. Pop. 2747.

PARTNERSHIP, LIMITED AND UNLIMITED LIABILITY.

Definition.

PARTNERSHIP, in *Political Economy*, the voluntary association of two or more individuals for carrying on some business or undertaking in common, each deriving a certain share of the profits, and generally bearing a corresponding share of the loss arising therefrom.[1]

The term *partnership* is commonly applied to those smaller associations—consisting usually of less than *six*, and not more than *twenty* persons—in which the partners personally conduct their joint affairs: the term *company* being applied to those great associations conducted by directors and servants appointed by the body of the partners to act for them, the latter having no direct concern in the management of the company's affairs.

Partnerships—principle on which founded.

I. *Partnerships*, whether the number of partners be great or small, are founded on that principle of association to which most great results may be ascribed. There are but few industrial undertakings that can be advantageously carried on without the co-operation of different persons. Many of them require a greater amount of capital than is usually at the disposal of individuals; and they almost all require a combination of various capacities and talents. And hence the advantage of uniting together to effect a common purpose. By the union of funds a sufficient capital is obtained. And when it happens, as is often the case, that those who contribute funds are without the peculiar skill or knowledge required to carry on the business, there are always parties to be found ready to supply this deficiency, and to contribute, as their share of the common stock, that science and practical knowledge[2] which the others want, and which are indispensable in all undertakings. And the income of both parties being dependent upon, and proportioned to, the profits which the business yields, they have the most powerful motive to exert themselves, and to put forth all their energies. Nothing can be more beneficial than such an organization. It brings different classes of individuals into the most intimate relationship, elicits their peculiar talents, and makes them mutually serviceable. In a properly-constituted partnership or association, capital, science, and skill are blended in their due proportions; and by their combined action produce results that would otherwise be wholly unattainable.

It happens, indeed, that, like most other things, partnerships are sometimes productive of mischievous results. But these are occasioned either by their perversion or abuse. The public interest requires that the whole partners in a firm should be bound by the acts of any one of their number; so that the folly or fraud of a single partner may entail very serious consequences upon those associated with him. Generally, however, this is not an evil of frequent occurrence; and there can be no question that, both in a private and public point of view, partnerships are highly beneficial. And hence their multiplication. They have grown with the growth of commerce and industry,

[1] *Societas est contractus juris gentium, bonæ fidei, consensu constans, super re honestâ, de lucri et damni communione; quam inire possunt omnes liberam habentes rerum suarum administrationem.* (Voet. *Comm.*, lib. xvii., tit. ii., § 1.)

[2] *Ita posse coiri societatem non dubitatur, ut alter pecuniam conferat, alter non conferat; et tamen lucrum inter eos commune sit, quia sæpe opera alicujus pro pecuniâ valet.* (*Instit.*, lib. iii., tit. xxvi., § 2.)

Partnership.

and have been at once a cause and a consequence of the extraordinary extension of the businesses carried on by their agency.

Leading principles in the law of partnership.

To enter into anything like a full discussion of the law of partnership would very far exceed our limits. We shall therefore merely state a few of those leading principles with respect to it with which it is of importance that mercantile men, and the public generally, should be acquainted.

The mere consent of the partners, fixed and certified by acts or contracts, is quite sufficient to constitute a private copartnership; so that if two or more merchants, or other persons, join together in trade, or in any sort of business, with a mutual, though it may be unequal, participation in the profit and loss of the concern, they are in every respect to be considered as partners. If there be no provision to the contrary, each partner would share in the profits according to the value of his contribution to the stock of the partnership, whether it consist of money, goods, skill, or labour; and, under the circumstances supposed, each would share in the loss in the same proportion in which he would have shared in the profit, had there been any. But the proportion of gain or loss to be borne by the various partners may be varied in every possible way. No particular form of words or proceeding is necessary to constitute a partnership. It may be entered into either by an express written agreement, or by a merely verbal one. The former, however, ought in almost all cases to be preferred. The contract of copartnery should state the parties to it; the business to be carried on; the space of time the partnership is to continue; the capital, time, or skill which each is to bring into the common stock, or give to the business; the proportions in which the profit and loss are to be divided; the manner in which the business is to be conducted; the mode agreed upon for settling accounts at the dissolution of the partnership; together with the special covenants adapted to the circumstances of each particular case.

To constitute a partnership, there must be a participation in uncertain profits and losses;[1] and the true criterion to determine whether a party be a partner or not is, to ascertain whether *the premium or profit he receives is certain and defined, or casual, indefinite, and depending upon the accidents of trade.* In the former case he is not, and in the latter he is, a partner. A participation in the profits of any business or adventure, without a participation in the losses, constitutes a partnership so far as to render the individual so participating liable to third parties for the engagements of the concern, though, as between the parties themselves, it may be no partnership. Persons acting merely in the *character of servants* in any undertaking, such as seamen in the whale or seal fishery, and receiving as wages a sum proportioned to the profits made by their employers, are not partners.

If an individual, by his own act or inadvertence, allow himself to appear to the world as a partner, he is precluded from disputing the fact, even though he have no interest in the profits. A partner who withdraws from a firm is liable for its debts should the remaining partners continue his name in the firm, though without his consent, unless he take the necessary precautions to show that he has ceased to belong to it. (See *post.*)

If there be no express stipulation as to the management of partnership business, the majority decide as to the disposition and conduct of the joint affairs of the firm; or if there be but two parties in a firm, one may manage the concern as he thinks fit, provided it be within the rules of good faith, and warranted by the circumstances of the case. The general duty of a partner is to keep in view, at all times and in all transactions, the interest and welfare of the partnership, by acting honestly and as a prudent man would conduct his own affairs. He ought to have no secrets apart from his copartners in matters connected with their common concern; and he ought carefully to abstain from engaging in any business or speculation, whether on his own account or with others, that would divert his attention from the affairs of the partnership, or would clash with, or be inimical to, its interests.

Partners may be avowed, ostensible, or dormant. In regard to the first two there is no difficulty; for whether a man be really a partner, or holds himself out to the public and passes as such, is immaterial in so far as his liability to the latter is concerned. And in the case of dormant partners—that is, of partners who participate in the profits of concerns without disclosing their names—they are as liable as the others the moment it is ascertained that they are partners; and they may be pursued for debts contracted when it was not known that they belonged to the partnership.

Partners may distribute their profits and regulate their affairs in any way they please among themselves; but they cannot by so doing limit, defeat, or elude their responsibility to others. Each partner, however small his share in the concern, is liable, in all ordinary partnerships, for the entire debts of the association. And it is for the advantage of the partners, as well as of the public, that such should be the case. It makes the former peculiarly sensitive in regard to each other's character and conduct, and cautious as to the nature of the transactions into which they enter; and it gives the latter that security to which they are entitled, and on which only they can place any reliance in dealing with the great majority of firms.

The act of one partner is not sufficient to bind the others, unless it relate to, and be connected with, the peculiar business carried on by the partnership: For it is only when they act with reference to the business of their respective firms that partners are to be considered as their accredited agents or delegates; and it is in such cases only that those who deal with them are entitled to rely on the security of the partnerships which they represent. It may sometimes, perhaps, be difficult to say whether a transaction into which a partner is willing to enter be so connected with the business of the partnership as to bind the latter. And in such cases third parties had better be cautious, and decline engaging in a doubtful transaction, unless they have special grounds for placing entire confidence in the partner with whom they are dealing, or have learned that his proceedings are known to, and will be sanctioned by, the firm. In matters which are clearly unconnected with the business of the partnership it is not in the power of one partner, unless under very peculiar circumstances, to bind the others. (Smith *On Mercantile Law*, 5th ed., cap. ii., § 5; Kent *On the Law of Partnership*, p. 37, &c.)

The powers of partners are very extensive. They may pledge or sell the effects of the partnership, or compound for its debts. And they may purchase such goods as they please, having relation to the business of their firms, provided there be no collusion between them and the sellers, and that no intimation has been made to the latter by the other partners that they will not be bound by the transaction. Partners are not bound by a contract entered into by one of their number as an individual only, and on his own account. But if it have exclusive reference to the business of the firm, the presumption is, that it has been entered into upon its account; and this presumption is not

[1] **A partnership in which all the profit is to go to one set of partners, and all the loss to the others, was called by the Roman lawyers a *leonine* society (*societas leonina*), from the lion, who, though assisted by other animals in his hunting expeditions, took all the prey to himself. (Phædrus, lib. i., Fab. 5.)**

Partnership.

to be disputed except by distinct and conclusive evidence. One partner cannot, as such, bind another by *deed*, except in bankruptcy.

Partners, though they should act in a fraudulent manner as respects their copartners, bind the firm in all matters connected with its peculiar dealings. But this rule will not hold unless the strangers or third parties with whom a fraudulent transaction has been concluded, have acted *bona fide*. Any knowledge of, or participation in, the fraud on their part will vitiate and upset the transaction, and relieve the partnership from its responsibility. And though the fraud were not really known to the third party, yet, if the circumstances were such as ought to have led a man of ordinary discernment to suspect there was something wrong —that the partner with whom he was dealing had no authority to act for the others, or that the transaction had a suspicious character—it would be set aside. In such cases, excess of negligence or stupidity has the same consequences as connivance or guilty knowledge. "There is no doubt," said Lord Mansfield, "but that the act of every single partner, in a transaction relating to the partnership, binds all the others. But there is no general rule which may not be infected by 'covin,' or by such *gross negligence* as may amount or be equivalent to covin; for covin is defined to be a contrivance between two to defraud or cheat a third." (Smith, *ubi supra*, p. 44.)

Parties have frequently been not a little surprised to find that they were, unknown to themselves, partners in bankrupt firms, and, as such, responsible for their debts. Nothing is more common than for books to be printed and published, the publisher taking the risk of the publication and defraying its cost, the author getting for his remuneration half the profits, should there be any, which is not often the case. This, however, is clearly a partnership transaction. And in the event of the failure of a publisher who has published a work in the way now stated, the printers, papermakers, binders, and others engaged in bringing it out, supposing their bills have not been paid, fall back upon the author, who, being a partner in the speculation, is bound to discharge their claims! Cases of this sort are not imaginary merely, but have occurred over and over again. This, indeed, is a matter in regard to which the writer of this article may truly say, "*Haud inexpertus loquor*." And such being the risks which authors who enter into engagements of this sort have to encounter, they will do well, before embarking in them, carefully to inquire into the character and position of the publishers with whom their interests are to be associated.

The authority of a partner is revocable; and it is fully established that a *disclaimer* of the authority of the partners in any particular transaction precludes the individual by whom it is made from binding his copartners. Even during the subsistence of the partnership one partner may to a certain degree limit his responsibility; and if there be any particular speculation or bargain proposed of which he disapproves, he may, by giving distinct notice to those with whom his partners are about to contract that he will not be concerned in it, relieve himself from the consequences. Such notice would rebut his *primâ facie* liability. The partnership would be suspended *quoad* this transaction. Thus, if a partner draw, accept, or indorse a bill or note, he will, in all ordinary cases, thereby render the firm liable. But, to use the words of Lord Ellenborough, "it is not essential to a partnership that every partner should have such power; they may stipulate among themselves that it shall not be done; and if a third party, *having notice of this*, will take such security from one of the partners, he shall not sue the other upon it, in breach of such stipulation, nor in defiance of notice previously given to him by one of them that he will not be liable for any bill or note signed by the others." (*Galway* v. *Matthew*, 10 East, 264.) And so in other cases.

When one of the partners has been made liable for the debts of the firm, he must seek his remedy in a rateable contribution against the others. Should one party enter into a smuggling or other illegal transaction on the partnership account, the other partners are liable for the duties and the penalty; and it is optional with the Crown to proceed against the real delinquent only, or against his partners. A bookseller or newspaper proprietor is answerable for the acts of his agent or copartner, not only civilly, but also *criminally*.

Dissolution of partnerships.

A partnership may be dissolved by the effluxion or expiration of the time during which it was originally agreed that it should continue. When it is formed for a single transaction, it is at an end as soon as it is completed. Partnerships may also be dissolved by death, agreement, bankruptcy, outlawry, &c. A court of equity will interfere to dissolve a partnership if a partner evince such gross carelessness or misconduct as would be ruinous to the firm, or would defeat the object for which the partnership was formed; or when a partner becomes insane, or is in such a state of mind as to render him permanently incapable of transacting the peculiar business of the firm; or where a partnership is formed for an impracticable purpose. Indeed, in all cases where even a partnership may be dissolved without the interference of a court of equity, it may be most prudent, if the dissolution be opposed by one or more of the partners, to file a bill praying a dissolution and account, and an injunction against using the partnership name.

When a partnership is dissolved by agreement, or one of the partners withdraws from it, public notice of the dissolution should be given in the *London Gazette*, and a specific intimation of the circumstances should be sent to all individuals accustomed to deal with the firm. Where such intimation has not been sent, an individual withdrawing from a firm may be made liable to third parties after he has ceased to have anything to do with it. He should also take care that his name is struck out of the firm; for if it be allowed to remain in it, strangers may suppose that he is still one of the partners, and he may thus be rendered responsible to them. A dormant partner, however, whose name has never been announced as belonging to a firm, may withdraw from it at pleasure without taking any step to disclose the dissolution of partnership.

Names of partners should be published.

It would, however, be expedient, in the view of getting rid of the serious inconveniences to which partners withdrawing from firms are sometimes subjected, and still more, of giving to the public that authentic information to which they are entitled, that the names of all partners in all partnerships, whether great or small, should be periodically published, and hung up in their places of business. Those who have to transact with firms, being in this way made aware of the individuals with whom they are really dealing, would act accordingly. But at present nothing may be known of these matters, or, if known, it may be by a few only; and there is no security whether, if inquiries were made regarding the matter, they would be truly answered. It is not by any means uncommon for firms to be continued under certain names long after the parties who bore them have ceased to exist, and without their having left either descendants or representatives of any sort in the business. And the designations A. B. & Co., A. B. C. & Co., and such like, are often assumed when in truth the Co. is a mere fiction. In these and similar cases the public is apt to be deceived, and to suppose that it is dealing with certain parties, when, in fact, it is dealing with totally different parties. But as such deceptions and ambiguities are uniformly mischievous, they ought to be put an end to, and firms proclaimed to be what they really are.

Partnership.

We therefore are disposed entirely to approve of the principle of the bill introduced into Parliament during the session of 1858 (by Lord Goderich) for the compulsory registration of the partners in partnerships. The clamour that was raised against it was most unreasonable. It could make no improper disclosures; for if a man be ashamed of being in a partnership, the sooner he leaves it the better it will be for himself and all concerned. Neither did it interfere in any manner of way with the freedom of industry or of association, or lay any restriction on one thing or another. Its sole object was to let in light on a few dark places; to show who Messrs A. B. & Co. really were. It eliminated fictitious names, and disclosed real and sleeping partners; but it did nothing more. It made no suggestions and gave no directions. And we have yet to learn that any wrong could be done to any honest man by its disclosures, while the benefits of which they would be productive are many and obvious. We have no doubt that some measure having the same objects in view will be eventually carried. It is difficult to suppose that it should be objected to, except by those who desire to be in the dark because it affords greater facilities for the carrying out of sinister projects.

When the joint debts of a firm are paid, and the property duly distributed among the partners, the dissolution may be said, in a general sense, to be accomplished. If any one of the firm be guilty of a breach of duty in misapplying the effects before the concern is finally wound up, the proper course is, to apply to the Court of Chancery to appoint a manager.

Within a reasonable time after the death of a partner, the survivor or survivors must account to the representatives of the deceased; and if not willing to do so, a court of equity will compel him or them. In taking partnership accounts at the death of a partner, they must commence with the last-stated account, or, if there be none such, with the commencement of the partnership; and they must end with the state of the stock at the time of the partner's death, and the proceeds thereof until it be got in.

No notice is necessary to third parties of the death of a partner; the partnership is dissolved, and all liabilities for subsequent acts cease. The surviving parties are to be sued alone for the partnership liabilities and obligations, for which they are liable to the full extent. But they are not liable for the separate debts of the deceased partner, unless, after payment of the joint debts, they have a surplus of partnership effects in their hands.

Upon a dissolution by death, if the joint effects be insufficient to pay the partnership debts, the separate estate of the deceased partner, if he have any, is liable for the deficiency.

The statements now made may probably be sufficient to give our readers a tolerably distinct notion of the formation of partnerships, and of the more important rights, duties, liabilities, &c., arising out of such institutions. Those who wish to go deeper into the subject may consult Collyer's *Practical Treatise on the Law of Partnership;* Chitty's *Commercial Law,* vol. iii., pp. 22–269; Woolrych *On Commercial Law,* pp. 298–317; Smyth *On Mercantile Law,* 5th ed., pp. 19–56; &c.

Formation and constitution of joint-stock companies.

II. *Companies.*—By a company, in commerce and the arts, is meant a copartnery or association of sundry (in Great Britain, at least *seven*) persons united together for the prosecution or carrying on of some lawful business or pursuit. The capital or joint stock of a company is greater or less according to circumstances; but whatever may be its amount, it is uniformly raised by the issue of such a number of shares of such magnitude as those interested may think expedient; the individuals enrolled in the books of the company as the holders of these shares being its partners. Owing, however, to the latter being in most instances very numerous, living at considerable distances from each other and being commonly engaged in other pursuits, it is impracticable for them personally to conduct the company's affairs. These are, in consequence, entrusted to the management of a board of directors, elected by, and responsible to, the shareholders. The latter, in fact, can do nothing individually. All their resolutions are taken in common, and are carried into effect by the directors they have chosen, and their officers. "In a private copartnery," says Adam Smith, "no partner, without the consent of the company, can transfer his share to another person, or introduce a new member into the company. Each member, however, may, upon proper warning, withdraw from the copartnery, and demand payment from them of his share of the common stock. In a joint-stock company, on the contrary, no member can demand payment of his share from the company; but each member may, without their consent, transfer his share to another person, and thereby introduce a new member. The value of a share in a joint-stock is always the price which it will bring in the market; and this may be either greater or less, in any proportion, than the sum which its owner stands credited for in the stock of the company." (*Wealth of Nations,* p. 333.)

Unlimited liability of partners at common law.

According to the common law of England, all the partners in joint-stock companies, without regard to the magnitude of the shares held by them, are jointly and individually liable, to the whole extent of their fortunes, for the debts of the companies. They may make arrangements among themselves limiting their liabilities with respect to each other; but unless established by authority competent to set aside the general rule, the partners are all indefinitely liable to the public. In some instances, however, Parliament interfered to limit the responsibility of the shareholders in joint-stock companies to the amount of their shares. And the act 6th Geo. IV., c. 96 empowered the Crown to grant charters of association to companies, the partners of which might be made liable to such an extent, and subjected to such regulations, as might be deemed expedient. And hence charters were sometimes granted for the purpose merely of enabling companies to sue and be sued in the courts of law, in the names of their office-bearers, without in anywise limiting or affecting the liability of the shareholders to the public. Such limitation was not to be implied by the grant of a charter, and was not held to exist unless it were distinctly set forth.

Limited liability of shareholders generally introduced in 1855.

It is much to be regretted that the liability of the shareholders has been still farther interfered with, and that, in this respect, a very serious inroad has been made on the old law of the country. The act of 1855 (the 18th and 19th Vict., c. 133) authorizes the establishment of companies for the carrying on of most descriptions of businesses (banking and insurance were excepted), the liability of the partners in which may be limited to the amount of their shares. And hence it results, that in all cases in which these have been fully paid up, the partners are relieved of all responsibility, and are no longer liable for anything. Though the bankruptcy of the companies to which they belong may occasion the ruin of thousands, they cannot be called upon to contribute a single farthing to the relief of distresses that have most probably been caused by their misconduct!

Well might the highest authority who can be appealed to on such subjects charge this system with injustice; for, as he observes, "in the case of the insolvency of a concern, it removes a portion of the loss, which must be borne by some party, from those who have voluntarily engaged in the concern, who have had the means of watching and controlling its progress, and who would have been the sole participators in the benefits of its success, for

Partnership.

the purpose of throwing it upon those who have had no means of insight into the state of the concern, no power over its management, and no share in its advantages. The *commandite* partners may have embarked a very small share of their property in the concern, and must, therefore, be very slightly injured by its failure; whilst those to whom it is indebted may be very seriously injured, even to the extent of ruin."[1]

Defective state of the law in regard to joint-stock companies.

Besides being vicious in principle, the law under which joint-stock companies are established is not a little confused and contradictory. Speaking generally, it may be said to be embodied in the act of 1856, the 19th and 20th Vict., c. 47, as amended by the act of the following year, the 20th and 21st Vict., c. 14. In the event, however, of a company being formed which requires peculiar or extraordinary powers,—such as the right to make roads or canals, to take up streets that gas or water pipes may be laid, and such like proceedings,—recourse must still be had to Parliament. But except in cases of this sort, the acts referred to are sufficient. And all partnerships or companies for ordinary industrial purposes, if they consist of more than twenty partners, *must* be established or registered under these acts, and made conformable to them; while, if they consist of seven and under twenty partners, they *may* be so established or registered; and in either case the liability of the partners may be limited to the amount of their shares, or be made or kept indefinite, as they may judge best. In like manner, banking companies with more than ten partners *must*, and those with seven and under ten *may*, be established, and must be registered under the act 20th and 21st Vict., c. 49; but, as already stated, the liability of the partners in such companies was not limited by the acts referred to. In addition to the clauses in the acts now mentioned as regulating the constitution of new and modifying that of old companies, there are others which relate to their voluntary and compulsory winding-up, their bankruptcy, &c. And, whether it were intended by Parliament or not, the effect of these statutes has been materially to modify the former indefinite liability of the partners in ordinary joint-stock companies. These associations have been, by a sort of legislative hocus-pocus, metamorphosed into incorporations; so that their funds only are liable to be taken in execution by their creditors. The rights of the latter have, in truth, been sacrificed without compensation or equivalent of any sort. A creditor cannot now, as he could have done three years ago, pounce upon any shareholder he pleased, and pursue him for payment of his debt, leaving to the shareholder to seek an indemnity from his copartners. When the funds of a company, supposing the liability of the partners to be unlimited, are insufficient to make good its engagements, a petition is presented to the Court of Chancery praying to have the company wound up. On this being done, the creditors can take no farther steps in the matter, but must wait the result. The court may order calls to be made sufficient to pay the debts due by the company. But this is always a very slow process; and if the creditors get paid in the end, which may be doubtful, it can only be after they have been kept out of their money for lengthened periods, most probably for a considerable number of years.[2]

We do not suppose that regulations having such consequences are likely to be permanent. Their nature and influence were not declared, and were indeed very imperfectly known, and that only to a few members, when they were before Parliament; but the longer they are maintained, the more mischievous will they be found to be. It is not going too far to say, that the present state of the law in regard to the constitution, winding-up, and bankruptcy of joint-stock companies is more than discreditable, that it is disgraceful to the country. Had its object been to introduce fraud and recklessness into their constitution and management, and delay and expense into the legal proceedings to which they may give rise, it is doubtful whether it could have been materially improved.

Undertakings which may be successfully carried on by joint-stock companies.

But supposing that joint-stock companies are properly organized, that the liability of the partners is unlimited, and that creditors have every facility given them for getting payment of their debts, still there are only certain varieties of undertakings to which they can be advantageously applied. To insure a reasonable prospect of success to a company, the undertaking should admit of its being carried on according to a regular systematic plan. The reason of this is sufficiently obvious. The business of a great association must be conducted by factors or agents; and unless it be of such a nature as to admit of their duties being clearly pointed out and defined, the association would cease to have any effectual control over them, and would be in great measure at their mercy; and, however conscientious and anxious to do their duty, they want the powerful motives to act vigorously, prudently, and economically, by which private individuals engaged in business are actuated. "Like," says Adam Smith, "the stewards of a rich man, they are apt to consider attention to small matters as not for their master's honour, and very easily give themselves a dispensation from having it. Negligence and profusion, therefore, must always prevail more or less in the management of the affairs of such companies." It also not unfrequently happens that they suffer from the bad faith, as well as the carelessness and extravagance, of their servants; the latter having in many instances endeavoured to advance their own interests at the expense of their employers. Hence the different success of companies whose business may be conducted according to a nearly uniform system, and those whose business does not admit of being reduced to any regular plan, and where much must always be left to the sagacity and enterprise of those employed. All purely commercial companies trading upon a joint stock belong to the latter class. Not one of them has ever been able to withstand the competition of private adventurers; they cannot subject the agents they employ to buy and sell commodities to any effectual responsibility; and from this circumstance, and the abuses that usually insinuate themselves into every department of their management, no such company has ever succeeded, unless when it has obtained some exclusive privilege or been protected from competition.

And even with these advantages, such is the negligence, profusion, and peculation inseparable from the management of great commercial companies, that those that have had the monopoly of the most advantageous branches of commerce have rarely been able to keep out of debt. To buy in one market; to sell with profit in another; to watch over the perpetually occurring variations in the prices, and in the supply and demand of commodities; to suit with dexterity and judgment the quantity and quality of goods to the wants of each market; and to conduct each operation in the best and cheapest manner, requires a degree of unremitting vigilance and attention which it would be visionary to expect from the directors or servants of a joint-stock association. Hence it has happened, over and over again, that branches of commerce which proved ruinous

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[1] From a paper drawn up by Lord Overstone when the subject of limited liability was first mooted in 1837. Subsequent experience has confirmed the accuracy of his lordship's views.

[2] Wordsworth's *New Joint-Stock Company Law of* 1856 *and* 1857, passim.

Partnership.

to companies have become exceedingly profitable when carried on by individuals.

"The spirit of monopolists," to borrow the just and forcible language of Gibbon, "is narrow, lazy, and oppressive. Their work is more costly and less productive than that of independent artists; and the new improvements so eagerly grasped by the competition of freedom are admitted with slow and sullen reluctance in those proud corporations, above the fear of a rival, and below the confession of an error."[1] (*Memoirs of his own Life, Miscellaneous Works*, i., p. 49, ed. 1814.)

But though in all respects unsuited for the prosecution of ordinary industrial pursuits, whether belonging to agriculture, manufactures, or commerce, there are, as stated above, various undertakings for which joint-stock companies are peculiarly well fitted, and for which, indeed, they appear to be indispensable. The railways and canals which intersect most parts of the country; the docks and warehouses in our great seaports; the gas-works and waterworks with which almost all our towns, whether great or small, are provided; and the greater portion of the public buildings and institutions by which they are embellished and the citizens amused and instructed, owe their existence to joint-stock companies. They are works that could not have been undertaken or completed except by the united capital and energies of great numbers of individuals; and being for the most part conducted on fixed principles, and according to a uniform system, their management, though not generally productive of much advantage to the shareholders, has, on the whole, been creditable to those concerned. It is not easy, indeed, to overrate the advantages which this country has derived from joint-stock associations, when applied to proper objects, and conducted by men of probity, skill, and caution.

The question in regard to the suitableness of joint-stock companies to conduct the business of banking has been frequently agitated, and is one of some difficulty. But as we have already treated this question at considerable length in the article MONEY, it is needless to resume the discussion in this place. Here it will be sufficient to observe, that much depends on the regulations under which joint-stock banks may be placed. And supposing that the unlimited liability of the partners is maintained and easily enforced, and that the bad faith or gross mismanagement of the directors is visited with suitable penalties, it is probable that the principal objections to joint-stock banks would be either removed or greatly diminished.

Limited liability in France, &c.

Partnerships with limited liability have been established in France, in the United States, and in other countries. In most cases they are subjected to peculiar provisions, but otherwise they may be instituted in a great variety of ways. Thus the responsibility of the partners may be limited to the amount of the sums which they have respectively contributed to the common stock, or to some multiple of these sums; and the power of the partners to interfere in the management of the company may be very variously regulated. The French call associations of this sort, partnerships *en commandite*. They consist of partners, or *commanditaires*, who are responsible only for the amount of their shares, and of a *gérant*, whose liability is unlimited, and who, at the same time that he is independent of the partners, has the entire management of the concern.[2] These institutions have existed in France for a lengthened period, but it is only of late years that they have been widely diffused. Latterly, however, their increase has been such that it was stated in a speech made in the *Corps Legislatif* in 1856, that more societies *en commandite* are now established in a single year than had formerly been established in half a century or in ten years of the reign of Louis Philippe. And this extraordinary increase of these societies, and the abuses of all sorts with which vast numbers of them have been infected, have attracted a large share of the public attention to their constitution, and occasioned various efforts for its improvement. But it was admitted on all hands that, down at least to 1856, the efforts referred to had been wholly ineffectual for any good purpose, and that the public was very often defrauded by the fallacious representations that were put forth in regard to the state of partnerships, by the declaration of dividends when, in fact, there was nothing to divide, and all those fraudulent devices of which we have recently had such extensive experience. And such has been the influence of this state of things, that, despite the many prejudices in favour of the system, it is believed by some high authorities that its entire suppression would be desirable.

In the meantime, however, a new law, which was the subject of a great deal of discussion, was passed in 1856 (promulgated 23d July) for the regulation of partnerships *en commandite*. But though it be in various respects an improvement on the law which it superseded, there are no good grounds for supposing that either this act, or that any other possible act, will be able to prevent abuse. It limits the amount of the shares according as the capital of the society is above or below 200,000 francs; it directs that one-fourth part of the capital shall be paid up before the business for which it has been formed can be undertaken; and it vests the entire conduct of the business, whatever it may be, in the *gérant*, or manager chosen by the partners. Inasmuch, however, as it has been found that *MM. les gérants* have very frequently issued the most deceptive statements in regard to the companies to which they are attached, a committee of *surveillance*, consisting of five members, is to be chosen in each partnership, who are to verify *les livres, la caisse, le portefeuille, et les valeurs de la société;* and the *gérant* and the committee of *surveillance* are to be subjected to very severe penalties if they knowingly emit any false representations of the state of the society. They must be sanguine indeed who suppose that a clumsy contrivance of this sort can have any effect, unless it be to multiply all sorts of abuses, to increase "*le grand nombre de mauvaises sociétés en commandite*" that existed in France when it was established. And such, we are assured, is the case. What was bad in these societies in 1856 is much worse in 1858.[3]

The French seem to suppose that by making the *gérant*

[1] The Abbé Morellet has given, in a tract published in 1769, *Examen de la Réponse de M. N.*, pp. 35–38), a list of 55 joint-stock companies for the prosecution of various branches of foreign trade, established in different parts of Europe since 1600, every one of which had failed, though most of them had exclusive privileges. Most of those that have been established since the publication of the Abbé Morellet's tract have had a similar fate.

[2] Exclusive of the societies or partnerships referred to above, there are in France *Sociétés Anonymes*, which are nearly identical with our incorporated companies, and *Sociétés en Nom Collectif*. The latter are ordinary partnerships, in which the partners are jointly and severally liable to the utmost extent for the debts of the partnership.

[3] We borrow the following statements from a paper of the 20th March 1858:—"Companies *en commandite* are giving a good deal of occupation to the courts of law here, just as directors of banks are doing in London, and the revelations that are made respecting them are well worth the consideration of that very numerous portion of the English commercial world which is interested in French speculations. Within the last few days the Tribunal of Correctional Police has condemned one honest gentleman (*gérant*) of the name of Damonien to imprisonment and fine, for having swindled the unfortunate shareholders of the 'Compagnie Parisienne des Equipages de Grande Remise' out of L.20,000 in cash and shares, having plunged them into debt to the amount of L.80,000, and having squandered all their capital, amounting to L.320,000. To be sure, he had what he called an 'idea,' which was to get up the company in shares; but

Partnership.

indefinitely responsible to the public, and independent of the company, they will obtain at one and the same time the advantages of individual enterprise and economy with the limited liability of the partners. But while these results are all but incompatible, the attempt to combine them seldom fails to have others that are highly pernicious. A manager who is really independent, and may conduct a company as he pleases without let or hindrance on the part of its members, is extremely apt to conduct it with a view mainly to his own interests, how much soever they may be at variance with those of his nominal constituents. To obviate this risk, the partners most commonly endeavour to select a manager on whose concurrence with, or subservience to, their views they think they may depend. And supposing them to succeed in this object, all the advantages said to be derived from the independence of the manager are at an end, and he becomes a mere instrument for carrying out the views of a clique of irresponsible partners. Hence in very many cases the *gérants* are in reality mere men of straw, directed by the disguised but well-understood hints or commands of the leaders of the association, who, secure in their non-liability, are enabled to gamble on a large scale, and to engage in any sort of adventure.

Limited liability in England unnecessary and mischievous.

The limited liability companies established in this country are relieved from the foppery of legislation now adverted to. Except in the license given them to contract an unlimited amount of debt, without being liable for more than a limited and, it may be, an inconsiderable amount of shares, they do not in other respects differ from ordinary companies. They are managed by boards of directors, whose duties are the same in their case as in that of others.

In countries like France, where the people are mostly in narrow circumstances, and unaccustomed to, and afraid of, speculative enterprises, there may perhaps be some ground for permitting the formation of partnerships *en commandite*. And if they were confined to undertakings that admitted of being carried on according to a system of routine, such as railways, canals, fire and life insurances, gas-works, and so forth, we do not know that they would be open to much objection. But in a country like this, where capital is abundant, and where all enterprises, however hazardous, that promise anything like a reasonable return are eagerly undertaken, all extraordinary inducements to make capitalists come forward are unnecessary, and therefore objectionable. We admit, indeed, that in the case of companies of the special class now alluded to, though nothing be gained, there is no great hazard of much being lost by the shareholders being endowed with the privilege of limited liability. Such companies are not easily perverted to improper purposes; and though the capital of the shareholders may be unprofitably expended, yet, as it is most commonly laid out on visible, permanent, and sometimes valuable works, there is a fund on which the creditors, in the event of the concern failing, may fall back. But modifying circumstances of this sort have very rarely any place in companies formed for conducting ordinary industrial or commercial businesses. In their case the entire capital of the association may be lost or embezzled, without a farthing being left to the creditors. And it is, moreover, if anything can be, a contradiction and an absurdity to suppose that ordinary industrial pursuits can be so well managed by great associations of any sort, whether the partners be indefinitely responsible or not, as they will be by individuals or small associations. The latter act on their own account, and reap all the advantages of superior skill, attention, and economy, at the same time that they are indefinitely responsible for all the losses they may incur, and for all the mistakes into which they may fall, whether in the contrivance or the execution of their projects.

But though great public companies be unsuitable for the conduct of all save routine businesses, the fair presumption, or rather we should say, the certainty is, that those in which the responsibility of the partners is limited, will be much more unsuitable, and more productive of mischievous results, than those in which there is no such limitation. It must, indeed, be conceded, that despite the heavy responsibility under which the partners in ordinary associations or partnerships now act, they too often display an inexcusable degree of foolhardiness. But it is probable that the recent experience of the ruin that may result from placing too much confidence in directors will lead to an improvement in this respect, and that the character and conduct of these functionaries will be more carefully inquired into. Independently, however, of this circumstance, those who compare the number of associations which have been ruined by the bad faith, incapacity, or mismanagement of certain sets of directors, and the carelessness and misplaced confidence of others, will, after all, find that they bear but a small proportion to the total number of such associations. Bankruptcy and insolvency, though treated with infinitely too much indulgence, are still, speaking generally, very serious calamities; and, except when the partners have associated for sinister purposes, or when they have an overweening confidence in their managers, they seldom fail to inquire into the condition of the association, and to adopt such measures as may be judged needful to

he made the shareholders recompense him for the 'idea' by a grant of paid-up shares to the amount of L.60,000. Part of the operations of the company was to buy up small livery stables; and the *gérant* made purchases in his own name, and sold them to the company for considerably more than he paid for them: in one case he made the company give him L.60,000 for what cost him L.36,000. The same tribunal has also had to condemn the *gérants* of another company, called the 'Lignéenne,' which professed to make paper from wood: its nominal capital was L.160,000, and of that sum the *gérants* took L.40,000 for a patent they brought into the concern, while they sold for their own advantage, and for whatever they would fetch, L.40,000 worth of shares, and coolly embezzled all the money the shareholders paid in, and all that could be borrowed. In another case before a tribunal, it appeared that a brace of knowing gentlemen had entered into an arrangement with some bankers to palm off on the public, for L.280,000 or L.320,000, some forests and mines in some outlandish region on the banks of the Danube which they had purchased for L.40,000. In another case, it appeared that the *gérants* of a mining company near Aix-la-Chapelle deliberately sold to their shareholders mines for L.100,000 which they were afterwards obliged to admit were worth only L.60,000. It would be easy to cite other cases of recent occurrence in which revelations not less startling have been made; but these few will suffice to enlighten the public. It must not, however, be forgotten that a case more scandalous than any of them has yet to be brought before the courts—that of M. Prost, of Discount Bank notoriety, who has defrauded his shareholders of many millions (of francs), and who has taken to flight. By the way, these shareholders had a general meeting a few days ago, and after a good deal of most vehement abuse of Prost and his '*Conseil de Surveillance*,' they nominated a committee of five of their body to make a searching investigation into their affairs, in order to ascertain precisely to what extent they have been robbed.

"Other companies *en commandite* there are which, though not falling or likely to fall into the hands of justice, have subjected the shareholders to grievous loss. I refer to those of which the shares during the speculating mania brought enormously high premiums, but which have now fallen to their true value. Thus the shares of the *Messageries Imperiales* once obtained 1510 francs; they are now at about 550 francs. The shares of the company '*des Petites Voitures*' were, shortly after being issued, at 210 francs; they are now to be had for 40 francs. The shares of the Union Company once sprung up almost at a bound from 395 francs to 500 francs; and 65 francs is about the present quotation. People at one time were very glad to give 750 francs for shares in the *Franco-Americaine* Navigation Company; now they can have as many as they like for 30 francs. The Amalgamated Gas Company shares at one time were done at 1120 francs; yesterday they were at 720 francs. And the difference between the past and the present value of the shares of the famous *Crédit Mobilier* is known to everybody."

Partnership.

improve its situation and prospects. This cautious *surveillance* is, of course, less manifested in great associations, where ordinary individuals feel that their efforts are apt to be of little avail; but even in their case it is always forcing itself into notice, while in smaller associations, or those comprising comparatively few partners, each being fully alive to his responsibility, exerts himself to obviate extravagance or mismanagement in the conduct of the business, and to make it a source of profit.

Without, however, insisting farther on these considerations, if parties will every now and then be careless of their interests, and forget or decline to adopt the necessary precautions to guard against abuse and loss when everything they have is staked on the result, their carelessness, it is obvious, will be immeasurably increased when they may limit their liability at pleasure, and speculate without any fear of the consequences. Can any one doubt that, under such circumstances, wild projects of all sorts will be very greatly increased; and that the number of those extensive bankruptcies which are productive of so much misery will be largely augmented? To suppose the contrary is to suppose what is plainly contradictory. It is equivalent to supposing that a man cares as much for L.1000 as for L.5000 or L.10,000, or any greater sum; or is as anxious about a small part as about the whole of his fortune, how large soever it may be.

Facilities which limited liability gives for organizing swindling associations.

It is obvious too, on the slightest consideration, that the facilities for organizing fraudulent and bubble companies have been greatly extended by the new system. A few half-employed attorneys, half-pay officers, and men upon town, with abundance of time on their hands and little money in their pockets, have no difficulty in establishing non-liability companies. They meet together and project an association for some purpose or other—it matters little whether it be practicable or not—which they affirm will yield a profit of some 10, 20, or 30 per cent. after all expenses are deducted. And having hatched their scheme and issued their prospectus, they sally forth to canvass for subscribers. They assure those to whom they address themselves that the project is sure to succeed; that their liability being limited, they run no risk; and as the shares are only some L.20 or L.50, of which not more than a half is required, they advise them as "friends" not to miss an opportunity, which is not likely to recur, of providing for their families, making themselves independent, or adding to their fortunes! And, what with this sort of blarney, the puffs and paragraphs of newspapers, and, above all, the legislative guarantee against risk, they seldom fail of accomplishing their object; that is, of becoming directors, secretaries, managers, and such like dignitaries. The reader must not suppose that this is an imaginary picture. It has been over and over again realized to the very letter in the getting-up of not a few of the non-liability companies that have been set on foot in England during the last two or three years. The affairs of some of them have already come before the courts of law; and if we took these for samples of the others, we should have to regard them as little better than mere swindling engines. But it would not be fair to conclude from the instances referred to that such was their uniform character. A good many have no doubt been honestly got up; and the greater number of these being for routine purposes, such as the supply of towns with water and gas, it may be assumed that they will be fairly conducted, and will succeed. But there are very many of a totally different character. And it would be childish to suppose that in any case the same consideration will be given either to their formation in the first instance, or to their future management, that would be given were the partners indefinitely liable. Hence, while the system operates to the prejudice even of the best schemes, it holds out every temptation to set on foot projects with the intention of deceiving and victimizing the public.

Number of non-liability companies no proof of their being required.

The contrivers of the new system tell us that, whatever it may really be, it is at all events popular with the public; and in proof of this, they refer to the great number of companies that have been already formed with limited liability. But no such reference was needed to enable any one to foresee that if a plan were set on foot to enable parties to contract debts without being bound to pay them, it would be eagerly grasped at. Gambling-houses are at present prohibited; but if they were to be licensed, does any one doubt that numbers of them would be opened in most considerable towns? And we should be told that this was a conclusive proof that the prohibition of gambling was disapproved by the public, and that it required the healthy excitement furnished by the newly-opened places of entertainment! But whatever may be the case with this or that institution, one should think that the former facilities for swindling might have sufficed, without giving them further encouragement.

Limited liability will not increase the caution of the public.

But however powerful the deleterious influence of the non-liability system (for such it is when the shares are paid up) on the formation and conduct of companies, we are assured that it will be more than countervailed by the greater caution it will infuse into those who may deal with them. The names and the number of shares held by the partners in such associations, and the magnitude of their capital, or of the "fund" to which their creditors have to look, are all to be made known; so that those who transact business with them will be really aware of what they have to depend upon. But we take leave to say that they will have no such knowledge. Suppose that a non-liability company had a capital of L.50,000 or L.100,000, and that it was wholly paid up when it was established: it may have been greatly reduced, or wholly lost, in the next or in any subsequent year; and yet, as the public can know nothing, or nothing certain, of its losses, and may, on the contrary, suppose it has been successful, its credit may not be impaired, and it may go on extending its business and adding to its obligations after it is really insolvent. Ordinary partnerships, unless they consist of parties of very questionable solvency or character, have seldom any considerable difficulty in obtaining large amounts of credit; and companies, it matters not of whom composed, which are reported to have some L.10,000, L.20,000, or L.50,000 of paid-up capital, will be sure to obtain loans to a much greater extent and with still greater readiness. In their case we have a kind of authorized guarantee for the possession of wealth. And this, it will be said, precludes all room for distrust; so that, unless we had access to very peculiar sources of information, it might be not a little dangerous to question the solidity of such an association; though the whole thing may be a snare and a delusion. The assurance, whether official or otherwise, that a certain amount of capital has been paid up, is really not worth a farthing. But the chances are, that it will, notwithstanding, serve its purpose with the million. It will make that appear to them to be gold which may not even be copper, and enable parties without a shilling to borrow large sums, and to trade or speculate on the means of others. In such cases the public is helpless. There is nothing on which it can rely; and when the imposture is discovered by the bursting of the bubble, no one is to be responsible for anything.

However it may be accounted for, there is nothing that is so lavishly and inconsiderately bestowed as credit. Frequently, indeed, it is rather thrust upon than given to individuals and firms. And it would be ludicrous to suppose that this is a case in which we can place any dependence on the caution of the public. The only real security is in

Partnership.

the discretion, good sense, and, more than all, in the unlimited liability of the partners. They know, or may know, what they are worth, and what they are about, which no one else can know. And in the vast majority of cases they farther know that they will be bankrupts and beggars unless they act prudently and circumspectly. Hence our late legislation is precisely the reverse of what it ought to have been. Instead of diminishing, we should have increased the responsibility of partners, by abstaining from all interference with their indefinite liability, and giving additional stringency to the bankruptcy laws.

That increased caution on the part of the public which it is said will be a result of the new system is really, therefore, no better than moonshine. It can have no practical influence. The only security which in such matters is worth a pinch of snuff consists in the responsibility of partners. It is not to those who deal with this or that house, but to the houses themselves—to the guarantees under which they have been placed—that we must look for protection against foolhardiness and fraud.

It may therefore be reasonably concluded, that in ordinary businesses,—that is, in all businesses for carrying on branches of agriculture, manufacture, or trade,—partnerships with limited liabilities can be neither more nor less than unmixed nuisances. If honestly conducted, they must fail in their competition with private parties; and if otherwise, they will only add to the means, which were already sufficiently extensive, of wasting capital and fleecing the public.

In the scheme laid down by Providence for the government of the world there is no shifting or narrowing of responsibilities, every man being personally answerable for all his actions. But the advocates of limited liability proclaim in their superior wisdom that the scheme of Providence may be advantageously modified, and that debts and obligations may be contracted which the debtors, though they have the means, shall not be bound to discharge. Borrow, say they, as much as you please, and pay as little as you like,—the less, it would seem, the better! And can it be doubted that the adventurous, the needy, the unprincipled, and the desperate, will be eager to avail themselves of such extraordinary privileges? The reckless speculation, and the consequent bankruptcy and ruin, that have on former occasions overspread the kingdom have been trifling compared with the revulsions which may be anticipated, should the new system be allowed to spread its roots and scatter its seeds on all sides. Even the soberest individuals may be tempted to embark in hazardous projects; for, by limiting the risk, they in great measure secure themselve against loss by failure, at the same time that they reap all the advantages of success. Were Parliament to set about devising means for the encouragement of speculation, over-trading, and swindling, what better could it do than to carry out the non-liability system?

Penalties in the 19th and 20th Vict., cap. 47, no security against fraud.

But we shall perhaps be told that these results, though apparently probable, cannot happen, inasmuch as Parliament has provided, by the Joint-stock Companies Act, the 19th and 20th Vict., chap. 47, sect. 14, that in the event of the directors of a company declaring and paying a dividend when the company is known by them to be insolvent, they are to repay the same out of their own pockets.[1] Perhaps the reader may be inclined to think that those who are disposed to trust to a security of this sort are rather easily satisfied. A body of directors who would, under any circumstances, declare a dividend when they knew that the concern over which they presided was bankrupt, will not be kept in the right path by the threat now referred to. The declaration of dividends when there is nothing to divide is not the way in which dishonest directors would be most likely to defraud their constituents and the public. They would make loans to each other, or if that be prohibited or apt to excite suspicions, they may do the same thing indirectly by the intervention of third parties. The capital and credit of the institution may be perverted, abused, and dissipated in a thousand ways before the circumstance becomes known to the public. And when the courts of law begin to inquire into the matter, they may probably find that the directors, like those of the Eastern Bank of London, have gone to enjoy themselves and repair their exhausted energies on the classic shores of the Mediterranean.

It is the merest delusion to suppose that anything, save the unlimited liability of the shareholders, can be made to afford even the semblance of an efficient check over the conduct of directors. And they no doubt may, and frequently do, fail to exercise that degree of *surveillance* over them which is as necessary for their own security as for that of the public. But if so, the fault is theirs, and there is no ground or reason why they should be permitted to escape from its consequences. The public have neither right nor power to interfere in the matter. Directors are the servants of shareholders, and they must answer, and, if needful, suffer, for their proceedings.

Increase of liability without making it unlimited.

Some who are friendly to the principle of limited liability, but who are at the same time aware of the abuses to which it cannot fail to lead if the liability be limited to the mere amount of the shares, say that they would not object to its increase. It has, in consequence, been proposed to fix the liability at double or treble the amount of the shares; so that when a limited company failed, the subscribed capital of which had been fully paid up, the partners would not, as is now the case, be relieved of all responsibility, but would be obliged to make a further payment, if that were required, equal to the amount of their shares, or to double that amount, as might be decided upon. And this would undoubtedly be a very great improvement upon the existing system; for, while it would raise the character of the partners in limited associations, and make them more careful in regard to those they might choose for directors, and more disposed to watch their proceedings, it would make them contribute to the entire or partial relief of those whom they might otherwise have involved in total ruin. If, therefore, the system is to be continued, we should strongly recommend that the liability of the partners should be raised to at least double the amount of their shares. This would add to its solidity, and divest it of some of its worst features.

But, after all, this is only paltering with or mitigating an evil which should be cut up by the roots. Every sound principle is outraged when a man who has the means of paying his just debts does not pay them. Whether they are contracted by himself directly, or in company with others, is of no importance. He is in either case bound to pay them; and to pass laws to protect him in declining to pay them is to give a legislative sanction to dishonesty and villany.

The prohibition of limited liability not an improper interference with the freedom of industry.

It is alleged, however, that these representations are fallacious; that it is a manifest encroachment on the great principle of the freedom of industry to hinder individuals from engaging in partnerships under such conditions as they may choose to lay down; that in the event of these conditions being publicly declared, and everybody made aware

[1] This is the statement in the body of the act; but in the "Regulations for the Management of Companies" attached to it we are told that "no dividend shall be payable, except out of the profits arising from the business of the company." We of course do not presume to decide whether this or the other statement be the more correct; but their contradictory nature affords a curious illustration of the slovenly, slipshod style in which the most important statutes are often compiled.

of what they are, they cannot be justly objected to; for as it is optional to deal or not deal with the association, those who dislike the conditions upon which it is established may keep aloof from it. But sophistry of this sort is too transparent to deceive any one, and might, in truth, be employed to excuse almost any sort of jugglery or delusion. The question is not whether limited liability be consistent with this or that abstract principle, but what are its practical results—what its probable influence over that public well-being, to promote which either is or should be the object of all legislation? It is with its operation in this respect, and with it only, that we have to deal. Publicans and carriers have made frequent attempts to limit or reduce their heavy responsibilities to those who make use of their services. But the great principle of public utility stood in the way of their claims; and they have not yet succeeded, and it is to be hoped never will succeed, in effecting their object; though ten times more may be said in favour of their exemption from indefinite liability than can be said in favour of the exemption of those engaged in ordinary businesses. If, indeed, there be one principle which more than another conduces to the public advantage, and may be said to constitute the foundation of all dealings between man and man, it is the obligation to discharge one's debts and obligations. And when such is the case, it is the bounden duty of government strictly to enforce the rule of unlimited liability, unless in cases, if such there be, when it can be clearly made out that the public interests will be better promoted by its relaxation or suspension. If a case of this sort be satisfactorily established, then undoubtedly the rule referred to should be waived in as far as it is concerned. But we entirely deny that, when tried by this test, it either has been or can be shown that partnerships *en commandite* are publicly advantageous. On the contrary, we have seen that they are in the last degree injurious, and that it is not possible they should be extensively introduced without giving an immense stimulus to fraud and reckless speculation.

In dealing with ordinary firms or associations, people trust, or believe they may trust, to the reputation for skill and integrity, and to the presumed wealth, of one or more of the partners. Such presumptions are not, indeed, always to be depended upon. In these, as in other matters, people may be misled by appearances, and may place an unmerited degree of confidence in earnest though insincere professions and promises. But how deceptive soever, the presumptions or indications referred to afford not merely the best, but the only guarantees that can really be had for upright conduct. Most people engaged in business, as hitherto carried on, are impressed with the well-founded conviction that their interests will be best promoted by their preserving an unblemished reputation; and when they act under the heaviest responsibility, the chances are ten to one that they will behave discreetly and honourably. But we have no such guarantees for the conduct of the partners of a society *en commandite*. Character is in their case of little, or rather of no consequence. Instead of being responsible, they are all, or may be all, but irresponsible. A, who is worth L.50,000 or L.100,000, has not more, perhaps, than some L.1000 or L.2000 vested in the society. Whether he lose or gain by such investment is a matter about which he probably cares very little. Most likely he has joined the association that he might engage, without fear or apprehension, in the boldest speculations. But whether this be or be not his object, it is an insult to common sense to suppose that associations of this description will be as carefully and skilfully conducted as those in which the partners are indefinitely liable for their proceedings.

It has been attempted to apologize for the non-liability system by referring to the usury laws, which permit loans to be made at any rate of interest and under a great variety of conditions. That, however, has evidently no real bearing on the matter. If A lend B a sum at 5, 10, or 15 per cent., it is the affair of the parties, and of none else. They enter into the transaction with a full knowledge of the circumstances, and believe it will be for their mutual advantage. There is, however, no limitation of risk either on the one side or the other. The business in which the loan is to be employed may not succeed, and the borrower may become bankrupt; but if so, his entire effects will be liable to the uttermost farthing for this and his other debts. He therefore has every motive to manage his business so that he may avert a catastrophe that would bring with it his inevitable ruin. But such would not be the case were B's liability limited; and it would be foolish to expect to have the conduct suited to one set of circumstances under a totally different set.

Influence of non-liability in the United States.

It would be the easiest thing imaginable, were it at all necessary, to corroborate the previous statements by illustrations drawn from the United States, where the principle of limited liability has been long established. But these must be familiar to almost all our readers. Everybody knows that, notwithstanding the peculiarly favourable circumstances under which the Americans are placed, from their free institutions, their enterprising character, the lowness of their public burdens, and the boundless extent of their fertile and unoccupied lands, bankruptcy is ten times more prevalent among them than in England. The revulsions by which we are sometimes visited, though sufficiently severe, are gentle in the extreme compared with those that periodically devastate the United States. In various instances, one of which is of very recent occurrence, every banking company in the Union has stopped payment, while great numbers have been totally destroyed. And it is the same with associations of all sorts. A spirit of over-trading, or a determination, at all hazards, to "go a-head," is universally prevalent, and bears there, as here, its legitimate harvest of bankruptcy and disaster. So much so, indeed, is this the case, and such and so violent are the convulsions referred to, that it is no exaggeration to affirm that monied fortunes and personal property are more secure in Austria and Russia than in the United States. The national character has suffered through this miserable system. Those repudiations which have so justly damaged the credit of the Americans originated in their attempting to limit their responsibilities in their public as well as in their private capacity. And it could hardly, indeed, be expected that people who may contract debts to their neighbours which they are not bound to pay should be disposed to make an exception in the case of their foreign creditors.

Limited liability injurious to the poorer as well as to the richer classes.

We sometimes hear the rather unwarrantable assertion, that, unless their liability be limited, neither the poorer nor the richer classes are generally disposed to engage in extensive partnerships! But if it really had the effect of tempting the poorer classes to engage in them, that alone would be a very sufficient reason why all associations with limited liability should be suppressed. The condition of these classes will never be improved by withdrawing their attention from the businesses to which they have been bred, and in which they are engaged, to fix it on joint-stock adventures. The spirit of gambling and speculation is already quite enough diffused, without seeking to spread its baneful influence among the lower classes. Nothing should be done which it is possible to avoid to divert their attention from the pursuits of sober persevering industry. Their surplus earnings may be far more beneficially invested in savings-banks, in loans, and in contributions to friendly societies, than in joint-stock adventures.

And while, on the one hand, it would be very wrong to tempt by immunities of any sort the labouring classes to

engage in such schemes, it is, on the other, quite superfluous in the case of their richer brethren. They are already much too prone to embark in them. Even in those businesses, the hazard of which is extreme, there is no good reason for exempting those by whom they are carried on from the fullest responsibility. If the demand for gunpowder were doubled, the supply would very shortly be increased in an equal degree. Wherever there is extra risk it is compensated by extra profits; and, practically, it is not found that the cost of gunpowder, or of any like article, is in any degree increased from capitalists being disinclined to face the hazard of its production.

Cautious men are content with moderate profits, and encounter only moderate risks; while those who are sanguine and adventurous, whether they be rich or poor, eagerly grasp at the highest profits, and to realize them do not hesitate to run the greatest hazards. Now, there is nothing surely to object to or amend in this. And yet the whole doctrine of limited responsibility proceeds on the contrary assumption—on the principle, if we may so call it, that profit and risk shall be divorced from each other; that speculators may undertake adventures, having, on the one hand, the chance of making unlimited profits if they turn out well, and on the other, of escaping, though they may ruin others, with a comparatively trifling loss if they turn out ill. In that peculiar class of cases in which it would seem at the first blush of the matter that limited responsibility would be least objectionable, it will be found to be most pernicious; for it will give an unnatural stimulus to what certainly does not require it, that is, to hazardous enterprises and desperate adventures.

On the whole, nothing but mischief can be legitimately anticipated from the establishment of partnerships with limited liability, or *en commandite*. It was not by the aid of the principles which they involve, by shirking responsibility, and evading the risks inseparable from all undertakings, that we have attained to our pre-eminence in character, in wealth, and in manufacturing and commercial industry. But are we well assured that the adoption of a contrary system will not mark the æra of our decline?

Application of limited liability to banking.

We have already seen that the limited liability system was not applied in the outset to the business of banking. But this exemption has been of short continuance, a law having been passed in the course of the present year (1858) authorizing banking companies, not issuing notes, to be established with limited liability. It was successfully alleged in defence of this measure that there should be no exception to the general rule; and that Parliament having introduced the system of limited liability into other businesses, was bound, in consistency, to extend it to banking. But if this sort of reasoning is to have any influence in such matters, it would not justify merely, but require, that the system should be extended to all companies, however small the number of partners, and even to all individuals. Why is a privilege to be conceded to ten or twelve persons, and denied to six, to four, or to one? Where, may we ask, is the justice of such a proceeding? Why should not Mr A. be permitted to limit his liability; to declare, *à priori*, that whatever debts he may contract, he shall be liable only to the extent of some L.500 or L.1000; and that it is to this "fund," and not to his estates, his factories, or his consols, that his creditors have exclusively to look? But everybody knows, or ought to know, that there is something more than mere logical etiquette to be attended to in public affairs. When a law has been enacted which affects certain businesses or certain individuals, the question, whether it should be extended to others, depends in no degree on hypothetical notions about the symmetry of legislation, but on the fact whether it is a beneficial law, and on its being fitted to promote the interests of those to whom it is proposed to extend its operation. When the cook has ascertained that a particular sauce is good for the goose, she may then, but not till then, think of applying it to the gander. But limited liability is not a sauce which is suitable for anything. It has not a single good quality to recommend it; and instead of being extended, the sphere of its operation should be contracted as much as possible. In so far, however, as banks are concerned, we incline to think that its extension to them will not have much influence either one way or other; for we cannot believe it possible, were an ordinary bank to limit its liability, that half-a-dozen individuals would be found to entrust their money to its keeping. If they did, they would well deserve to meet the fate which would be all but certain to await them—that is, to lose their entire deposits. If it attempted, as it would probably do, to allure loans by the offer of a comparatively high rate of interest, that would make its ruin more certain and immediate: and is a bait that would be swallowed by those only whose ignorance was even greater than their voracity. We therefore have little doubt that the device of limited liability will be rejected by all banking companies that have any pretensions to character, or that have any wish to possess any portion of the public confidence. It is not by vicious and inapplicable measures of this sort that joint-stock banking will be improved. What is wanted in it is a return to the old law, which enabled the creditors of insolvent banks to seek redress by execution against such stockholders as they pleased to prosecute; to evince a determination to make all directors who act either dishonestly or with gross carelessness liable for the consequences; and to facilitate the proceedings in bankruptcy. This is all that is required to be done in respect of these matters in as far as banks are concerned. And a return to the old system of unlimited liability, except in special routine cases, which may be left to the decision of the Board of Trade, with the like leave to proceed against individuals, and the publication of their names, would obviate the principal objections to the present law in as far as it affects joint-stock companies. (J. R. M.)

PASCAL, Blaise,[1] one of the brightest names in the annals, not only of France, but of the human race, was born at Clermont in Auvergne, in the year 1623. He was not forty when he died. But the achievements which he crowded into his brief span of life, and which have made his name famous to all generations, may well make the world say with Corneille, "A peine a-t' il vécu; quel nom il a laissé?" From the earliest childhood Pascal exhibited most prococious proofs of inventive genius, especially in the department of mathematics. If we may believe a universally-received tradition, he had been purposely kept in ignorance of geometry, lest his propensity in that direction should interfere with the prosecution of other branches of knowledge. But in vain: his self-prompted genius, so it is said, discovered for itself the elementary truths of the forbidden science; and at twelve years of age he was surprised by his father in the act of demonstrating on the pavement of an old hall where he used to play, and with the

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[1] This biographical sketch is chiefly taken from the essay on the Life, Genius, and Writings of Pascal, inserted in the *Edinburgh Review* for January 1847. Some few additional paragraphs have been inserted, and the matter in general has been distributed differently, as well as abridged. For a fuller discussion of several important questions than would be possible in the limits of an article like the present, the reader is referred to the essay above mentioned.

help of a rude diagram, traced by a piece of charcoal, a proposition which corresponded to the thirty-second of the first book of Euclid. At the age of sixteen he composed a little tractate on the conic sections, which provoked the incredulity and admiration of Descartes. At nineteen, he invented his celebrated arithmetical machine; at the age of six-and-twenty, he had composed the greater part of his mathematical works, and made those brilliant experiments in hydrostatics and pneumatics which have associated his name with those of Torricelli and Boyle, and stamped him as one of the first philosophers of his age.

Strange to say, he then suddenly renounced the splendid career to which his genius so unequivocally invited him, and abandoned himself to totally different studies. In part this was attributable to the strong religious impulse given to his character at this period,—rendered deeper no doubt by early experience in the school of affliction; for from the age of eighteen he was a perpetual sufferer, and in 1647, when only in his twenty-fourth year, was visited by a slight attack of paralysis. His ill health seems mainly to have been occasioned by his devotion to study; his mind, in fact, consumed his body. The impulse, however, which finally drove him from the world, and turned him into a religious recluse, seems to have been aided by incidents which occurred a few years later. It is said that a hopeless attachment (so M. Faugère plausibly conjectures) to the sister of his accomplished friend and patron the Duc de Roannes, but which Pascal, from timidity, never avowed to the object of it, increased his constitutional melancholy; but however this may be, a far deeper effect was produced by an escape from a frightful death in the year 1654. He was in a coach and four with some friends, and, in crossing the Seine over a bridge, part of the parapet of which was thrown down, the leaders took fright and leaped into the water; their weight as they fell happily broke the traces, and left the carriage free. But Pascal's nervous system received a shock which it seems never to have recovered; and he was often haunted with the thought that on the left side of him—that on which the danger threatened on this occasion—there yawned a deep chasm; nor could he, it is said, sit at ease unless fortified on that side by the sensation of some solid obstacle, though, strange to say, an empty chair would answer the purpose.

So complete was his abandonment of science that he never returned to it but on one memorable occasion, and then only for a short time,—namely, when he solved the remarkable problems relating to the Cycloid. The accounts which have been transmitted to us by his sister of the manner in which these investigations were suggested and completed—accounts which are authenticated by a letter of his own to Fermat—strongly impress us with the vigour and brilliancy of his genius. We are assured that after long abandonment of the mathematics, his attention was directed to the curve in question by a casual train of thought suggested in one of the many nights which pain made sleepless. His inventive mind rapidly pursued the subject till he reached the brilliant results recorded in his own writings; and in the brief space of eight days these difficult investigations were completed. Partly in compliance with the fashion of the age, and partly from the solicitation of his friend the Duc de Roannes, he concealed for a time the results at which he had arrived, and offered the problems for solution to all the mathematicians of Europe, with a first and second prize to successful candidates. If no solution were offered in three months, Pascal promised to publish his own. Several were forwarded, but as none, in the estimation of the judges, completely fulfilled the conditions of the challenge, Pascal redeemed his pledge, under the name of Amos Dettonville, an anagram of Louis de Montalte, the famous pseudonym under which the *Provincial Letters* had appeared. This was in 1658–9, when he was thirty-six years of age. With this brief exception, then, and which occurs quite as a parenthesis in his history, Pascal practically abandoned science from the age of twenty-six; yet he did not at once become a religious recluse. For some years he lived a cheerful, sometimes even a gay, though never a dissipated life, in Paris, in the centre of literary and polite society, loved and admired by a wide circle of friends, and especially by the Duc de Roannes. At length, however, under the influence of the causes before specified, his indifference to the world—perhaps we might say his disgust for it—so far increased that he sighed for solitude. This he sought and found at Port-Royal, already endeared to him as the home of his sister Jacqueline.

Here he produced his immortal *Provincial Letters;* and, when death cut short his brief career, was meditating an extensive work on the fundamental principles of religion, especially on the existence of God and the evidences of Christianity. For its completion he asked ten years of health and leisure! An outline of the work had been sometimes (and on one occasion somewhat fully) given to his friends in conversation, but no part of it was ever completed. Nothing was found after his death but detached *Thoughts* (interspersed with some on other subjects) on the principal topics appropriate to such a work. They were the stones of which the building was to have consisted, many of them unhewn, and some few such as the builder, had he lived, would no doubt have laid aside. The form in which the *Thoughts* were put together comported but too well with their fragmentary character. It appears that Pascal did not even use a common-place book; but when, after profound meditation, any thought struck him as worth recording, he hastily noted it on any scrap of paper that came to hand, often on the backs of old letters; these he strung together on a file, or tied up in bundles, and left them till better health and untroubled leisure should permit him to evoke a new creation out of this chaos. It is a wonder, therefore, that the *Pensées* of Pascal have come down to us at all. Never, surely, was so precious a freight committed to so crazy a bark. But we shall return to this subject when we come to criticize the writings of Pascal, for the literary history of the *Pensées* is not a little curious. The latter years of his life were spent in almost incessant suffering, not a little increased by the maceration and ascetic rigour to which he subjected a body but little adapted originally to sustain such severe discipline. After lingering in a long decay, through the clouds of which, however, his genius shone with undiminished radiance, even to its setting, he died at Port-Royal in 1662, at the early age of thirty-nine.

We now proceed to make a few observations on the genius and character of this great man. His was one of the rare minds, apparently adapted almost in equal measure to the successful pursuit of the most diverse departments of philosophy and science, of mathematics and physics, of metaphysics and criticism. Many have transcended him in *knowledge;* for Pascal followed the predominant law of all very inventive minds,—he was fonder of thought than of books, of meditation than of acquisition. Perhaps, also, the character of Pascal's genius was less excursive than that of some other men. But in inventiveness few have been his equals; few even in mathematics, while in moral science, the science of man, we know of nothing out of Bacon and Shakspeare that will bear comparison in depth, subtlety, and comprehensiveness with some of the *Thoughts* of Pascal. But, in another characteristic of true genius, and which, for want of another name, we must call *felicity*, scarcely any one can, in the full import of the term, be compared with him. Endowed with originality the most active and various, all that he did was with grace. Full of depth, subtlety, brilliancy, both his thoughts, and the man-

ner in which he expresses them, are also full of beauty. His just image is that of the youthful athlete of Greece, in whom was seen the perfection of physical beauty and physical strength,—in whom every muscle was developed within the just limits calculated to secure a symmetrical development of all, the largest possible amount of power and flexibility in union.

In all the manifestations of Pascal's mind this rare felicity is exuberantly displayed: in the happy methods by which he lighted on truth and pursued scientific discovery; in the selection and arrangement of topics in all his compositions; in the peculiar delicacy of his wit, so strongly contrasted with all the ordinary exhibitions of that quality with which his age was familiar; and, above all, in that indescribable elegance of expression which uniformly characterizes his finished efforts, and often his most negligent utterances, and which even time can do nothing to impair.

In his scientific writings, the traces of this felicity may be discerned almost equally in the *matter* and the *form*. In relation to the first, there is probably a little illusion practised upon us. In reading his uniformly elegant and perspicuous exposition of his own scientific discoveries, we are apt to underrate the toil and intellectual struggles by which he achieved them. We know that they were, and must have been, attended with much of both,—nay, that his shattered health was the penalty of the intensity of his studies. Still, it is hardly possible to read his expositions without having the impression that his discoveries resembled a species of inspiration, and that his mind followed out the first germinant thought to its ultimate consequences with more ease and rapidity than is usually the case. One can scarcely imagine it necessary for him to have undergone the frightful toils of Kepler, had he been led into the same track of discoveries; and, in fact, whatever illusion his ease and elegance of manner may produce, we know that, comparatively speaking, his achievements were rapidly completed. It was so with the problems on the cycloid; it was so with his discoveries in pneumatics and hydrostatics. In fact, though his *Traité de l'Equilibre des Liqueurs*, and the one *De la Pesanteur de l'Air*, were not composed till 1653, they seem to have been only another form of the treatise he promised in his *Nouvelles Expériences Touchant le Vide*, published in 1647, and of which that tract was avowedly an abridgment. Indeed, as already said, Pascal had nearly quitted these investigations before the completion of his twenty-sixth year.

There was no scientific subject which Pascal touched in which the felicity of his genius, the promptitude and brilliancy of his mind, did not shine forth. We see these qualities eminently displayed in his *Traité du Triangle Arithmétique*, in the invention and construction of his arithmetical machine, in the mode of solving the problems respecting the cycloid,—in which, while employing Cavalieri's Method of Indivisibles, he proposes to remove the principal objection which had been made to it, by conceptions which bring him within a step of the Fluxions of Newton and the Calculus of Leibnitz. The same qualities of mind are eminently displayed in the manner in which he establishes the hydrostatic paradox, and generally in the experiments detailed in the *Nouvelles Expériences*, and the other connected pieces,—most of all in the celebrated *crucial* experiment on the Puy-de-Dôme, by which he decided the cause of the suspension of the mercury in the barometrical tube. As there are few things recorded in the history of science more happily ingenious than the conception of this experiment, so never was there anything more pleasantly *naïve* than the manner in which he proposes it in his letter to M. Perier. "You doubtless see," says he, "that this experiment is decisive of the question; and that if it happen that the mercury shall stand lower at the top than at the bottom of the mountain (as I have many reasons for thinking, although all those who have meditated on this subject are of a contrary opinion), it will necessarily follow that the weight and pressure of the air are the sole cause of this suspension of the mercury, and not the *horror of a vacuum;* since it is very certain that there is much more air to press at the base than on the summit of the mountain; while, on the other hand, we surely cannot say that nature abhors a vacuum more at the bottom of a mountain than on the top of it."[1]

The usual felicity of his style is seen throughout his philosophical as well as his other works. They possess the highest merit which can belong to scientific composition. It is true that, in his purely *mathematical* writings, partly from the defective notation of his age, itself a result of the want of that higher calculus, the invention of which was reserved for Newton and Leibnitz, he is often compelled to adopt a more prolix style of demonstration than would have been subsequently necessary; but even here, and still more in all the fragments which relate to natural philosophy, his style is in striking contrast with the clumsy expression of the generality of contemporary writers. His Fragments abound in that perspicuous elegance which the French denominate by the expressive word *netteté*. The arrangement of thought and turn of expression are alike beautiful. Probably no one ever knew so well when to stay his hand.

But it is, of course, in his writings on moral and critical subjects that this felicity may be chiefly expected to appear; and here we may well say, in the eloquent language of M. Faugère, it is a "style grand sans exagération, partout rempli d'emotion et contenu; vif sans turbulence, personnel sans pédanterie et sans amour propre, superbe et modeste, tout ensemble;" or, as he elsewhere expresses it, "tellement identifié avec l'âme de l'écrivain qu'il n'est que la pensée elle même, parée de sa chaste nudité comme une statue antique." By the confession of the first French critics, the *Lettres Provinciales* did more than any other composition to fix the French language. On this point the suffrages of all the most competent judges—of Voltaire and Bossuet, D'Alembert and Condorcet—are unanimous. "Not a single word occurs," says the first, "partaking of that vicissitude to which living languages are so subject. Here, then, we may fix the epoch when our language may be said to have assumed a settled form." "The French language," says D'Alembert, "was very far from being formed, as we may judge by the greater part of the works published at that time, and of which it is impossible to endure the reading. In the *Provincial Letters* there is not a single word that has become obsolete; and that book, though written above a century ago, seems as if it had been written but yesterday." And as these Letters were the first models of French prose, so they still remain the objects of unqualified admiration. The writings of Pascal have indeed a paradoxical destiny,—flourishing in immortal youth, all that time can do is to superadd to the charms of perpetual beauty the veneration which belongs to age. His style cannot grow old.

When we reflect on the condition of the language when he appeared, this is truly wonderful. It was but partially reclaimed from barbarism; it was still an imperfect instrument of genius. He had no adequate models,—he

[1] Descartes claimed the suggestion of this brilliant experiment. But it is certain that Pascal, who was the very soul of honour, repeatedly declares that he had determined to make it from the very time he had verified Torricelli's, and only waited the opportunity of performing it. On the other hand, Descartes was jealous of the discoveries of others, and, as Leibnitz truly observes, slow to give them all the praise and admiration which were their due.

was to create them for others. Now, to seize a language in its rude state, and compel it, in spite of its hardness and intractability, to become a malleable material of thought, is the exclusive prerogative of the highest species of minds; nothing but the intense fire of genius can fuse these heterogeneous elements, and mould them into forms of beauty. As a proof, we have the fact that none but the highest genius has ever been equal to this task. Genius of less than the first order will often make improvements in the existing state of a language, and give it a perceptible impulse; but only the most creative and plastic power can at once mould a rude language into forms which cannot become obsolete,—forms which remain in perpetuity a part of the current literature, amidst all the changes of time and the caprices of fashion. Thus it required a Luther to mould the harsh German into the language of his still unrivalled translation of the Scriptures, in which, and in his vernacular compositions, he first fairly reclaimed his native language from its wild state, brought it under the yoke, and subjected it to the purposes of literature. Pascal was in a similar manner the creator of the French.

The severely pure and simple taste which reigns in Pascal's style seems, when we reflect on those faults which more or less infected universal letters, little less than a miraculous felicity. One wonders by what privilege it was that he freed himself from the contagion of universal example, and rose so superior to his age. Taste was yet almost unfelt: each writer affected extravagance of some kind or other: strained metaphor, quaint conceits, far-fetched turns of thought, unnatural constructions,—these were the vices of the day; not so much perhaps in France as in England, but to a great extent in both. From all these blemishes Pascal's style is perfectly free; he anticipated all criticism, and became a law to himself. Some of his observations, however, show that his taste was no mere instinct; they indicate how deeply he had revolved the true principles of composition. His thoughts *Sur l'Eloquence et le Style* are well worth the perusal of every writer and speaker. In one of them he profoundly says, "The very same sense is materially affected by the words that convey it. The sense receives its dignity from the words, rather than imparts it to them." In another he says, "All the false beauties that we condemn in Cicero have their admirers in crowds." And in a third he admirably depicts the prevailing vice of strained antitheses; "Those," says he, "who frame antitheses by forcing the sense are like men who make false windows for the sake of symmetry. Their rule is not to speak justly, but to make just figures." The time spent on his own compositions shows that even such felicity as his could not dispense with that toil which is an essential condition of all perfect writing,—indeed of all human excellence,—and affords one other proof of the extreme shallowness of that theory which would have us believe that, to attain success, genius alone is all-sufficient. He is said, when engaged on his *Lettres Provinciales,* to have sometimes employed twenty days upon a single letter.

Another circumstance which, as already intimated, indicates Pascal's felicity of genius, is the peculiar delicacy and refinement of his *wit.* We say its *delicacy* and *refinement;* for the mere conjunction of great wit with great aptitudes for either philosophy or poetry cannot be considered as a felicity peculiar to Pascal. It is the *character* of that wit. The conjunction of distinguished wit, in one or other of its many forms, with elevated genius, is far too common to be regarded as a peculiarity of Pascal's mind. Paradoxical as the statement may at first sight appear to those who have been accustomed to consider wisdom and wit as dwelling apart, it may be doubted whether there is any one attribute so common to the highest order of mind, whether scientific or imaginative, as wit of some kind. Plato, Bacon, and Shakspeare may be cited as examples.

The wit of Pascal appears even now exquisitely chaste and natural—attired in a truly Attic simplicity of form and expression. In one quality—that of irony—nothing appears to us to approach it, except what we find in the pages of Plato, between whom and Pascal (different and even opposite as they were) it is easy to trace a resemblance in other points besides the character of their wit. Both possessed surpassing acuteness and subtlety of genius in the department of abstract science; both delighted in exploring the depths of man's moral nature; both gazed enamoured on the ideal forms of moral sublimity and loveliness; both were characterized by eminent beauty of intellect; and both were absolute masters of the art of representing thought, each with exquisite refinement of taste, and all the graces of language. The Greek, indeed, possessed a far more opulent imagination, and often indulged in a more gorgeous style than the Frenchman; or rather Plato may be said to have been a master of all kinds of style. But his dramatic powers, in none of his dialogues, can be greater than those which Pascal has displayed in his *Provincial Letters.*

The moral aspects of Pascal's character are as inviting as those of his intellect: here, too, he was truly great. Some infirmities indeed he had, for he was no more than man. He is nevertheless one of the very few who as passionately pursue the acquisition of moral excellence as the quest after speculative truth; who practically, as well as theoretically, believe that the highest form of humanity is not intellect, but goodness. Usually it is far otherwise; there is no sort of proportion between the diligence and assiduity which men are ordinarily willing to expend on their intellectual and their moral culture. Nor is it less than an indication of something wrong about human nature, a symptom of spiritual disease, that of those three distinct orders of greatness which Pascal has so exquisitely discriminated in his *Pensées*—Power, Intellect, and Goodness—the admiration inspired by the two first should be so much greater than that inspired by the last.

Few men have ever dwelt on the ideal of moral perfection, or sought to realize its image in themselves, with more ardour than Pascal; not always, indeed (as regards the *mode*), with as much wisdom as ardour. Yet upon all the great features of his moral character one dwells with the serenest delight. Much as he is to be admired, he is yet more to be loved. His humility and simplicity, conspicuous as his genius and acquisitions, were those of a very child. The favourite of science, often crowned, as an old Greek might have said of some distinguished young hero at Olympia, with the fairest laurels of the successful mathematician and the unrivalled polemic,—making discoveries even in his youth which would have intoxicated many men to madness,—neither pride nor vanity found admission to his heart. Philosophy and science produced on him only their proper effect; and taught him, not how much he knew, but how little,—not merely what he had attained, but of how much more he was ignorant. His perfect love of truth was beautifully blended with the gentlest charity, and his contempt of fraud and sophistry never made him forget, while indignantly exposing them, the courtesies of the gentleman and the moderation of the Christian; and thus the severest raillery that probably ever fell from human lips flows on in a stream undiscoloured by one particle of malevolence, and unruffled by one expression of coarseness and bitterness. The transparency and integrity of his character not only shone conspicuous in all the transactions of his life, but seem even now to beam upon us as from an open, ingenuous countenance, in the inimitable frankness and clearness of his style. It is impossible to read the passages in his philosophical writings, in which he notices or refutes the calumnies to which he had

been exposed, and by which it was sometimes sought to defraud him of the honour of the discoveries he had made, in one instance even to cover him with the infamy of appropriating discoveries which had been made by others, without being convinced of the perfect candour and uprightness of his nature.[1] His generosity and benevolence were unbounded; so much so, indeed, as to become almost vices by excess, passing far beyond that mean in which the Stagyrite fixes the limits of all virtue. He absolutely beggared himself by his prodigal benefactions: he did what few do, mortgaged even his expectancies to charity. To all which we may add, that he bore the prolonged and excruciating sufferings of his latter years with a patience and fortitude which astonished all who witnessed them.

The failings of Pascal (for to these we must advert) were partly the result of that system of faith in which he had been educated; and which, though he did so much to expose many of the worst enormities which had attached themselves to it, still exercised considerable influence over him. It is lamentable to see such a mind as his surrendering itself to some of the most grievous extravagances of asceticism. Yet the fact cannot be denied; nor is it improbable that his life—brief, perhaps, at the longest, considering his intense study and his feeble constitution—was made more brief by these pernicious practices. We are told not only that he lived on the plainest fare, and performed the most menial offices for himself,—not only that he practised the severest abstinence and the most rigid devotions,—but that he wore beneath his clothes a girdle of iron, with sharp points affixed to it; and that whenever he found his mind disposed to wander from religious subjects, or take delight in things around him, he struck the girdle with his elbow, and forced the sharp points of iron into his side. We even see but too clearly that his views of life to a considerable extent became perverted. He cherished mistrust even of its blessings, and acted, though he meant it not, as if the very gifts of God were to be received with suspicion as the smiling tempters to ruin—the secret enemies of our well-being. He often expresses himself as though he thought, not only that suffering is necessary to the moral discipline of man, but that nothing but suffering is at present safe for him. "I can approve," he says in one place, "only of those who seek in tears for happiness." "Disease," he declares in another place, "is the natural state of Christians." It is evident that the gracious Master in whose school we all are, and whose various dispensations of goodness and severity are dictated by a wisdom greater than our own, does not think so: if he did, health would be the exception, and disease the rule.

Pascal was obviously misled, by these sentiments, into the self-imposed ascetic severities which aggravated all the sufferings of his later years. But it is at our peril that we interfere with the discipline which is provided for us. He who acts as if God had mistaken the proportions in which joy and sorrow, prosperity and adversity, should be allotted to us,—who seeks, by hair shirts, prolonged abstinence, and self-imposed penance, to render more perfect the discipline of suffering,—only enfeebles instead of invigorating his piety, and resembles one of those hypochondriacal patients—the plague and torment of physicians—who, having sought advice, and being supposed to follow it, are found not only taking their physician's well-judged prescriptions, but secretly dosing themselves in the intervals with some quackish nostrum. Thus did Pascal; and it is impossible not to see that the experiment was attended in his case with very pernicious effects.

It is indeed pitiable to read that, during his last days, his perverted notions induced him to refrain from the natural expressions of fondness and gratitude towards his sisters and attendants, lest the affection with which they regarded him should become inordinate,—lest they should transfer to an earthly creature the affection due only to the Supreme. Something, indeed, like an attempted justification of such conduct occurs in his *Pensées*—"Il est injuste qu'on s'attache à moi, quoiqu'on le fasse avec plaisir et volontairement. Je tromperais ceux à qui j'en ferais naître le désir; car je ne suis la fin de personne, et n'ai pas de quoi les satisfaire. Ne suis-je pas prêt à mourir? Et ainsi l'objet de leur attachment mourra donc. Comme je serais coupable de faire croire une fausseté, quoique je la persuadasse doucement et qu'on la crût avec plaisir, et qu'en cela on me fit plaisir; de même je suis coupable de me faire aimer." Madame Perier has cited this passage in the life of her brother as accounting for his apparent coldness to herself.[2]

It is wonderful that a mind so powerful should have been misled by a pernicious asceticism to adopt such maxims; it is still more wonderful that a heart so fond should have been able to act upon them. To restrain, even in his dying hours, expressions of tenderness towards those whom he so loved, and who so loved him; to simulate a coldness which his feelings belied; to repress the sensibilities of a grateful and confiding nature; to inflict a pang, by affected indifference, on hearts as fond as his own; here was indeed a proof of the truth upon which he so passionately meditated, the greatness and the misery of man,—of his strength and his weakness: weakness, in supposing that such perversion of all nature could ever be a dictate of duty; strength, in performing, without wincing, a task so hard. The American Indian, bearing unmoved the torture of his enemies, exhibits not, we may rest assured, greater fortitude than Pascal, when, with such a heart as his, he received in silence the last ministrations of his devoted friends, and even declined, with cold and averted eye, the assiduities of their zealous love. That same melancholy temperament which, united with a pernicious asceticism, made him turn his gaze even from innocent pleasure, and suspect a serpent lurking in every form of it, also gave to his *representations* of the depravity of our nature an undue intensity and Rembrandt-like depth of colouring. His mode of expression is often such that, were it not for what we otherwise know of his character, it might be mistaken for an indication of misanthropy. With this vice, accordingly, Voltaire does not hesitate to tax him. "Ce fameux écrivain, misanthrope sublime." Nothing can be more unjust. As to the *substance* of what Pascal has said of human frailty and infirmity, most of it is at once verified by the appeal to individual consciousness; and as to the *manner*, we are not to forget that he everywhere dwells as much upon the greatness as upon the misery of man. "It is the ruined archangel," says Hallam, with equal justness and beauty, "that Pascal delights to paint." It is equally evident that he is habitually inspired by a desire to lead man to truth and happiness; nor is there anything more affecting than the passage with which he closes one of his expostulations with Infidelity, and which M. Cousin finely characterizes as "une citation glorieuse à Pascal." "This argument," you say, "delights me. If this argument

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[1] See more particularly his letters to Father Noel, M. Le Pailleur, and M. De Ribeyre.

[2] The passage of Madame Perier is deeply affecting. "Meanwhile, as I was wholly a stranger to his sentiments on this point, I was quite surprised and discouraged at the rebuffs he would give me upon certain occasions. I told my sister of it, and not without complaining that my brother was unkind. and did not love me; and that it looked to me as if I put him in pain, even at the very moment I was studying to please him, and striving to perform the most affectionate offices for him in his illness." (Madame Perier's *Memoirs of Pascal*)

pleases you, and appears strong, know that it proceeds from one who, both before and after it, fell on his knees before that infinite and invisible Being to whom he has subjected his whole soul, to pray that He would also subject *you* to Himself, for your good and for His glory; and that thus omnipotence might give efficacy to his feebleness."

In addition to this, it must be said that, in his most bitter reflections, this truly humble man is thinking as much of himself as of others, and regards Blaise Pascal as but a type of the race whose degeneracy he mourns. His most bitter sarcasms often terminate with a special application to the writer. Thus he says, "Vanity is so rooted in the heart of man, that a common soldier or scullion will boast of himself, and will have his admirers. It is the same with the philosophers. Those who write would fain have the fame of writing well; and those who read it, would have the glory of having read it; *and I, who am writing, probably feel the same desire, and not less those who shall read it.*"

It is true, indeed, that some of his reflections are as caustic and bitter as those of Rochefoucauld himself. For example:—"Curiosity is but vanity. Often we wish to know more, only that we may talk of it. People would never traverse the sea if they were never to speak of it, for the mere pleasure of seeing, without the hope of ever telling what they have seen." And again:—"Man is so constituted that, by merely telling him he is a fool, he will at length believe it; and if he tells himself so, he will constrain himself to believe it. For man holds an internal intercourse with himself which ought to be well regulated, since even here 'evil communications corrupt good manners.'"—"I lay it down as a fact, that if all men knew what they say of one another, there would not be four friends in the world. This appears by the quarrels which are sometimes caused by indiscreet reports."

Still, as it is the motive which gives complexion to all our moral actions, so Pascal's bitter wisdom, or even his unjust satire, is something very different from misanthropy. With what noble eloquence—with what deep sympathy with humanity—does he rebuke the levity of those infidels who tell us, as if it were matter of triumph, that we are the inhabitants of "a fatherless and forsaken world," and who talk as if their vaunted demonstration of the vanity of our immortal hopes gave them a peculiar title to our gratitude and admiration! "What advantage is it to us to hear a man saying that he has thrown off the yoke; that he does not think there is any God who watches over his actions; that he considers himself as the sole judge of his conduct, and that he is accountable to none but himself? Does he imagine that we shall hereafter repose special confidence in him, and expect from him consolation, advice, succour, in the exigencies of life? Do such men imagine it is any matter of delight to us to hear that they hold that our soul is but a little vapour or smoke, and that they can tell us this in an assured and self-sufficient tone of voice? Is this, then, a thing to say with gaiety? Is it not rather a thing to be said with tears, as the saddest thing in the world?"

We now proceed to make a few observations on the principal writings of Pascal. The one on which his fame, as a great thinker, chiefly rests, fragmentary as it is, is the *Pensées*. We have alluded to the literary history of this work as highly curious. The thoughts were written, as already said, on any scraps of paper that came to hand; these were strung on a file, and left till health and leisure should enable the author to develop and arrange them.

Health and leisure never came. But it was not this only which has rendered the work so fragmentary. Many of the thoughts are themselves only half developed; others, as given us in the literal copy of M. Faugère's admirable edition, break off in the middle of a sentence, even of a word. Some casual interruption—frequently, no doubt, some paroxysm of pain, to which the great author in his latter years was incessantly subject—broke the thread of thought, and left the web imperfect for ever.

On the imperfect sentences and half-written words, which are now given in the volumes of M. Faugère, we look with something like the feelings with which we pore on some half-defaced inscription on an ancient monument,—with a strange commixture of curiosity and veneration; and, whilst we wonder what the unfinished sentences may mean, mourn over the malicious accident which has perhaps converted what might have been aphorisms of profoundest importance into a series of incoherent ciphers. One of the last things, assuredly, which we should think of doing with such fragments would be to attempt to alter them in any way; least of all, to supplement them, and to divine and publish Pascal's meaning. There have been learned men who have given us supplements to the lost pieces of some ancient historians; erudite Freinsheimiuses who hand us a huge bale of indifferent Latin, and beg us only to think it Livy's lost *Decades*. But what man would venture to supplement Pascal? Only such, it may be supposed, as would feel no scruple in scouring an antique medal; or a successor to those monks who obliterated manuscript pieces of Cicero that they might inscribe them with some edifying legend. But more noted people were scarcely more scrupulous in the case of Pascal. His friends decided that the fragments which he had left behind him, imperfect as they were, were far too valuable to be consigned to oblivion; and, so far, all the world will agree with them. If, further, they had selected whatever appeared in any degree coherent, and printed these, *verbatim et literatim*, in the best order they could devise, none would have censured, and all would have thanked them. But they did much more than this, or rather they did both much more and much less. They deemed it not sufficient to give Pascal's remains with the statement that they were but fragments; that many of the thoughts were very imperfectly developed; that none of them had the advantag of the author's revision,—apologies with which the world would have been satisfied; but they ventured upon mutilations and alterations of a most unwarrantable description. In innumerable instances they changed words and phrases; in many others they left out whole paragraphs, and put a sentence or two of their own in the place of them; they supplemented what they deemed imperfect by an exordium or conclusion, without any indication as to what were the respective ventures in this rare species of literary copartnery. It must have been odd to see this committee of critics sitting in judgment on Pascal's style, and deliberating with what alterations, additions, and expurgations it would be safe to permit the author of the *Provincial Letters* to appear in public. Arnauld, Nicole, and the Duc de Roannes were certainly no ordinary men; but they were no more capable of divining the thoughts which Pascal had not expressed, or of improving the style where he had expressed them, than of completing a sketch of Raphael.

It appears that, large as was the editorial discretion assumed, they had contemplated an enterprise still more audacious,—nothing less than that of completing the work which Pascal had projected, partly out of the materials which he had left, and partly from what their own ingenuity might supply. It even appears that they had actually commenced this heterogeneous structure; and an amusing account has been left by M. Perier of the progress the builders of this Babel had made, and the reasons for abandoning the design. "At last," says he, "it was resolved to reject the plan, because it was felt to be almost impossible thoroughly to enter into the thoughts and plan of the author, and, above all, of an author who was no more; and because it would not have been the work of M. Pascal, but a work altogether different—*un ouvrage tout différent.*" Very different indeed!

If this naïve expression had been intended for irony, it would have been almost worthy of Pascal himself.

Subsequent editors took similar liberties, if not so flagrant. While the original editors left out many passages from fear of the Jesuits, Condorcet, in his edition, omitted many of the most devout sentiments and expressions, under the influence of a very different feeling. Infidelity, as well as superstition, has its bigots, who would be well pleased to have their *index expurgatorius* also.

It had been long felt that no trustworthy edition of Pascal's *Thoughts* had been published—that nobody knew precisely what was his, and what was not. M. Cousin, in his valuable *Rapport*, demonstrated the necessity of an entirely new edition, founded upon a diligent collation of the original manuscripts; and this task M. Faugère performed with incredible industry. We must refer the reader to his interesting Introduction for proof of this statement. There the editor has given the details of his labours. Suffice it here to say, that every accessible source of information was carefully ransacked; every fragment of manuscript, whether in Pascal's own hand, or in that of members of his family, was diligently examined; and every page offers indications of minute attention, even to the most trivial verbal differences. Speaking of the autograph manuscript preserved in the Royal Library at Paris,—a folio into which the original loose leaves are pasted, or, when written on both sides, carefully *let into* the page ("*encadrès*"),—he says, "We have read, or rather studied, this manuscript page by page, line by line, syllable by syllable, from the beginning to the end, and, with the exception of some words which are illegible, it has passed entire into the present edition." As the public, in the former editions, did not exactly know what was Pascal's and what was not, M. Faugère has been compelled to do what, under other circumstances, would have been undesirable, and, indeed, hardly just; what, indeed, any author of reputation would vehemently protest against in his own case. He has been obliged to give every fragment, however imperfect, *verbatim;* and the extracts, as we have already said, often terminate in the middle of a sentence, sometimes even of a word. M. Vinet justly observes in relation to this feature of M. Faugère's labours, that Pascal himself would hardly have been satisfied with "either his old editors or the new." At the same time, it must be confessed that, apart from this circumstance, it is deeply interesting to contemplate the first rude forms of profound or brilliant thoughts as they presented themselves to the ardent mind of Pascal. As M. Vinet says, "we are taken into the great sculptor's studio, and behold him at work chisel in hand."

It is impossible to determine, from the undeveloped character of these *Thoughts*, the precise form of the work Pascal contemplated; all we are told is, that it was to have treated of the primary truths of all religion, and of the evidences of Christianity. It is clear that about half the *Thoughts* which relate to theology at all have reference to the former, and form by far the profoundest portion.

In Pascal's day, however, both classes of subjects might have been naturally included in one work. The great deistical controversies of Europe had not yet commenced, and there had been little reason to discriminate very nicely the limits of the two investigations. Pascal himself could hardly have anticipated the diversified forms which the subject of the evidences of Christianity alone would assume; so diversified, indeed, that they are probably insusceptible, from their variety, of being fully exhibited by one mind, or consequently in one volume. The evidences of Christianity almost form a science of themselves.

Fragmentary as the *Pensées* are, it is easy to see, both from their general tenor and from the character of the author's mind, where the strength of such a work would be. His proofs of the truths of natural religion would have been drawn from within rather than from without; and his proofs of the truth of Christianity from its internal rather than external evidences—including in this term "internal" not only the adaptation of the doctrines revealed, to man's moral nature, but whatsoever indications the fabric of Scripture itself may afford of the divinity of its origin.—It is evident that he had revolved all these topics profoundly. None had explored more diligently the abyss of man's moral nature, or mused more deeply upon the "greatness and misery of man," or on the "contrarieties" which characterize him, or on the remedies for his infirmities and corruptions. And there are few, even since his time, who seem to have appreciated more fully the evidences of Christianity arising from indications of truth in the genius, structure, and style of the Scriptures; or from the difficulties, not to say impossibilities, of supposing *such* a fiction as Christianity the probable product of any human artifice, much less of such an age, country, and (above all) such men as the problem limits us to. In one passage he gives expression to a thought very similar to that which suggested the *Horæ Paulinæ*. He says, "The style of the gospel is admirable in many respects, and, amongst others, in this, that there is not a single invective against the murderers and enemies of Jesus Christ. . . . . If the modesty of the evangelical historians had been affected, and, in common with so many other traits of so beautiful a character, had been affected only that it might be observed; then, if they had not ventured to advert to it themselves, they would not have failed to get their friends to remark it to their advantage. But as they acted in this way without affectation, and from a principle altogether disinterested, they never provided any one to make such a criticism. *And, in my judgment, there are many points of this kind which have never been noticed hitherto;* and this testifies to the simplicity with which the thing was done."[1]

He has also, with characteristic comprehensiveness, condensed into a single paragraph the substance of the celebrated volume of *Bampton Lectures* on the contrasts between Mohammedanism and Christianity. "Mahomet founded his system on slaughter; Jesus Christ by exposing his disciples to death: Mahomet by forbidding to read; the apostles by commanding it. In a word, so opposite is the plan of one from that of the other, that if Mahomet took the way to succeed according to human calculation, Jesus Christ certainly took the way to fail; and instead of arguing that, since Mahomet succeeded, Jesus Christ might also succeed, we ought rather to say, that since Mahomet succeeded, it is impossible but that Jesus Christ should fail"

On the subject of the external evidences we doubt whether he would have been equally successful, partly because the spirit of accurate historic investigation had not yet been developed, and partly from the character of his own mind. On the subject of miracles, too, he scarcely seems to have worked his conceptions clear; and in relation to that of prophecy, he was evidently often inclined to lay undue stress on analogies between events recorded in the Old Testament and others recorded in the New, where Scripture itself is silent as to any connection between them; —analogies in some cases as fanciful as any of those in which the fathers saw so many types and prefigurations of undeveloped truths.

From certain passages in the *Pensées*, a vehement charge of scepticism has been preferred by M. Cousin, from which, says that writer, Pascal sought refuge in a voluntarily blind credulity. "Le fond même de l'âme de Pascal est un scepticisme universel, contre lequel il ne trouve d'asîle que dans une foi *volontairement aveugle.*"

[1] Tom. ii., p. 370.

These are certainly charges which, without the gravest and most decisive proof, ought not to be preferred against any man, much less against one possessing so clear and powerful an intellect as Pascal. It is, in fact, the most degrading picture which can be presented of any mind; for what weakness can be more pitiable, or what inconsistency more gross, than that of a man who, by a mere act of will—if indeed such a condition of mind be conceivable—surrenders himself to the belief of the most stupendous doctrines, while he at the same time acknowledges that he has no proof whatever of their certainty?

It appears to us that M. Cousin has forgotten that Pascal by no means denies that there is sufficient evidence of the many great principles to which scepticism objects; he only maintains that we do not arrive at them by *demonstration*. He has powerfully vindicated the certainty of those intuitive principles which are not ascertained by reasoning, but are presupposed in every exercise of reasoning. Let us hear him: "The only strong point," says he, "of the dogmatists is, that we cannot, consistently with honesty and sincerity, doubt our own intuitive principles. . . . . . We know the truth, not only by reasoning, but by feeling, and by a vivid and luminous power of direct comprehension; and it is by this last faculty that we discern first principles. It is vain for reasoning, which has no share in discovering these principles, to attempt subverting them. . . . . . The Pyrrhonists who attempt this must try in vain. . . . . . The knowledge of first principles—as the ideas of space, time, motion, number, matter—is as unequivocally certain as any that reasoning imparts."

But let us hear him still more expressly on the subject of Pyrrhonism: "Here, then, is open war proclaimed among men. Each must take a side; must necessarily range himself with the Pyrrhonists or the dogmatists—for he who would think to remain neuter is a Pyrrhonist *par excellence*. He who is not against them is for them. What, then, must a person do in this alternative? Shall he doubt of everything? Shall he doubt that he is awake, or that he is pinched or burned? Shall he doubt that he doubts? Shall he doubt that he is? We cannot get so far as this; and I hold it to be a fact, that there never has been an absolute and perfect Pyrrhonist." M. Cousin must suppose Pascal to have made an exception in favour of himself, if it be indeed true that he was an universal sceptic. It appears to us that M. Cousin has not sufficiently reflected that, in those cases in which conclusions truly involve processes of reasoning, Pascal does not deny that the preponderance of proof rests with the truths he believes, though he denies the demonstrative nature of that proof; and he applies this with perfect fairness to the evidences of Christianity as well as to the truths of natural theology. "There is light enough," says he, "for those whose sincere wish is to see, and darkness enough to confound those of an opposite disposition." Of Christianity he says, "It is impossible to see all the proofs of this religion combined in one view without feeling that they have a force which no reasonable man can withstand."

It is not without reason that M. Faugère says, in reference to the charge of scepticism urged against Pascal, "Faith and reason may equally claim him. If they sometimes appear to clash in his mind, it is because he wanted time, not only to finish the work on which he was engaged, but even to complete that internal revision (son œuvre intérieure) which is a kind of second creation of genius; and to unite into one harmonious whole the diverse elements of his thoughts. Amongst the inedited fragments of Pascal we find these remarkable lines:—'Il faut avoir ces trois qualités; Pyrrhonien, géomètre, Chrétien soumis; et elles s'accordent et se temperent en doutant où il faut, en assurant où il faut, en se soummettant où il faut.' These bold words comprise the entire history of Pascal, and express in brief the state of his mind." But it is impossible in the limits of this article to enter with the requisite fullness into the question of Pascal's imputed scepticism. The subject will be found fully treated in the essay of which this article is an abridgment; in M. Faugère's admirable Introduction to his edition of the *Pensées;* and in some very acute papers of M. Vinet, first collected and published in 1848, under the title *Etudes de Blaise Pascal;* especially in those *Sur le Pyrrhonisme de Pascal*, and *Du Livre de M. Cousin sur les Pensées*.

If the *Pensées* are the most profound, the *Lettres Provinciales* are the most brilliant of Pascal's works, and among the very few which, though turning on local and transient controversy, are so instinct with genius, so beautiful in thought and style, as to command the attention of all time.

Nothing could be apter for the purpose—that of throwing into strong light the monstrous errors of the system he opposed—than the machinery the author has selected. The affected ignorance and *naïveté* of M. Montalte, seeking information respecting the theological disputes of the age, and especially the doctrines of the Jesuits; the frankness of the worthy Jesuit father, of whom he asks instruction, and who, in the boundless admiration of his order, and the hope of making a convert, details without hesitation, or rather with triumph, the admirable contrivances by which their casuists had inverted every principle of morals and eluded all the obligations of Christianity; the ironical compliments of the supposed novice, intermingled with objections and slightly-expressed doubts,—all delivered with an air of modest ingenuousness which humbly covets further light; the acute simplicity with which he involves the worthy father in the most perplexing dilemmas; the expressions of unsophisticated astonishment, which but prompt his stolid guide eagerly to make good every assertion by a proper array of authorities,—a device which, as Pascal has used it, converts what would have been in other hands only a dull catalogue of citations into a source of perpetual amusement; the droll consequences which, with infinite affectation of simplicity, he draws from the Jesuit's doctrines; the logical exigencies into which the latter is thrown in the attempt to obviate them;—all these things, managed as only Pascal could have managed them, render the book as amusing as any novel. The form of letters enables him at the same time to intersperse, amidst the conversations they record, the most eloquent and glowing invectives against the doctrines he exposes. Voltaire's well-known panegyric does not exceed the truth, that Molière's best comedies do not excel them in wit, nor the compositions of Bossuet in sublimity. "This work," says D'Alembert, "is so much the more admirable, as Pascal, in composing it, seems to have *theologized* two things which seem not made for the theology of that time—language and pleasantry."

The success of the work is well known. By his inimitable pleasantry Pascal succeeded in making even the dullest matters of scholastic theology and Jesuitical casuistry as attractive to the people as a comedy; and by his little volume did more to render the formidable society the contempt of Europe than was ever done by all its other enemies put together. The Jesuits had nothing for it but to inveigh against the letters as "the immortal liars" (*les mênteurs immortelles*).[1]

Of the scientific writings of Pascal we have already spoken. (H. R.)

[1] To the charge of having garbled citations and tampered with evidence, in order to produce an unfair impression against the society (practices utterly abhorrent to all Pascal's habits of mind and dispositions of heart), he replies, with the characteristic boldness and

Pascal I. (Pope) succeeded Stephen IV. in the pontifical chair in 817, and died in 824.

Pascal II. (Pope), whose real name was *Ranieri*, was a monk of the order of Cluni, and succeeded Urban II. in 1099. An inveterate struggle with the occupants of the imperial throne, regarding investitures, extended over the whole of his pontificate. He began the contest in 1102 by renewing the decrees of his predecessors on that subject, and by excommunicating the Emperor Henry IV. He then encouraged the son of that monarch to raise the standard of revolt, and to supplant his father in the throne. Under the new emperor, Henry V., the controversy only assumed a more serious aspect. The emperor refused to give up his right of investiture to the Pope. The Pope threatened to withhold the ceremony of coronation from the emperor. In 1110 the emperor advanced into Italy at the head of a large army, seized upon the person of the Pope, and consigned him to bondage. For more than two months the Pope continued obstinate, and was only induced by the entreaties of his friends to crown the emperor, and yield the point of dispute. Yet the controversy thus settled was soon started again by the synods and councils of the church. They recalled the concession that had been forcibly extracted by the emperor, and renewed their claim to the right of investiture. In this manner they brought the two great potentates once more into the field against each other. Henry V. led an army towards Rome in 1116, and Pascal retreated to Benevento. The former in course of time retired from the city; and the latter, returning during the absence of his adversary, was actively engaged in preparing war when he was cut off by disease in 1118.

PASCO, or Cerro di Pasco, a town of Peru, capital of the department of Junin, stands in an irregular hollow in the elevated plain of Bonbon, 140 miles N.E. of Lima. It is meanly and irregularly built on uneven ground, the houses being for the most part low and wretched, and generally thatched. The ground on which it is built abounds in silver ore, and is almost honeycombed by the mines, many of which open in the interior of the houses. These silver mines occupy a space about 15 miles broad, from E. to W.; but it is only the most valuable of them that are now worked. Coal is also found in the vicinity. As the surrounding country is very barren, most of the provisions have to be brought to Pasco from a distance. This town is the highest permanently-inhabited spot in America, and probably also in the whole world. Its elevation is stated at 14,280 feet above the level of the sea. The population varies at different periods from 7000 to 18,000, according to the season of the year and the state of the mines.

PASCUARO, or Patzcuaro, a town of Mexico, state of Mechoacan, stands on the S.E. shore of the Lake of Pascuaro, 30 miles S.W. of Valladolid. In the neighbourhood are copper mines; and at some distance the best sugar plantations in the state. Pop. 6000.

PAS-DE-CALAIS, a department of France, lying between 50. and 51. N. Lat., 1. 35. and 3. 10. E. Long. It is bounded on the N. by the Strait of Dover, N.E. and E. by the department of Nord, S. by that of Somme, and W. by the English Channel; length, from N.W. to S.E., about 86 miles; average breadth, 33 miles; area, 2561 square miles. The country is traversed from N.W. to S.E. by a low chain of hills, from which the ground slopes gradually down on either side. The highest elevation of these hills does not exceed 327 feet; and the two slopes are scarcely to be distinguished from each other. These heights form the watershed of the rivers of the department —the Lys, the Scarpe, the Sensée, and the Aa, flowing down the N.E. slope,—the first three into the Escaut, and the last into the sea; while the Authie, the Canche, the Liane, and the Slack traverse the S.W. slope, and fall into the English Channel. The valleys of these rivers are separated by small spurs diverging from the main ridge of hills. Most of the streams are navigable for some distance, either naturally or by means of canals. Those on the north flow sluggishly through an almost flat region; and during the whole of the winter they form extensive marshes, which deposit a large quantity of alluvial soil, and increase the fertility of the country. The only promontory on the coast is Cape Grinez, between Calais and Boulogne, where the range of hills terminates in a series of chalk cliffs similar to those of Dover, on the opposite side of the Channel, and extending several miles on each side of the cape. The rest of the coast is in general low, and bordered by sandy and barren downs, having an average breadth of about two miles, and an entire area of 44,000 acres, and presenting a very bleak aspect. Along the coast-line, which is about 80 miles in length, the only good harbours are those of Calais and Boulogne. These are formed by artificial piers, and are capable of receiving large vessels; while the others can only be approached by fishing-boats. The constant accumulation of sand has destroyed several harbours that formerly existed here; and even those that still exist are in some danger of being likewise filled up.

In geological structure, the country for the most part belongs to the chalk formation. Iron and coal are found in small quantities, and several mines are wrought. Marble, limestone, quartz, rock-crystal, and other minerals, are also obtained. There are several Artesian wells in the department. These were first sunk here upwards of a century ago, and derived their name from the old province of Artois, to which this country then belonged. Richness, rather than picturesque beauty, is the prevailing aspect of the country; tracts of well-cultivated ground alternate with extensive meadows and pasturages. The country is marshy in many places; and towards the north, the low and flat ground near the coast has, as in Holland, to be defended by dykes from the incursions of the sea. The soil is very fertile, especially for corn; the farms are large, and agriculture is in an advanced state. In its variable climate, Pas-de-Calais resembles the south-western parts of England. The winters are long and rainy, and the climate in general cold, damp, and in some places not very healthy. Corn, pulse, potatoes, beet-root, hops, flax, and hemp are the principal crops raised; and a small part of the country is occupied by woods and orchards. The live stock reared here are generally of inferior breeds; but there are estimated to be in the department 80,000 horses, 180,000 horned cattle, 300,000 sheep, 7000 goats, 140,000 pigs, &c. The sea near the coast abounds in fish; and hence affords employment to a large number of the inhabitants. Manufacturing industry is actively and extensively carried on. It is cal-

frankness of his nature,—"I was asked if I repented of having written *Les Provinciales?* I reply that, far from having repented, if I had to write them now, I would write yet more strongly. . . . I was asked why I had employed a pleasant, jocose, and diverting style. I reply that, if I had written in a dogmatical style, it would have been only the learned who would have read, and they would have had no necessity to do it, being at least as well acquainted with the subject as myself; thus I thought it a duty to write so as to be comprehended by women and men of the world, that they might know the danger of those maxims and propositions which were then universally propagated, and of which they permitted themselves to be so easily persuaded. I was asked, lastly, if I had myself read all the books I have cited. I answer, No; for in that case it would have been necessary to have passed my life in reading very bad books; but I had read through the whole of Escobar twice, and, for the others, I caused them to be read by my friends. But I have never used a single passage without having myself read it in the book cited, or without having examined the subject on which it is adduced, or without having read both what precedes and what follows it, in order that I might not run the risk of quoting what was, in fact, an objection, for a reply to it, which would have been censurable and unjust."

culated that there are 700 manufactories, employing 25,000 hands, and producing annually goods to the value of L.1,920,000. The most important of the articles manufactured are,—beet-root sugar, soap, oils, cotton and woollen fabrics, linen, hosiery, and lace. Paper-mills, foundries, glass-works, potteries, tanneries, distilleries, and breweries are also in operation. The chief articles of export are,—corn, flour, sugar, oils, marble, building-stone, timber, and manufactured articles. There is a considerable coasting trade in corn and other rural produce; and the foreign commerce is chiefly carried on with England. Communication is kept up by steamers between the ports of this department and London, Dover, and Folkestone; and there is a submarine telegraph cable between Dover and Calais. The means of internal communication are furnished by three railways, extending over 88 miles, besides numerous roads, rivers, and canals. Pas-de-Calais contains a school of medicine at Arras, an academy, four colleges, a normal school, and 1220 elementary schools. It forms the diocese of Arras; and contains 6 primary courts and 4 courts of commerce. The capital is Arras; and the department is divided into arrondissements as follows:—

	Cantons.	Communes.	Pop. (1856).
Arras	10	211	169,123
Bethune	8	142	139,844
Saint-Omer	7	118	109,624
Saint-Pol	6	193	79,928
Boulogne	6	100	138,557
Montreuil	6	139	75,770
Total	43	903	712,846

PASEWALK, a town of Prussia, in the government of Stettin, on the Ucker, 27 miles W. by N. of Stettin. It is surrounded by walls; and has a court of law, churches, hospitals, and several breweries. The town is ancient, and once belonged to the Hanseatic League. Some trade is still carried on. Pop. 7217.

PASIGRAPHY (from πᾶς, *all*, and γράφω, *I write*), the imaginary art of writing so as to be universally understood by all nations of the earth. The idea of establishing such a language is deemed by many extremely fanciful, whilst the practicability of it is as strenuously contended for by others. Hints respecting such an universal language are to be met with in the writings of many eminent philosophers; but the attempt has signally failed, even in the hands of Leibnitz, Kircher, Becher, and Wilkins. Kant is of opinion, however, that such a pasigraphy falls within the limits of possibility; nay, he even prognosticates that it will certainly be established at some future period.

PASIPHAË. See MINOS.

PASKIEWITCH, IVAN FREDOROVITCH, Field-Marshal, Prince of Warsaw, Viceroy of Poland, and General-in-Chief of the Russian army, was born at Pultowa on the 12th May 1782, and was appointed at an early age aide-de-camp to the Emperor Paul. The first part of his career was one continued series of arduous campaigns and hot engagements. He began service in the terrible field of Austerlitz in 1805. Then he served from 1807 to 1812 in the army which acted against Turkey. No sooner was that expedition ended than the war with France involved him in the very thick of the most desperate of modern struggles. He fought at the battles of Dachkofka, Soultanofka, Smolensk, and Moskwa, in 1812; at the battles of Kulm, Dresden, and Leipsic, in 1813; and at the battle of Arcis-sur-Aube, in 1814. Out of that long course of deadly strife fortune brought Paskiewitch with safety and honour. She was reserving him for more successful achievements. Appointed to the command of the army of the Caucasus, he won a diamond-mounted sword by his victory at Elizavetopol in 1826, the surname of Erivansky by his storming of Erivan in 1827, and the dignity of field-marshal by his capture of Erzeroum in 1829. Entrusted in 1831 with the suppression of the revolt in Poland, he dispersed the Poles, carried their capital, and was rewarded with the titles of Prince of Warsaw and Viceroy of Poland. Sent also in 1849 to assist Austria in crushing the Hungarians, he was soon able to write home to the emperor in these words: "Hungary is at your feet." Success, however, deserted Paskiewitch at last. He was repulsed by the Turks at Silistria in 1854, and received a contusion at the same time which compelled him to retire from service, and eventually caused his death on the 29th January 1856.

PASQUIN, a mutilated statue at Rome, in a corner of the palace of the Ursini. It took its name from a cobbler of that city called *Pasquino*, famous for his sneers and gibes, and who diverted himself by telling facetious and satirical stories to those who frequented his stall, as well as by cracking his jokes upon all passers-by. The witty sayings of the cobbler came to be called *pasquinate* (hence *pasquinade*), a term subsequently applied by the Romans to all kinds of humorous epigrams and satirical lampoons. These lampoons, which attacked persons in high station, were frequently fixed by night at or near the mutilated statue alluded to, which, from that circumstance, came to be called *Pasquino*, after the defunct cobbler.

PASS, or PASSADE. See FENCING.

PASSAGE, a town of Ireland, county of Cork, on the W. side of Cork harbour, about 5 miles S.S.E. of the town of Cork. It has an Established, a Methodist, and a Roman Catholic church, and several schools. The place is much frequented as a watering-place; and has many handsome villas in the neighbourhood. There is a good harbour; and vessels that are too large to ascend to Cork unload their cargoes here. Passage has also dockyards, and is connected with Cork by a railway. Pop. 2857.

PASSAMAQUODDY BAY, an inlet of the Atlantic Ocean, on the borders of New Brunswick and the state of Maine. It extends into the land for the distance of 12 miles, and is about 6 miles broad at its mouth. It affords an excellent harbour for the largest vessels, and is never obstructed by ice. It contains several islands; and the waters abound in fish of various kinds.

PASSANT. See HERALDRY.

PASSAU, a town of Bavaria, circle of Lower Bavaria, stands at the confluence of the Danube and the Inn, 91 miles E.N.E. of Munich. Its position at the junction of these broad streams, and shut in by lofty and steep mountains, is extremely grand and picturesque, although the buildings are for the most part not good. Passau proper stands between the right bank of the Danube and the left of the Inn, but it has several suburbs beyond: Innstadt, on the right bank of the Inn; Anger and Ilzstadt, on the left of the Danube,—the former above and the latter below the Ilz, which here joins that river from the north, opposite to the Inn. The Inn and the Danube are crossed here by wooden bridges; that over the latter resting on seven granite piers. The town and its suburbs are defended by citadels and fortifications, the strongest of which is the castle of Oberhause, on the left bank of the Ilz. Passau is in fact one of the most important strongholds on the Danube. Among the public buildings in the town, one of the most remarkable is the cathedral of St Stephen, an edifice originally built in the Gothic style, but which having been, with the exception of the choir, entirely destroyed by fire, was rebuilt in the Italian style. It contains many interesting monuments. In the Cathedral Square (*Domplatz*), which is the finest in Passau, stands a large bronze statue of King Maximilian Joseph. Besides the cathedral, there are in the town seven churches, some of which are fine buildings. The royal palace, formerly the residence of the bishops, and the post-office, in which the treaty of Passau was signed in 1552, are also worthy of notice. The town contains a public library, theatre, town-

hall, several schools and hospitals, an infirmary, and a lunatic asylum. The principal manufactures of the place are iron, copper, porcelain, pottery, tobacco, beer, leather, and paper. An active trade is carried on, both up and down the Danube. Passau is the capital of a bishopric which was formerly an independent state, but was secularized in 1803, and incorporated with Bavaria in 1809. The most important historical event that took place here was the treaty of 1552 between Maurice of Saxony and Ferdinand, King of the Romans, on behalf of Charles V., by which the religious freedom of the Protestants was secured. Pop. 12,000.

PASSERI, GIOVANNI BATTISTA, one of the greatest authorities on Italian art, was born at Rome about 1610. The circumstances of his career were peculiarly fitted to qualify him for writing on the fine arts. He practised composition both in prose and verse, and acquired the ease and skill of a professional *littérateur*. He cultivated, at Frescati, the friendship of Domenichino, and caught from the lips of that great artist a knowledge and appreciation of the great principles of art. He was also himself a painter of no mean standing, as his picture of the "Crucifixion between two Saints," in the church of San Giovanni della Malva at Rome still testifies. Accordingly, at his death in 1679, Passeri left behind him in manuscript a collection of lives of painters, sculptors, and architects, which has been considered one of the most authentic of art histories. In general its facts are accurate, its criticisms just, and its theories profound. It was first published by an anonymous editor, supposed to be Bottari, in 1772, and presented a biographical account of Italian art from 1641 to 1673 inclusive.

PASSERONI, GIAN CARLO, an Italian satirical poet, was born in the county of Nizza in 1713, and entered into holy orders. His career presents a rare instance of a good-natured contempt for the gifts of fortune. He was still young when he resigned the office of chaplain to the papal nuncio at Cologne, and retired to a humble cellar in Milan to enjoy solitude and practise austerity. A cock was his only companion, and a thread-bare suit and a few mean articles of furniture were his only riches. His door was closed against all donations, and all offers of place and position. He sat down at his humble table to write his *Il Cicerone*, a satirical poem which railed at fortune and society in easy and unaffected language, and in a strain of pleasant and decorous banter. The fame which this work gained for him did not affect his humility. A pension which the Cisalpine Republic bestowed on him did not alter his abstemious habits. He continued to cultivate frugality in his lonely cellar till he died in 1802, at the age of eighty-nine. Besides his *Il Cicerone*, which was published in 6 vols., Milan, 1768, Passeroni wrote *Translations of Several Greek Epigrams*, Milan, 1786–94; and *Æsopian Fables*, in 6 vols., Milan, 1786.

PASSIGNANO, the surname which Domenico Cresti, an eminent Italian painter, derived from his native place. He was born, according to some, in 1560, and according to others, about 1557. His studies were prosecuted at Venice under Naldini and Frederigo Zuccaro. He became a thorough-going admirer of the Venetian school, and learned to imitate Paul Veronese in the richness of his architecture and drapery. The brightest part of his professional career was spent at Rome. He painted the "Crucifixion of St Peter" for the church of St Peter's, and the "Entombing of Christ" for the Borghese palace. The closing years of his life were spent at Florence. He died there in 1638. The most distinguished of Passignano's pupils was Pietro Sorri of Siena.

PASSION-WEEK, the week immediately preceding Easter, and so called because in that week, according to some, happened our Saviour's passion and death. The Thursday of this week is called Maunday Thursday; the Friday, Good Friday; and the Saturday, the Great Sabbath.

PASSOVER (פֶּסַח; πάσχα, *a passing over, sparing, or protection*), a solemn Jewish festival having both a historical and a typical reference. As a commemorative institution, it was designed to preserve amongst the Hebrews a grateful sense of their redemption from Egyptian bondage, and of the protection granted to their first-born on the night when the destroying angel *passed over* the houses of the Hebrews, but slew all the first-born of the Egyptians (Exod. xii. 27); as a typical institute, its object was to shadow forth the great facts and consequences of the Christian Sacrifice (1 Cor. v. 7). The word *passover* has three general acceptations in Scripture:—1*st*, It denotes the yearly solemnity celebrated on the 14th day of Nisan or Abib, which was strictly the *Passover of the Lamb*, for on that day the Israelites were commanded to roast the paschal lamb, and eat it in their own houses; 2*d*, It signifies that yearly festivity, celebrated on the 15th of Nisan, which may be called the *Feast of the Passover* (Deut. xvi. 2; Num. xxviii. 16, 17); 3*d*, It denotes the whole solemnity, commencing on the 14th, and ending on the 21st day of Nisan (Luke xxii. 1), though in strictness of speech, the *Passover* and the *Feast of Unfermented Things* are distinct institutions. The Passover was to be kept on the eve of the 14th of the first month (Abib), in which, although unfermented things were enjoined to be eaten with the lamb, yet the feast of unleavened bread did not commence until the following morning. It continued seven days, of which the first and last only were sabbaths (Lev. xxiii. 5-8); the first probably in commemoration of the commencement of their march out of Egypt; the last of their passage through the Red Sea.

On the 10th of the month Abib, the master of a family separated a ram or a goat of a year old, without blemish (Exod. xii. 1–6; 1 Pet. i. 19), which was slain on the 14th day "between the two evenings," before the altar (Deut. xvi. 2, 5, 6). Originally the blood was sprinkled on the posts of the door (Exod. xii. 7), but afterwards the priests sprinkled the blood upon the bottom of the altar (comp. Deut. vi. 9; 1 Pet. i. 2; Heb. viii. 10; ix. 13, 14). The ram or kid was roasted in an oven, whole, with two spits forming a cross. It was next served up with a bitter salad, indicative of the bitterness of their bondage in Egypt, and eaten with unleavened or unfermented bread. Wine also to the quantity of four or five cups was drunk by each person. Considerable dispute has been raised as to whether the wine used on this occasion was fermented or unfermented,—was the ordinary wine, in short, or the pure juice of the grape. Those who hold it was unfermented appeal mainly to the expression "unfermented things," which is the true rendering of the word translated "unleavened bread." The rabbins would seem to have interpreted the command respecting ferment as extending to the *wine* as well as to the *bread* of the passover. The modern Jews, accordingly, generally use *raisin wine*, after the injunction of the rabbins. What of the flesh remained uneaten was to be consumed with fire, lest it should see corruption (comp. Exod. xii. 10; Ps. xvi. 10; Acts ii. 27). Not fewer than ten, nor more than twenty persons, were admitted to this sacred solemnity. At its first observance, the Hebrews ate the Passover with loins girt about, sandals on their feet, staves in their hands, and in haste, like travellers equipped and prepared for immediate departure (Exod. xii. 11); but subsequently the usual mode of reclining was adopted, in token of rest and security (John xiii. 23). The rabbins enumerate the following particulars as peculiar to its original observance, but which were afterwards modified:—1. The eating of it in their houses dispersed in Egypt; 2. The taking up of the paschal lamb from the tenth day; 3. The charge to

strike the blood on the door-posts; 4. The eating of it in haste (Bab. Talmud, *Pesachim*, c. 9; Maim. *Corban Pesach.*, c. 10, § 15). But the command not to break a bone of the offering was always observed (John xix. 36). The ceremonies practised at the eating of the paschal supper will be found fully detailed in the Mishna. (See Kitto's *Cyclopedia of Biblical Literature.*)

PASSPORT, a letter, license, or document of one sort or other, issued by competent authority, permitting the bearer to enter into and remain in a particular country, or portion thereof, for an indefinite or a specified time, and sometimes also for a specified purpose.

Every independent state has the right to exclude such individuals as it pleases from its territory; and it consequently has the right to require all strangers entering, or desiring to enter, its territories to bring with them properly authenticated documents showing what they are, and (if required) for what purpose they desire to visit the country. (See Marten, lib. iii., cap. 3; and a host of other authorities.) Passports have been introduced principally with the view of preventing persons hostile to the government or institutions of a country from crossing its frontier. And this obviously is a power which all governments would wish, were it in their power, to exercise and make effectual. But the widest experience has sufficiently proved that the facilities for travelling and for getting into extensive countries are now so great, that the regulations with respect to passports merely obstruct that free intercourse between the well-behaved and peaceable inhabitants of different nations that is so advantageous, without throwing any serious obstacle in the way of the transit of dangerous or suspicious characters. The latter have either little difficulty in obtaining passports under false pretences, or in making their way without them; and it is found that the countries in which the regulations as to passports are enforced with the greatest strictness are those in which suspicious characters are most common. On the whole, there can be little doubt that their abolition would be of great public advantage, and that it would not be productive, either in France or elsewhere, of any injurious consequences.

PASTO, a town of New Granada, in the province of Cauca, stands among the Andes, at an elevation of 8576 feet above the sea, 148 miles N.N.E. of Quito. In the vicinity is an active volcano. The town contains a fine church; and has some trade in wooden articles. Pop. 7000.

PASTORAL (Latin, *pastor*, a shepherd) is the name given to a species of poetry which is devoted to descriptions and delineations of country life, or to dramatic compositions in which the principal characters are shepherds or other rustics. (See ECLOGUE, BUCOLIC, and IDYLL.)

PASTORAL THEOLOGY is that department of theology which has to do with the practical duties of a clergyman as the teacher, counsellor, comforter, and guide of his spiritual flock.

PASTORAL LETTERS are those circulars addressed by a bishop (the *pastor* of his people) to his diocesans, for their religious instruction or guidance in matters of ecclesiastical discipline.

PATAGONIA, a large country of South America, occupying the southern extremity of that continent from the Rio Negro to the Strait of Magellan. It lies between S. Lat. 38. 50. and 53. 55., W. Long. 63. and 76., and is bounded on the N. by the Argentine Republic, E. by the Atlantic, S. by the Strait of Magellan, W. by the Pacific, and N.W. by Chili. Its length from N. to S. is 970 miles, its breadth varies from 200 to 420, and its area is about 300,000 square miles. The country is divided into two regions differing widely from each other in their general character. The one of these lies along the west coast, and is entirely mountainous; while the other, to the east, is in general low and flat. In the western region, the mountains all belong to the chain of the Andes, which is here much lower than in the more northerly parts of South America, for the average height of the range in Patagonia does not exceed 3000 feet; but even here there are some mountains upwards of 7000 feet above the sea. Southwards from the Gulf of Ancud, where the Chilian and Patagonian territories meet, the country along the shore of the Pacific presents an aspect quite different from that which is met with farther north. Instead of having a narrow strip of low land, with an almost unbroken coast extending between the mountains and the Pacific, as is generally the case on this coast, the Patagonian Andes rise abruptly out of the sea, which, frequently flowing into the deep defiles of the mountains, extends long and winding arms far into the land. Numerous high and rocky islands, rising abruptly out of the sea, line the coast. The chief of these are,—Chiloe, the Chonos Archipelago, Wellington Island, the Archipelago of Madre de Dios, Hanover Island, and Queen Adelaide's Archipelago. There is also a large peninsula, called Tres Montes, lying between the Chonos Archipelago and Wellington Island, joined to the mainland by a narrow isthmus. Near the southern extremity of Patagonia two remarkable inlets break the continuity of the Andes chain. The first of these divides itself into two branches,—Last Hope Inlet, extending to the N., and Ancon Sin Salida, or Obstruction Sound, to the S.; while the second, which is much larger, spreads itself out in two sheets of water—Otway Water and Skyring Water—connected by a narrow strait. Farther to the S., not only the mountain chain, but the entire mass of the land is divided by the Strait of Magellan, extending from the Pacific to the Atlantic, and separating Tierra del Fuego and the adjacent islands from Patagonia. All the mountains of Western Patagonia, as well as those on the islands, are thickly wooded on their western declivities, but entirely bare on the side that is exposed to the ocean. The whole of the region is subject to incessant winds and rains, the breezes being generally from the W., and bringing from the Pacific an immense quantity of moisture, which is condensed on the mountains, and deluges the country with almost incessant showers. The ground is thus kept constantly wet; and there are few days in the year when rain does not fall in summer, or snow and sleet in winter. The largest river in Western Patagonia is the San Tadio, a small stream which falls into the Pacific S. of the peninsula of Tres Montes. It is formed by two mountain torrents, and is navigable for about 11 miles. On the mainland opposite the island of Chiloe there are two volcanoes, the farthest S. of any that are known to have been active in modern times. These are Minchinmadiva, 8010 feet, and Corcovado, 7500 feet above the sea. The eastern part of Patagonia is in its surface and climate the very reverse in many respects of the western. The land is low and flat, rising gradually in terraces from the Atlantic to the Andes. The uniformity of the surface is, however, broken by the high lands of Espinosa, which occupy a large promontory between S. Lat. 47. and 48., and rise to the height of 4000 feet above the sea. In the southern portion of the country the soil consists of tertiary strata, covered over with shingle, and destitute of all vegetation, except here and there scattered tufts of grass and low bushes. Although numerous salt pools occur in this region, there is a great scarcity of fresh water. North of 45. S. Lat., the country is more undulating, and not so entirely destitute of vegetation as the southern portion; for in some places the valleys and low hills are covered with grass and stunted trees, and there are even parts where good pasturage and timber may be obtained. Eastern Patagonia is traversed by several rivers, which are much larger than those that water the western region. The Rio Negro, which forms the northern

Patagonia. boundary of Patagonia, rises in the Andes, flows first N.E., then E., and finally S.E., falling into the Atlantic. Its whole length is about 700 miles; and at a long distance from its mouth it has a breadth of 500 yards. Of the other rivers little is known except their mouths; the Chupat, the Camerones, the Desire River, the Santa Cruz, and the Gallegos, are the most important,—all falling into the Atlantic. The Santa Cruz is a river of considerable size, and is believed to flow through several lakes, one of which, Lake Capar, is 30 miles long and 10 or 12 broad. This river flows for a great part of its course in a deep valley, through an elevated plain which rises in some parts 1800, and in others between 2000 and 3000 feet above the sea. Along the banks there are in some places deep and extensive layers of lava. The eastern coast of Patagonia, from the entrance of Magellan's Strait as far northwards as 49. S. Lat., consists of cliffs of marly clay rising 200 or 300 feet perpendicularly from the sea, and somewhat resembling, when seen from a distance, the coast of Kent. North of this, as far as 45. S. Lat., the cliffs are somewhat higher, and their prevailing structure is porphyritic. Beyond this point the coast presents a different aspect, consisting of a shingly beach skirted by a reef of rocks. The largest gulfs of the eastern coast are those of San Matias, S. of the Rio Negro; and St George, N. of Cape Blanco. There are also several harbours along this coast, such as Port San Antonio, in 41. S. Lat.; Nuevo Golfo, in 43.; Port Desire, in 47. 5.; Port San Julian, in 49. 12.; Santa Cruz, in 50. 7.; and Gallegos, in 51. 38. The climate of Eastern Patagonia is as remarkable for dryness as that of the western region is for its constant showers. Captain Fitzroy, who explored the Patagonian coasts between the years 1826 and 1836, thus speaks of the climate of this country:—"One naturally asks why Eastern Patagonia should be condemned to perpetual sterility, while the western side of the same country, in the same parallel of latitude, is injured by too much rain? The prevailing westerly winds and the Andes are the causes. The winds bring much moisture from the Pacific, but they leave it all, condensed, on the west side of the mountains. After passing the cordillera, those same winds are very dry. Easterly winds are very rare upon the east coast; they are the only ones which carry rain to the almost deserts of Patagonia. Westward of the Andes, an east wind is dry and free from clouds. All this country is exposed to severe cold weather in winter, and to excessive heat in summer. Great and sudden changes of temperature take place, when, after very hot weather, cold winds rush northwards with the fury of a hurricane." The temperature of the country S. of the 45th parallel of latitude is in general extremely cold, although during the short summer great heat is experienced. The vegetable products of Patagonia are very scanty, the only portion where there is a luxuriant vegetation being the country near the Rio Negro, in which the same plants are found as in the adjacent parts of the Argentine Republic. Among the forests of the west several species of beech and many large and beautiful ferns occur. Animals are found in greater abundance than vegetables in most parts of Patagonia. Herds of guanacoes, amounting to several hundreds in number, roam about the country; and the puma, the wolf, the fox, the opossum, the cavia, the armadillo, the otter, and the seal, are also met with. There are an immense number of animals of the class Rodentia,—more, perhaps, than in any other part of the world. The horse is found in all parts of the country, being the invariable companion of the natives of Eastern Patagonia. The condor and the cassowary are the principal terrestrial birds; but the sea-fowl are very numerous, including several species of swans, ducks, and geese. Fish and other sea-animals are plentiful along the coasts.

The aboriginal natives of Patagonia are a tall and extremely robust race of men. Their bodies are bulky, and their head and features large, but their hands and feet are small. Their limbs are neither so muscular nor so large-boned as their height and apparent bulk would lead one to suppose; they are rounder and smoother than those of white men. Their colour is a rich reddish brown, rather darker than the hue of copper. The only attractive feature about their persons is their teeth, which are sound and white. Their cheek-bones are prominent, and so is their brow, which is broad but low. Their heads are furnished with a profusion of rough, lank, and coarse black hair, which is tied above the temples by a fillet of plaited or twisted sinews; and they wear no other covering upon this part of their body. The size of the Patagonians has been represented by some writers as quite gigantic; and, although the earlier voyagers have given somewhat exaggerated accounts of them, which have been improved by some subsequent authors, it seems to be the universal testimony of those who have visited the country in modern times, that they do considerably exceed the average stature of Europeans. Captain Byron, in the middle of last century, saw a number of men above 8 feet, and some as much as 9 feet in height. Captain Fitzroy thus speaks of the natives that he saw:—"Among two hundred or three hundred natives of Patagonia scarcely half a dozen men are seen whose height is under 5 feet 9 or 10 inches; the women are proportionably tall. I have nowhere seen an assemblage of men and women whose *average* height and *apparent* bulk equalled that of the Patagonians. Tall and athletic as are many of the South Sea islanders, there are also many among their number who are slight and of lower stature. The Patagonians seem to be high-shouldered, owing perhaps to their habit of folding their arms across the chest, in their mantles, and thus increasing their apparent height and bulk, because the mantles hang loosely, and almost touch the ground. Until actually measured, it is difficult to believe that they are not much taller than is the case."

Mr Bourne, an American seaman, who was for some time a captive in Patagonia in 1849–50, says that their average height is 6½ feet, while some nearly reach 7 feet. These accounts are so precise and satisfactory that the question as to the actual size of the Patagonians may be regarded as completely set at rest. Is it more improbable that there should be races of men *above* the European standard, than it is that there should be races whose height is *below* it? Yet we know beyond a doubt that the Esquimaux are so.

With the exception of the head, little hair grows upon their bodies; and from the face it is carefully removed by shells or pincers. They do not disfigure their naturally coarse features by piercing either nose or lip, but they bedaub their body with white, black, or red paint, forming grotesque figures, such as circles around their eyes or great marks across their faces. This ornamental body-painting is practised by all the different races of Patagonians from Cape Horn to Buenos Ayres. On their feet and legs they wear boots made of the skins of horses' hind legs. Spurs made of wood, but of iron if they can get it, balls (*bolas*), or stones, attached to a long leather thong, for the purpose of catching the guanaco or the ostrich by throwing the balls so as to wind round their legs, whilst a long tapering lance, and a knife, if it can be procured, complete their equipment. "Mounted upon horses of a middle size," says Captain Fitzroy, "under fifteen hands high, and rather well bred, the Patagonians seem to be carried no better than dragoons who ride eighteen stone upon horses able to carry ten; yet they go at full speed in chase of ostriches or guanacoes. When hunting or making long journeys they often change horses. The women are dressed and booted like the men, with the addition of a half

petticoat. They clean their hair, and plait it into two tails. Ornaments of brass, beads, bits of coloured glass, or such trifles, are prized by them. The huts of these wanderers are somewhat like gipsy tents. Poles are stuck in the ground, to which others are fixed. Over them are thrown the skins of animals, an irregular tilt-like hut being thus formed." It is to be observed that the inhabitants of Tierra del Fuego, and of the islands to the S. and S.W., wear little or no clothing. The Patagonians appear to possess nothing like towns, but lead a wandering and unsettled life, somewhat resembling that of the Tartars. The different parts of the country are inhabited by several distinct nations, the chief of which are the following:—The Moluche, or Warrior Indians, who inhabit the Andes and neighbouring regions immediately S. of the Rio Negro; the Puelche, or Eastern People, who wander about the N.E. of Patagonia; the Chulian Indians, who occupy the mountainous regions S. of 42. S. Lat.; the Te-huel-het, or Southern People, who inhabit the south-eastern extremity of the country; and the Fuegians, who people not only the island of Tierra del Fuego, but the western coast of the mainland, as far N. as the peninsula of Tres Montes. The last of these differs from the others in being of much lower stature. The various tribes into which they are divided are generally under the command of chiefs; and they subsist chiefly on the flesh of mares, guanacoes, emus, &c. Very few traces of any religious ceremonies have been observed among them. We are informed by Falconer, the Jesuit missionary, that after the dead have been interred twelve months, the graves are visited by the tribe for the purpose of collecting the bones, and conveying them to their family sepulchres, where they are set up, and adorned with all the beads and ornaments which the friends and family of the deceased are able to collect for the occasion. The ceremony is performed by certain women of the tribe, whose peculiar office it is to attend to these rites. In corroboration of the Jesuit's testimony, Captain King informs us, that near Port Desire he had seen the graves of the Indians upon the summits of hills, but without the bodies, which he supposes to have in all probability been removed by the Indians.

It seems highly probable that Magalhaens was the original discoverer of the southern coast of Patagonia and the northern coast of Tierra del Fuego, as well as of the strait which bears his name. Sir Francis Drake passed the strait in the year 1578; and being driven by storms to the S., discovered the western and south-western coast of Tierra del Fuego, and also Cape Horn; although the honour of the discovery of the latter has generally been ascribed to Jacob Le Maire, a Dutchman in the service of the states of Holland. In the year 1616 this navigator was the first who doubled that terminus of South America, and called it Cape Horn, after a village in Holland. Proceeding in a north-easterly direction, he crossed the strait which bears his name, and discovered Staten Island, which he so designated after the states of Holland. It is supposed that Davies, one of the companions of Cavendish in his voyage to the South Seas in 1592, was the first person who saw the Falkland Islands; but they were not, properly speaking, discovered till the year 1594, when Sir Richard Hawkins examined them, and called them in honour of his queen and himself, Hawkins' Maiden Land. The name, however, was subsequently changed to Falkland Islands by Strong, another English navigator. During the early part of the eighteenth century they were re-discovered by some French navigators; and hence the origin of the French name, Malouine Islands. To Captain Cook we are indebted for the first accurate account of the south-eastern coast of Tierra del Fuego, which he explored in 1774; and so little was known concerning it before this period that, when actually in sight of Cape Horn, he was unable to decide whether it was a detached island or a part of Tierra del Fuego. Amongst the other distinguished names connected with the discovery or investigation of this part of the South American continent, are those of Sarmiento (whose account of a voyage down the western coast, and through the Strait of Magalhaens, has never been surpassed), Sir John Narborough, Cordova, Byron, Willis, Carteret, Bougainville, Weddel, King, Stokes, and Fitzroy. It only remains to be noticed that, although repeated attempts had been made to form permanent settlements in Patagonia, or upon the neighbouring islands, particularly by the Spaniards, until recently none of these has been successful. In 1843, however, the government of Chili founded a settlement at Port Famine, on the Strait of Magellan, which was in 1850 transferred to Sandy Point, some distance to the N. This colony contained in 1853 about 20 houses, with a chapel and sacristy. The population was 150; and they had 10 horses, 18 goats, and a number of swine. Another settlement on the strait has recently been projected; and in 1854 an exploring expedition was sent thither with a view to that undertaking. The western part of Patagonia is claimed by Chili, and the eastern by the Argentine Republic. With regard to population, it must be quite obvious that no accurate idea can be formed. It has, however, been estimated at 120,000. By far the greater part of the country—that which stretches along the eastern side of the Andes, from their base to the Atlantic Ocean—is almost entirely unknown, with the exception of a very few places upon the coast. It is quite possible, therefore, that the inhabitants may be far more numerous in this region than is supposed; but the general sterility of the country holds out little prospect of any great commercial advantages to be gained by intercourse with them, except in the precious metals, which are doubtless to be found in the Patagonian Andes.

PATAK, Saros, a market-town of Hungary, county of Zemplin, on the right bank of the Bodrog, here crossed by a bridge, 14 miles S.W. of Zemplin. It contains a once famous but now ruined castle, a celebrated Protestant college, a Roman Catholic upper school, &c. Cloth is manufactured here; and wine is produced in the vicinity. Pop. 5480.

PATANI, a small kingdom on the eastern coast of the Malay Peninsula, subject to Siam. It is the most fertile portion of Malacca; rice and salt are obtained in large quantities; and these articles, as well as tin, are exported. The chief town, Patani, stands on the coast, N. Lat. 7., E. Long. 105. 35.; and was formerly much resorted to by vessels trading between India and China, though at present it is rarely visited. There is, however, some communication kept up between this place and Singapore. Patani is also the name of a cape on this coast, at the entrance of the Gulf of Siam.

PATAVINITY (*patavinitas*), properly the mode of speaking peculiar to the people of Patavium, is a term employed by literary critics, to denote generally any provincial idiom. The word takes its origin from the alleged provincialisms to be found in the writings of Livy, who was a native of Patavium, a provincial town belonging to the Roman empire. According to Quintilian (i. 5, § 56; viii. 1, § 3), Pallio censured the historian for this alleged defect, but it does not appear that any critic has ever pointed out precisely in what the patavinity of Livy really consists. It was perhaps of so subtle and delicate a nature that we are no longer in a position to detect it. Niebuhr simplifies the matter by altogether disbelieving Quintilian's story.

PATAVIUM. See Padua.

PATENTS: Letters Patent *for Inventions.* These are documents bearing the great seal of the United Kingdom, by which inventors obtain a monopoly in their inventions for a certain number of years; which monopoly is similar in principle to that conceded to authors and artists

under the name of copyright. There are persons who argue that no such privilege should be permitted; there are others who think that the most trifling exertions of the inventive faculties should be protected. The right course lies between these extremes. All civilized nations have considered it desirable to give inventors an exclusive right to their inventions for a limited period, not only as a matter of justice to individuals, but as a piece of sound policy tending to the advantage of the whole community. The monopoly is granted in the expectation that the inventor will derive some profit from it; and the hope of profit is known to be a great stimulus to invention. When an author writes a book, or an artist designs a picture, the law allows a right of property to those persons in their productions, and accompanies the recognition of this right with the power to repress infringements. If this were not so, very few persons would employ their time in writing books or creating works of art; and hardly any one will be bold enough to assert that the extinction of the race of authors and artists is to be desired. The same principle applies to inventors, who ought to have the works of their brain protected from piracy fully as much as the other classes of mental producers. By holding out to them the prospect of gain, they are induced, at a present loss of time and money, to attempt to discover improvements in the useful arts, in machinery, in manufacturing processes, &c.; and thus the interests of the community are advanced more rapidly than if such exertions had not been brought into play. Just as the rule of rewarding inventors is in theory, the practical application of it is attended with difficulty. To grant a very long term of exclusive possession would be detrimental to the public, since it would tend to stop the progress of improvement. A limited property must therefore be allowed; large enough to give the inventor an opportunity of reaping a fair reward, but not barring the way for an unreasonahle period. And when this compromise has been decided on, it will be seen how difficult it may be to determine beforehand what is the real merit of an invention, and apportion the time to that merit. Hence it has been found necessary to allot one fixed period for all kinds of inventions falling within the purview of the patent laws. This regulation appears to be open to the complaint, that the most worthless and the most meritorious inventions are placed on the same footing. But it may be replied, that in the result this is of little consequence, since meritorious inventions alone obtain the patronage of the public, those which are destitute of value being neglected. Besides, if the complaint were well founded, there is here no sound argument against the policy of privileges of this nature, seeing that it is impossible to weigh beforehand one invention against another in the scale of merit, or to obtain a true standard of comparison.

Leaving the discussion of general considerations, we will now give an outline of the law affecting patent privileges in the United Kingdom. In the old times, the reigning prince considered himself entitled, as part of his prerogative, to grant privileges, in the nature of monopolies, to any one who had acquired his favour. These grants became so numerous that they were oppressive and unjust to various classes of the commonwealth; and hence, in the reign of James I., a statute was wrung from that king which declared all monopolies that were grievous and inconvenient to the subjects of the realm to be void. There was, however, a special exception from this enactment of all letters patent and grants of privilege of the "sole working or making of any manner of new manufactures which others at the time of making such letters patent and grants should not use, so they be not contrary to law, nor mischievous to the state." Upon these words hangs the whole law of letters patent for inventions. Various statutes were afterwards passed (which it would be well to consolidate into one act), and the principal of these is the Patent Law Amendment Act of 1852. These statutes, however, do not materially alter the law; it is chiefly the practice of obtaining letters patent, and their form, that are affected. The positive law has to be gathered from the numerous decisions of the courts, for patent law is for the most part "judge-made law." Of that law, as it now stands, we proceed to give an outline.

The inventions for which patents are obtained are chiefly either vendible articles formed by chemical or mechanical operations, such as cloth, alloys, vulcanized india-rubber, &c.; or machinery and apparatus, or processes. It may be remarked here, that a scientific principle cannot form the subject of a valid patent unless its application to a practical and useful end and object is shown. An abstract notion, a philosophical idea, may be extremely valuable in the realm of science, but before it is allowed to form a sound basis for a patent, the world must be shown how to apply it so as to gain therefrom some immediate material advantage. With regard to processes, the language of the statute of James has been strained to bring them within the words "any manner of new manufactures," and judges on the bench have admitted that the exposition of the act has gone much beyond the letter. However, it is undoubted law that a process is patentable; and patents are accordingly obtained for processes every day.

The principal classes of patentable inventions seem to be these:—

1. New contrivances applied to new ends.
2. New contrivances applied to old ends.
3. New combinations of old parts, whether relating to material objects or processes.
4. New methods of applying a well-known object.

We have not space to enlarge upon these rough divisions, and will only remark, with regard to a patent for the new application of a well-known object, that there must be some display of ingenuity in making the application, otherwise the patent will be invalid on the ground that the subject-matter is destitute of novelty. For example, a machine already in use as an excavator on land cannot be separately patented as an excavator under water; nor can a machine employed in the finishing of cotton goods be afterwards patented as applied to the finishing of woollen fabrics. A small amount of invention is indeed sufficient to support a patent where the utility to be derived from the result is great. A small step in advance, a slight deviation from known processes, may have been apparently brought about by the exercise of little ingenuity; but if the improvement be manifest, either as saving time or labour, a patent in respect of it will stand. The mere omission of a step from some commonly practised process has been held sufficient to support a patent for a new method of manufacture; and how often do we see what appears to be a very trifling degree of novelty, attended with very advantageous consequences, sometimes resulting in the entire revolution of a manufacture, or in a lowering of price appreciable in every pound of an article extensively used by the public.

Whatever be the nature of the invention, it must possess the incidents of utility and novelty, else any patent obtained in respect of it will be invalid. The degree of utility need not, however, be great; it is sufficient if a jury can find some utility in it. As to novelty, this is the rock upon which most patents split; for if it can be shown that other persons have used the invention before the date of the patent, it will fall to the ground, although the patentee was an independent inventor deriving his ideas from no one else. The difficulty of steering clear of this rock will be apparent at once. Suppose A. in London patents an invention the result of his own ingenuity and patient study, and it afterwards appears that B., in some distant part of the kingdom, had been previously openly using the same thing in his workshop, A.'s patent is good for nothing. Thus, in one of the cases which

arose out of Heath's carburet of manganese patent, a patent celebrated in the law courts, it appeared that three firms had used a process in the manufacture of steel which was substantially the same as that forming the subject of the patent. They had used the process openly in the way of their trade previous to the date of the patent, although it had not become generally known. This prior use of the invention was held to deprive the patent of validity. It is therefore a very frequent subject of inquiry, whether an invention has been previously used to such an extent as to have been publicly used in the sense attached by the courts to this phrase; the more especially as, if the prior use of the invention by some other person has not been public and general, an act of Parliament (5 and 6 Will. IV., cap. 83) has given the patentee a remedy against the strict rule of law by means of a petition to the Privy Council. The inventor himself is not allowed to use his invention either in public or secretly, with a view to profit, before the date of the patent. Thus, if he manufactures an article by some new process, keeping the process an entire secret, but selling the produce, he cannot afterwards obtain a patent in respect of it. If he were allowed to do this, he might in many cases easily obtain a monopoly in his invention for a much longer period than that allowed by law. The rule, that an inventor's use of the invention invalidates a subsequent patent, does not, however, apply to cases where the use was only by way of experiment with a view to improve or test the invention. And it has been repeatedly decided that the previous experiments of other persons, if incomplete, or abandoned before the realization of the discovery, will not have the effect of vitiating a patent. Nor will such an effect be produced by the previous discovery of the subject-matter of a patent, if the discoverer keeps the secret to himself, the law holding that he is the "true and first inventor" referred to in the statute of James, who first obtains a patent.

When an invention is the joint production of more persons than one, they must all apply for and obtain a joint patent, for a patent is rendered invalid on showing that a material part of the invention was due to some one not named therein. The mere suggestion of a workman employed by an inventor to carry out his ideas will not, however, require that he should be joined, provided that the former adds nothing substantial to the invention, but merely works out in detail the principle discovered by his employer. In certain cases in which patents taken out by the celebrated Sir Richard Arkwright came to be inquired into, it was proved that the inventions were really made by persons in Arkwright's employment. Their value being perceived by him, he adopted them, and obtained the patents in question, but under these circumstances they were adjudged invalid.

If it can be shown that the invention in respect of which a patent has been obtained was previously described in a printed book in circulation in Great Britain, whether such book be in the English or a foreign language, the patent is also invalid; because a man has no right to obtain a monopoly in that which is already a part of the stock of public information; and it is not necessary to prove that the patentee was acquainted with the book, and derived his ideas from that source.

But persons are allowed to obtain patents for inventions imported from abroad, if such inventions are new within the realm, and if they acknowledge, on the face of their petitions, that the inventions are imported, not original. Such patents are now common. If the invention has been patented abroad, the law directs that the British patent shall expire at the same time as the foreign patent.

The attributes of novelty and utility being possessed in due degree by an invention, the chief remaining difficulty with which a patent has to contend resides in the specification, the instrument by which the inventor describes the nature of the invention, and the means by which it may be carried into effect. An inventor is bound, in return for the monopoly conceded to him, to instruct the public how to work the invention when the monopoly shall have expired, and to inform them in the meantime what it is they are shut out from using. The patentee may either file this instrument along with his petition for a patent, or he may reserve it until the end of six months from the date of the patent. In either case, he must make a full disclosure of his secret; he must not keep anything back either wilfully or accidentally; he must render everything plain and clear, showing no attempt to mislead, and leaving nothing ambiguous; he must distinguish what is old from what is new, and take care that he claims no more than he is entitled to; in short, the invention must be accurately and intelligibly described, properly limited, and communicated to the public in such a way that they may have a complete knowledge of that in which they are granting to him a temporary monopoly. Very many patents have been invalidated by inattention to these rules in framing the specification, — the most common fault being, that it claims too much; in other words, it claims something that is already public property, or another man's patented invention. And here we are brought back again to the question of novelty.

If a patentee discovers that his specification claims more than he is entitled to, he may put the matter right by filing a disclaimer, and excising the superfluous parts; but he will not be allowed to extend his claims in any degree. He may cut out anything, but he can insert nothing.

The term for which a patent is originally granted is fourteen years, but the Crown has power, under an act of Parliament (5 and 6 Will. IV., c. 83), and on the report of the Judicial Committee of the Privy Council, before which the proceedings to this end take place, to extend the time of a patent from its expiration for any additional time not longer than fourteen years. But an extension will only be granted on the patentee showing that he has not been adequately rewarded; and what is adequate reward depends on the special circumstances of each case.

Patent privileges, like most other rights, can be made the subject of sale. Partial interests can also be carved out of them by means of licenses, instruments which empower other persons to exercise the invention, either universally and for the full time of the patent (when they are tantamount to an assignment of the patentee's entire rights), or for a limited time, and within a limited district. By an exclusive license is meant one that restrains the patentee from granting other licenses to any one else. By means of a license a patentee may derive benefit from his patent without entering into trade, and without running the risks of a partnership.

A patentee's remedy for an infringement of his rights is by civil suit, there being no criminal proceeding in such a case. In prosecuting such suit, he subjects those rights to a searching examination, for the alleged infringer is at liberty to show that the invention is not new, that the patentee is not the true and first inventor, &c., as well as to prove that the alleged infringement is not really an infringement. But it may here be remarked, that a patentee is not bound down (unless he chooses so to be) to the precise mode of carrying the invention into effect described in the specification. If the principle is new, it is not to be expected that he can describe every mode of working it; he will sufficiently secure the principle by giving some illustrations of it; and no person will be permitted to adopt some mode of carrying the same principle into effect, on the ground that such mode has not been described by the patentee. On the other hand, when the principle is not new, a patentee can only secure the particular method which he

has invented, and other persons may safely use other methods of effecting the same object. Instances of this occur every day; and it is well known that scores of patents have been taken out for screw-propellers, steam-hammers, water-meters, &c., each of which is limited to the particular construction described, and cannot be extended farther. Again, where the invention patented consists of a combination of parts, some old and some new, the whole constituting a new machine or a new process, it is not open to the world to copy the new part and reject the rest. A man is not suffered to allege that the patent is for a combination, and that the combination not having been used, there has been no infringement.

The Crown has power to repeal any letters patent on good grounds being shown by means of a writ of *scire facias;* and this is issuable at the request of any subject. Want of novelty in the invention, the fact of the patentee not being the inventor, and the insufficiency of the specification, form good grounds for repealing a patent.

Patents are not now extended to the colonies, and such of our colonies as possess a legislature are gradually acquiring patent laws for themselves.

The patent business of the United Kingdom is carried on under the direction of commissioners appointed by the act of 1852, the chief of whom is the lord chancellor; and the whole of it is transacted at one office in London, instead of at many offices, as formerly. Previous to that act, a separate patent was issued for each of the three kingdoms, but now one patent is valid throughout the realm. The proceedings taken with a view to obtain a patent commence with the presentation of a petition, accompanied by a sketch of the invention and a declaration of its originality. Various steps are interposed before the patent is issued, in order to afford those who have grounds for opposing the grant an opportunity of doing so. Most patents are obtained through persons styled *patent agents*, who devote themselves to this branch of business. The act just referred to introduced various useful reforms in the proceedings for obtaining patents, but greater simplicity and a lessening of the expense are still desirable.

(For further information on the subject of this article, the reader is referred to Johnson's *Patentee's Manual*, second edition, 1858, as comprising an exposition of the law and practice within a moderate compass.) (J. Y. J.)

PATERA, a broad flat dish, or libation-saucer, among the Romans, deriving its name, according to Macrobius (*Sat.* v. 21), from its *open*, shallow form ("planum ac patens est"). The ordinary pateræ were made of common red earthenware, slightly ornamented; but the more valuable vessels of this class were composed for the most part of bronze, and every family of easy circumstances possessed one of silver. The original use of the patera seems to have been domestic, which gave origin, in all likelihood, to its employment at sacrifices. Numerous specimens of pateræ are to be seen in almost all collections of ancient fictile vases, and especially in the British Museum.

PATERCULUS, Caius Velleius, a Roman historian, was the son of a præfect of cavalry, and is conjectured to have been born in 19 B.C. He was descended from a Campanian family which had been distinguished during several generations for its devoted attachment to the Romans. One of his ancestors, Decius Magius, was the leader of the Roman party in Capua when the majority of the citizens were revolting to Hannibal. Another of his ancestors, Minatius Magius, fought zealously and bravely on the side of Rome in the Social War. His grandfather also, a retired captain of the artificers, was so chagrined when the infirmities of age would not permit him to follow his general, Claudius Nero, into banishment, that he run himself through with his own sword. From these old heroes Paterculus inherited a warlike zeal and energy. Succeeding his father in 4 A.D. as a præfect of cavalry in the army of Tiberius Cæsar in Germany, he soon gained preferment and honour. He obtained the quæstorship in 7 A.D., a share in the triumphal honours of his general in 12 A.D., and the prætorship in 14 A.D. His services and abilities seem also to have secured for him the friendship of the Emperor Tiberius, and of the emperor's rising favourite, Sejanus. It was, however, in the character of a historian that Paterculus won his brightest laurels. In 30 A.D. he sat down to write a historical compendium which should embrace not only the annals of his own country down to his own time, but also those of the rest of the civilized world. The cursory nature of such a work would not permit him to dwell long upon any particular scene, and whirled him along, as he said himself, "with the rapidity of a wheel or torrent." Yet, by omitting all incidents that were not absolutely essential, and by describing at length those events that formed the characteristics of the several ages, he succeeded in making his narrative at once comprehensive and interesting. The shortness of the time allotted for the task often hurried him into confused and slovenly sentences. Yet he narrated facts with great point and vigour, and made reflections that were strikingly original and appropriate. The work was finished the same year in which it had been begun; and was dedicated to M. Vinicius, the ruling consul. When and how Paterculus died have not been ascertained. It has been conjectured that he was involved in the ruin of Sejanus in 31 A.D., along with that minion's other friends. The work of Paterculus has come down to modern times under the title of a *Roman History*, and with some of its parts wanting. Beatus Rhenanus discovered the manuscript in the monastery of Murbach in Alsace, and printed it at Basle in 1520. The most valuable edition is that of Ruhnken, Leyden, 1779, reprinted by Frotscher, Leipsic, 1830–39. The edition of Orelli, Leipsic, 1835, contains some textual improvements. An English translation of Paterculus forms, in conjunction with translations of Sallust and Florus, a volume of Bohn's "Classical Library."

PATERNO, a town of Sicily, province of Catania, stands at the foot of Mount Ætna, 10 miles N.W. of Catania. It is a very ancient place; and contains numerous convents and churches. The surrounding country is fertile, producing corn, oil, wine, flax, hemp, and timber; in which articles an active trade is carried on. In the vicinity of the town are mineral springs and a salt mine. Paterno gives the title of Prince to one of the principal families of Sicily. Numerous vestiges of antiquity have been discovered here; among others, the remains of baths, a tomb, an aqueduct, and a ruined bridge. The town is supposed to occupy the site of the ancient Hybla Major. Pop. 10,700.

PATERSON, a town of the United States of North America, in the state of New Jersey, stands on the right bank of the Passaic River, 13 miles N. of Newark, and 17 N.W. of New York. The streets are straight and well paved, and the houses substantially built. There are about eighteen churches, belonging to various sects, and some of them are edifices of much elegance. There are also a court-house, jail, two banks, several schools, a philosophical society with a library, and a mechanics' institution. The manufactories of the place are extensive. There are about twenty cotton factories, several dyeing and printing establishments, two large manufactories of locomotives, besides paper-mills, fulling-mills, foundries, &c. Paterson is thus one of the principal manufacturing towns in the States; and in New Jersey it is second only to Newark. Immediately above the town the Passaic falls over a precipice 50 feet high. This forms, during the time of flood, a magnificent spectacle. A great part of the water is carried off by a canal into a basin, from which, by different channels, it is conveyed to the various mills of the town. Paterson is connected by railway with New York, and by canal with

the Atlantic. On the opposite side of the river, which is crossed by two bridges, stands the village of Manchester. Paterson was originally founded in 1791 by a company for the manufacture of cotton; and although it had to be abandoned soon afterwards, the original design was subsequently carried out. Pop. (1850) 11,338; (1853) about 13,000.

PATERSON, William, founder of the Bank of England, was born, according to tradition, at Skipmyre in Tinwald, Dumfriesshire, and, as his will testifies, in the spring of 1665. Little is definitely known respecting the early part of his career. He is said to have been originally destined for the Scottish Church, and received accordingly a suitable elementary education. While yet a lad, however, he was compelled, it is said, to flee to England for safety from the persecutions then raging in his native country against the outlawed Presbyterians, with whom he at that early age seems to have associated. He found refuge in the house of a maternal relative in Bristol, who, dying soon after, left young Paterson some trifling property. Having succeeded as a pedlar, as some would have it, he took up his residence in London in the capacity of a merchant. Traces of him are to be found about this time in the West Indies, some say in the character of a bucaneer, but more probably in the capacity of a merchant. Whether or not this occurred previous to his taking up his residence in the metropolis, does not definitely appear. At all events, during his residence abroad he acquired extensive information respecting Spanish America, which he found frequent occasion to turn to account, and especially in connection with the Darien expedition. Much of this information he could only have obtained through the bucaneers; yet there is sufficient reason to believe that he was in no way associated with the exploits of these naval marauders. On his return to England, Paterson seems to have projected schemes of trade more bold and original than any yet known among the trading companies of Britain. He is believed to have contributed largely to the pages of a pamphlet published ostensibly by his friend Sir Dalby Thomas in 1690, and entitled *An Historical Account of the Rise and Growth of the West India Colonies, and of the great advantage they are to England in respect of Trade.* The great ability and strict integrity of Paterson had by this time gained for him an eminent standing in society; and his monetary schemes seem to have been listened to by the wisest heads in the country. Among his attached friends he counted Fletcher of Saltoun and Baillie of Jerviswood, countrymen of his own; and he was in close alliance with such eminent men of business as Godfrey and Sir Theodore Jansen. His financial proposals in connection with the founding of the Bank of England met with strenuous opposition, however, from Lowndes, secretary to the Treasury. A tract entitled *A Brief Account of the Intended Bank of England*, London, 1694 (the year of its foundation), is supposed to have come from Paterson's pen. (For an account of the establishment of this bank, see Money, § iii.) Despite his eminent services in projecting the bank, a difference of opinion seems to have soon arisen between him and the directors, which induced him to resign his connection with it. It seems certain that, so far from participating in the foundation of the Bank of Scotland in 1695, he was decidedly opposed to it. The project of "a free commonwealth in Darien" had long occupied the thoughts of this enterprising trader. Even so far back as 1687 we find him advocating the scheme in the coffee-houses of Amsterdam. For at least ten years he had been pressing his plan upon the English minister and upon foreign states; when about 1695, at the request of certain of his countrymen, he visited Scotland, and in all probability drew up the Scottish act of that year constituting the Darien company. Accordingly "twelve hundred men sailed in five stout ships" on that ill-fated expedition from the harbour of Leith, on the 26th July 1698; but Paterson had no share in the management of it, and embarked with the fleet in the capacity of a private adventurer. What with the gross mismanagement of the council of seven, the opposition of the English government, and other unfavourable circumstances, this unfortunate colony came to utter ruin. (See Darien.) Paterson's conduct on his return to Scotland was admirable. He set vigorously to work to frame a new plan for the colony; and wrote in 1701 an interesting work, hitherto attributed to the notorious John Law, entitled *Proposals and Reasons for constituting a Council of Trade.* On his return to London in 1701, he met with a friendly reception from King William; but the death of that monarch, shortly afterwards, cast a temporary cloud over Paterson's future prospects. He had an important share in the union of the English and Scottish Parliaments, as able tracts from his pen still attest; he was unremitting in his endeavours to relieve the distress of his native country; he had a sharp controversy with John Law on paper-money; and was elected member of Parliament for Dumfries in 1708. At the treaty of Union, an indemnity in favour of Paterson was recommended to Queen Anne by the Scottish Parliament, in consideration of his losses in connection with the Darien company, and of his "carrying on other matters of a public nature, much to his country's service." George I. had ascended the throne, however, before this indemnity was gained. The remainder of his years were spent at Westminster, in the metropolis, in unavailing hostility to the ruinous schemes of his relative and old financial foe John Law. Paterson died in January 1719. (See *William Paterson, the Merchant Statesman, and Founder of the Bank of England, his Life and Trials*, by S. Bannister, Edinburgh, 1858. Paterson's biographer, who has industriously collected all available information regarding him, also advertises *The Writings of William Paterson, with a Biographical Introduction*, 2 vols. 8vo, 1858.)

PATHOLOGY (πάθος, *suffering* or *disease*, and λόγος, *a discourse*) is properly, and in its widest sense, the science of disease. It is usually divided by scientific men into *general* and *special* pathology. The former includes, first, the more general principles relative to the primary elements of disease, including the various phenomena and causes of those derangements to which the animal economy is subject; and, second, the general facts or principles relative to the more obvious analogies of disease, derived from a comparative view of particular diseases. The latter or special division of pathology comprehends the consideration of particular diseases as they occur in nature. The French divide pathology into *external* and *internal*, employing those terms in a sense synonymous with what English writers usually call the principles and practice of surgery and physic. From whatever point of view, however, we regard the derangements of the animal frame, the objects of investigation are precisely the same. There are, *first*, the morbid phenomena symptomatic of derangement; *second*, the morbific agents by which derangements of the economy are liable to be produced; *third*, the more immediate seats, and the peculiar nature of each, of those derangements to which the system is liable; and, *fourth*, the morbid changes discoverable after death, whether as cause or as effect of certain derangements of functions known to exist during life. In short, pathology has for its bases the observation of the circumstances that precede a disease, of its symptoms when present, and especially the examination of the body after death. (See Medicine, and Physiology.)

PATIBULUM. See Furca.

PATMOS, one of the group of islands in the Ægean Sea which were called the Sporades, was situated to the south of Samos. Ancient writers represent it to have been about 30 Roman miles in circumference, and to have had a sea-port town of the same name as itself. It is celebrated

as the place where the apostle John endured banishment, and where he wrote the Apocalypse. The credulous point out a cave in which he is said to have sat while the heavenly visions passed before the eye of his imagination.

PATNA, a town of British India, capital of a district of the same name, in the presidency of Bengal, stands on the right bank of the Ganges, 10 miles E. of Dinapore, 157 E. of Benares, and 377 N.W. of Calcutta. The city and suburbs extend along the river to the length of 9 miles, and inland for about 2 miles; but the city itself, which is of a rectangular form and surrounded with walls, is only about a mile and a half in length, by three-quarters of a mile in breadth. When viewed from the water, the appearance of Patna is very beautiful, as there are then seen many large and handsome houses with flat roofs and carved balustrades, numerous temples and mosques, Saracenic arches and ancient towers; while many *ghats*, or flights of stairs, lead down to the Ganges; and in the background a range of heights closes in the view. There is one principal thoroughfare extending parallel to the river, between two gates in the eastern and western walls. This street is wide, though neither straight nor regular; but the other streets and lanes are very narrow and crooked. The better class of houses are built of brick, and have flat roofs and balconies; but a great number consist of little better than mud, and are covered with tiles or thatch. There are numerous mosques in the city, but the majority of them are treated with so little reverence or care, that they are used as warehouses,—a fate from which even the principal mosque, though a handsome building, is not exempt. The chief place of Mohammedan worship is in the west suburb, where vast multitudes of Mussulmans frequently congregate. In the same suburb are the residences of the Europeans, for the most part along the river's bank, but they are neither many in number nor splendid in appearance. A penitentiary and house of correction have recently been erected within the city; and there is also a school where the English language and literature, history and mathematics, are taught. The eastern suburb contains the principal market-place and several granaries. The manufactures of Patna are neither extensive nor important; but the bazaars are well supplied with domestic and foreign goods; and some trade is carried on in rice, opium, wheat, indigo, saltpetre, sugar, &c. During the summer the heat is very great, as the sun's rays are reflected from a bare and sandy island opposite the town. Patna is a place of great antiquity. Its old Sanscrit name was *Pataliputra*, and it is supposed to be the place mentioned by Greek and Roman writers under the name of *Palimbothra*. It was visited by Megasthenes, who went as an ambassador from Seleucus Nicator to Sandracottus, and who afterwards wrote an account of India. It is said to have been then 80 stadia in length and 15 in breadth, and surrounded with a stockade and ditch. It seems to have been at this time the capital of an independent state, but subsequently it formed part of the kingdom of Kunnouj, which was in early times one of the most powerful nations of India. In 1194 A.D. this kingdom was conquered and annexed to the empire of Delhi, of which Patna, along with the rest of Bengal and Behar, thenceforward formed a part. Factories were established here at an early period by the British, and a trade was carried on in rice and opium. In 1763 disputes began to arise between Meer Cossim, the nawaub of Bengal and Behar, and the servants of the East India Company, about the transit-dues levied on native traders, from which the English claimed exemption. The nawaub for some time refused to accede to these demands; but finally he entirely abolished all the imposts both on British and native goods, a step which was not desired by the Company, and which must have greatly diminished his revenues. In revenge for this injury, he proceeded in various ways to annoy the British; and at length went so far as to seize some of their boats on the Ganges. On this, Mr Ellis, the chief of the factory at Patna, made an attack on the city, and took possession of it, although Meer Cossim soon afterwards recovered it, and forced the British to take refuge in the factory. For four months hostilities continued between the two parties, in the course of which the nawaub was several times defeated, until he became so exasperated at the loss of the city of Monghyr, that he ordered the murder in cold blood of 200 prisoners. The grave of these prisoners is marked by a column in the city. On the 6th of November in the same year Patna was taken by the British; and in May 1764 Meer Cossim's troops were totally defeated under the walls. Since that time the place has remained undisturbed in the hands of the British. Pop. stated at 284,132.

PATNA, a district of British India, deriving its name from the above town, is bounded on the N. by the districts of Sarun, Tirhoot, and Monghyr; E. by that of Monghyr; S. by those of Monghyr and Behar; and W. by that of Shahabad; and extends from N. Lat. 25. 3. to 25. 38., E. Long. 84. 45. to 86. 10. Length, from E. to W., 85 miles; breadth, 45; area, 1828 square miles. The Ganges flows along its northern frontier; and the Son, a tributary of that river, forms the western boundary for a considerable distance. The chief of the other rivers are the Poonpoon and the Lesser Poonpoon; but during the rainy seasons the whole country is intersected with streams. The soil is very fertile and well cultivated: rice, wheat, and barley are grown in abundance; and many groves and orchards diversify the aspect of the country. The climate is very hot in summer, but the winters are mild. The district is traversed by the East India Railway, and by several roads. Pop. 1,200,000.

PATRAS (anciently *Patræ*), a fortified town of Greece, capital of the monarchy of Achaia and Elis, stands on the E. side of the gulf of the same name, near the entrance of that of Corinth, 10 miles S.S.W. of Lepanto. It is built partly on a plain and partly on the slope of a hill, on the summit of which stands a castle. The principal streets are broad, straight, and regular; and many of the houses are large, well-built, and surrounded with gardens, but they are generally but of one storey high, on account of the frequency of earthquakes. The only important buildings besides the castle, which is very strong, are the barracks, military hospital, and churches. An active trade is carried on with the Ionian Islands, Italy, Marseilles, &c.; the chief exports being corn, wine, oil, currants, and other fruits; silk, cotton, wool, &c. The number of vessels that cleared from the port in 1854 was 439; tonnage, 34,616; value of cargoes, L.100,570: in 1855,—vessels, 609; tonnage, 53,684; value of cargoes, L.251,994. The number of vessels that entered in 1854 was 443; tonnage, 52,573; value of cargoes, L.64,002: in 1855,—vessels, 571; tonnage, 42,914; value of cargoes, L.123,828. The harbour is not safe, being exposed to a heavy sea; but there is a mole at some distance from the town, where vessels can lie close to the wharf. The ancient Patræ was founded by the Ionians; and on their expulsion from the Peloponnese, was occupied by the Achæans, from one of whom, called Patreus, it is said to have derived its name. In the Peloponnesian war Patræ embraced the side of the Athenians; and, on the advice of Alcibiades, the city and port were connected by walls. It afterwards was one of the cities of the Achæan League, but remained comparatively insignificant till the time of Augustus. That monarch, after the battle of Actium, made Patræ a Roman colony, and gave it the dominion over the neighbouring towns. In the time of Pausanias the town contained a theatre, music-hall, numerous temples, and other buildings. Patræ was a dukedom under the Byzantine empire, but was sold to the Venetians in 1408, and taken by the Turks in 1446, who, though the

Venetians recovered it for a short time in 1533, continued to hold it till the Greek revolution. The war which then took place considerably injured the prosperity of the town. The citadel was held for a long time by the Turks, who, after repeated assaults of the Greeks, at length capitulated in 1828. Since that period it has recovered much of its former prosperity, and is now the most important town in the Morea. Pop. 10,000.

PATRIARCH (πατήρ, *a father*, and ἄρχω, *I govern*) is a title applied to the heads of families in early history, and especially to the ancestors of the Israelites from Adam to Jacob, and to his twelve sons in particular. The name was kept up among the Jews after the dispersion; and Hillel the Babylonian is said to have been the first of the *Jewish patriarchs*. The principal business of this class seems to have been the instruction of the people.

The title of *Patriarch* was also assumed in the Christian church about the fourth century by the bishops of the principal cities of the Roman empire, such as Rome, Constantinople, Alexandria, and Antioch. The patriarchate of Constantinople swallowed up those of Antioch and Alexandria; and the Bishop of Constantinople assumed the title of "Universal Patriarch." The Bishop of Rome in turn bore the name of "Prince of the Patriarchs;" and the struggle which ensued between the two rival ecclesiastics led to the separation of the Eastern and Western Churches.

PATRICIANS (*patricii*, from *pater*, a father) was the name given among the Romans to the original *gentes*, of which the *populus Romanus* was composed, or to their descendants by blood or adoption. *Patricii* and *patres* were originally convertible terms, and have essentially the same meaning. During the period of Roman history extending from the building of the city to the formation of the *plebs* as a distinct order of citizenship, Niebuhr has satisfactorily shown that the patricians and the *populus Romanus* were in point of fact identical. The earlier inhabitants of the places occupied by the sovereign people were reduced to a state of servitude, and are known by the names *cliens* and *plebs*; but the conquering race were all regarded as patricians or burghers, from whom a select body of senators was chosen as their representatives. The amalgamation of the Latin, Sabine, and Etruscan tribes gradually gave rise to the distinction of *patres majorum gentium* and *patres minorum gentium*, the latter epithet being employed to designate those recently elevated to a rank of equality with the old privileged patrician class forming the *populus Romanus*. The one class was created by Romulus, the other by Tarquinius Priscus. During this period every Roman citizen was a patrician, and, in contrast with the client beneath him, an aristocrat.

The aristocracy was not certainly exclusive in those days, when every citizen could claim the honour; but in the succeeding period, dating from the creation of the plebeian order to the reign of Constantine, the patricians became a genuine aristocracy of birth. The sovereign people no longer consisted exclusively of the patricians, but of the populus (or patricians) and the plebs. In course of time, however, this distinction well nigh ceased; and the term *populus* came to denote the entire body of Roman citizens, including both patricians and plebeians. During the reign, again, of the Antonines, the patricians were not included under the populus, but formed an exclusive aristocratic class, which no power could degrade to the plebeian level, except the free-will of the patrician himself. The first centuries of this period witnessed a constant struggle for ascendancy between the patricians and plebeians. The former class strove to monopolize all the great offices, both civil and religious, of the nation. In this they generally succeeded; but the upshot of the contest was the establishment of the political equality of the two rival orders, and the consequent partition of the political and religious honours of the state.

From the reign of Constantine downwards, the patrician dignity ceased to be hereditary, and became an exclusively personal distinction, bestowed irrespectively on those individuals who had done the emperor or the empire good service. Old Roman families could claim no share, as such, in the new patrician dignity created at Constantinople. It elevated the individuals honoured with it to the highest rank in the state next to the consuls; and, unlike the old Roman order, the modern patricians were distinguished from the ordinary citizens by their dress and equipage. The honour was not hereditary, however, and was but warily bestowed by the emperors.

In this, as in other matters, the Popes, when they came to power, imitated the imperial right of temporal sovereigns in bestowing the patrician rank on persons deemed worthy of the distinction. In several European kingdoms also the sovereigns imitated the ancient custom of honouring certain distinguished subjects with the title of *patricius*. In certain parts of Italy, the term *patrician* is still applied to the hereditary nobility. (See Niebuhr's *History of Rome*, vol. ii.; Becker's *Handbuch der Rom. Alterth.*, vol. ii.; Ersch und Gruber's *Encyclopadie*, v. "Patricier;" Smith's *Dict. of Gr. and Rom. Antiquities*; and Adam's *Roman Antiquities*.)

PATRICK, St, the apostle and the second bishop of Ireland, is supposed to have been born on the 5th of April 373, of a good family, at Kirkpatrick, near Dumbarton in Scotland. During some inroad of certain exiles from Ireland he was taken prisoner, and carried into that kingdom. After serving there for six years, and making himself master of the Irish language, he effected his escape, and returned home. It was about two years afterwards that he formed the design of converting the Irish. Repairing to the Continent to qualify himself for this undertaking, he studied under his mother's uncle, St Martin, Bishop of Tours, who ordained him deacon, and under St German, Bishop of Auxerre, who ordained him priest. Pope Celestine then consecrated him bishop, changed his name into Patricius or Patrick, and gave him a commission to evangelize the Irish. The new apostle reached his destination in 432, and landing, as some suppose, at Wicklow, proceeded to convert and baptize the natives. After labouring seven years indefatigably in this great work, he returned to Britain, which he delivered from the heresies of Pelagius and Arius. He then visited the Isle of Man, which he converted in 440. His return to Ireland took place in 448; and in thirteen years more the conversion of the whole island was completed. The remainder of his career was spent in superintending the monasteries of Armagh and Saul, which he had founded. After having established schools and an academy, he closed his life, in the 120th year of his age, in 493, and was buried at Down (now Downpatrick), in the same grave with St Bridget and St Columba. The genuine Works of St Patrick were collected and printed by Sir James Ware, 1656. There are no fewer than seven lives of the Irish apostle published in Colgan's *Acta Triadis Thaumaturgæ*. (See also *Annals of the Kingdom of Ireland*, by the Four Masters, edited by O'Donovan, Dublin, 1851.)

PATRICK, *St*, *Order of*, an institution of knighthood, founded in Ireland by Geo. III. on February 5, 1783. "The most illustrious Order of St Patrick" consists of the sovereign, a grand master (viz., the lord-lieutenant for the time being), and twenty-two knights.

PATRICK, *Simon*, a learned English bishop, and author of a number of useful works in practical divinity, was born at Gainsborough in Lincolnshire in 1626. He entered Queen's College, Cambridge, in 1644; and after taking orders, he became successively chaplain to Sir Walter St John, and vicar of the church at Battersea in Surrey. He

was afterwards preferred to the rectory of St Paul's, Covent Garden, London, where he continued during the plague of 1665 amongst his parishioners. In 1668 he published his *Friendly Debate between a Conformist and a Nonconformist.* This was answered by the dissenters, whom he had much exasperated; but by his moderation and candour towards them afterwards, they were greatly reconciled to him; and he is said to have gained over many of them to the communion of the Established Church. He was made dean of Peterborough in 1678, bishop of Chichester in 1689, and bishop of Ely in 1691. In 1689 he was employed, with others of the new bishops, to settle the affairs of the church in Ireland. He died in 1707.

Bishop Patrick's sermons and devotional writings are very numerous. In this species of composition he was considered one of the happiest authors of his time; and his writings are still esteemed by pious Christians. His *Commentary on the Historical and Poetical Books of the Old Testament*, 14 vols. 4to and 8vo, London, 1695, &c., is the result of extensive reading, and, without being highly critical, continues to be one of the best in the language for practical purposes. He proceeded no farther than the Song of Solomon; and the commentaries of Lowth, Arnald, Whitby, and Lowman are generally added to complete the work. (See a new edition, with the text printed at large, in 4 vols. imp. 8vo, 1853.) His works have never been published in a collected form; but a complete list of them will be found in Darling's *Cyclopædia Bibliographica*, London, 1854. An autobiography of the bishop appeared at Oxford in 18mo, 1839.

PATROCLUS, a Grecian chief, was the son of Menœtius of Opus. His fame was chiefly owing to his intimate connection with Achilles. He was first the playmate of the rising hero at the court of Phthia. Then, actuated by pure motives of affection, he became his companion in arms at the siege of Troy. He slept in his tent at night, he fought at his side during the day, and when the great champion absented himself from the field in a fit of peevishness, the inseparable friend stayed at home to keep him company. Nor was this connection severed by the approach of death. Patroclus received his fatal wound from Hector in the armour of Achilles; his tomb was soon re-opened to receive the ashes of "great Thetis' son;" and the two are said to have met each other and renewed their friendship in the lower world.

PATROL, in war, a round or march made by the guards or watch in the night-time, to observe what passes in the streets, and to secure the peace and tranquillity of a city or camp. The patrol generally consists of a body of five or six men, detached from a body on guard, and commanded by a serjeant.

PATRON (*patronus*, from *pater*, a father) was an appellation given by the Romans to a master who had freed his slave. As soon as the relation of master and slave expired, that of patron and freedman (*libertus*) began. The connection, as the name implies, was something analogous to that of father and son. The Romans, in giving their slaves their freedom, did not despoil themselves of all rights and privileges in those manumitted; the law still subjected them to considerable services and duties towards their patrons, the neglect of which was very severely punished. The most important part, however, of the relation between the patronus and the libertus was the right of the former, in certain cases, to the whole or part of the property of his freedman at his death. The libertus was also regarded as the *cliens* of his patron. (See CLIENT.) *Patrona* was the name borne by a female who had a freedwoman (*liberta*); but the laws regulating their connection differed in some points from those affecting the *patronus* and *libertus*.

Any Roman citizen desirous of a protector might attach himself, as client, to any patron he chose. Patron was thus not necessarily limited to the relation of patron and freedman. The patron and client were mutually attached and mutually obliged to each other; and by this means, in consequence of reciprocal ties, all those seditions, jealousies, and animosities, which were sometimes the effect of a difference of rank, were prudently avoided. For it was the duty of the patron to advise his clients in points of law, to manage their suits, to take care of them as of his own children, and secure their peace and happiness. The clients were to assist their patrons with money on several occasions; to ransom them or their children when taken in war; to contribute to the portions of their daughters; and to defray, in part, the charges of their public employments. The patron and client were never to accuse each other, or take contrary sides; and if either of them was convicted of having violated this law, the crime was equal to that of treason, and any one was allowed to kill the offender with impunity. This patronage was a tie as effectual as any consanguinity or alliance, and had a wonderful effect towards maintaining union and concord amongst the people for the space of six hundred years, during which time we find few dissensions or jealousies between the patrons and their clients, even in the times of the republic, when the populace frequently mutinied against those who were most powerful in the city.

PATRON, in the Church of Rome, a saint whose name a person bears, or under whose protection he is placed, and whom he takes particular care to invoke; or a saint in whose name a church or order is founded.

PATRONYMIC (πατήρ, *a father*, and ὄνομα, *a name*) signifies properly a name taken from one's father, and is applied by grammarians to such names of men or women as are derived from those of parents or ancestors. Patronymics are derived from the father, as Pelides,—that is, Achilles, the son of Peleus; or from the mother, as Philyrides,—that is, Chiron, the son of Philyra; or from the grandfather on the father's side, as Æacides, or Achilles, the grandson of Æacus; or from the grandfather by the mother's side, as Atlantiades, Mercury, the grandson of Atlas; or, lastly, from the kings and founders of nations, as Romulidæ, the Romans, so called from their founder King Romulus. The terminations of Greek and Latin patronymics are chiefly four,—viz., *des*, of which we have already given examples; *as*, as Thaumantias,—that is, Iris, the daughter of Thaumas; *is*, as Atlantis,—that is, Electra, the daughter of Atlas; and *ne*, as Nerine, the daughter of Nereus. Of these terminations, *des* is masculine, and *as*, *is*, and *ne* are feminine; *des* and *ne* are of the first declension, *as* and *is* of the third. In Greek, and particularly in Sanscrit, patronymics are very numerous. There are very few patronymics in English, and those are chiefly of Celtic origin, as names formed by the addition of *Mac* or of *O'*. The termination *son* (as *John-son*) is also a frequent mode of forming patronymics in English names. English patronymics are, however, already fixed, and are no longer in process of formation.

PATTA, or PATA, a town of Africa, on an island off the E. coast, in S. Lat. 2. 8., E. Long. 41. It is separated from the mainland by a narrow channel, navigable only for boats; and seems to have been formerly a much more important place than at present. It is composed of scattered huts of an oblong form, built of stakes and reeds plastered over with mud. The Portuguese formerly built a castle here; but they were driven out by the natives, who subsequently became subjects of the Imam of Muscat. They wear long white garments and white embroidered turbans, and are armed with sabres and daggers. A considerable coasting trade is carried on. Pop. about 4000.

PATTI, a town of Sicily, province of Messina, on the northern coast of the island, 15 miles S.W. of Melazzo, and 33 W.S.W. of Messina. It is well built, with broad and regular streets; and contains a cathedral, the ruins of a fine

abbey, and a house of refuge. Earthenware is made here; and fishing is carried on. Pop. 6000.

PAU, a town of France, capital of the department of Lower Pyrenees, stands on a ridge of hills on the right bank of the Gave de Pau, 58 miles E.S.E. of Bayonne, and 468 S.W. of Paris. Its situation is very beautiful, as the river has its banks lined with trees, and is crossed by a picturesque bridge; while the view to the south is extremely fine, commanding the bold and serrated range of the Pyrenees, appearing in the distance between the gaps in the rounded and wooded hills that rise in front. The town is well and regularly built, having one principal street, several squares, and public walks. The Place Royale, near the centre, is planted with trees, and contains a statue of Henri IV.; the Place de la Comedie is also a fine square; but the most beautiful public place is the Parc, a natural terrace shaded with fine trees, which extends along the bank of the Gave de Pau. The most remarkable building in the town is the castle, a large irregular structure with five towers, standing at the west end, overlooking the river. This castle is interesting on accouut of its historical associations; for Henri IV. was born here, and his cradle, consisting of a large tortoise-shell, is still preserved. The castle was much injured during the first revolution, when it was used for barracks; but it was handsomely restored by Louis Philippe, and was for some time the residence of Abd-el-Kader. There are in Pau, Roman Catholic and Protestant churches, courts of law, a college, museum, public library, literary society, and market-house. The manufactures consist of handkerchiefs, table linen, carpets, rags, leather, and paper. A considerable trade is carried on in wine, chestnuts, hams, salt meat, cotton and woollen goods, &c. Pau is a favourite residence of the English, especially in winter, on account of the mildness and dryness of the climate. It is also much resorted to by the Parisians. Bernadotte, the King of Sweden, as well as Henri IV., was born here. Pop. (1856) 17,238.

PAUL, originally SAUL, an apostle of Jesus Christ, and author of several portions of the New Testament canon. Though a native of Tarsus, a city of Cilicia,[1] he was the son of Jewish parents belonging to the tribe of Benjamin.[2] From his father he inherited the rights of Roman citizenship,[3] which had probably been conferred upon some of his ancestors for some important services rendered to the commonwealth;[4] and it has been conjectured, though with no great probability, that the cloak and parchments which he so earnestly charged Timothy to bring with him to Rome were the Roman toga and the certificates of his citizenship, which he expected might be of use to him in his anticipated trial before the emperor. The name *Saul* (שׁאוּל), which he received at his birth, and which signifies "the longed-for, the desired," would seem to indicate that he was the first-born son of his parents, and that his birth was viewed by them as an answer to prayers; that he was not, however, their only child, is apparent from Acts xxiii. 16, where mention is made of his "sister's son." In the 16th chapter of the Epistle to the Romans he himself names six persons whom he styles his *συγγενεῖς*; but it has been questioned whether by that term he intends more than *fellow-countrymen*, though the probability is, he uses it in its proper sense of *relations*.[5] The name Saul (שׁאוּל) was afterwards dropt, and that of Paul (Παῦλος) constantly used both by himself and others. Much difference of opinion exists as to the relation of these names to each other, and the reason why the one was dropt and the other retained. Some think that, as Luke mentions the name *Paul* for the first time in connection with the apostle's interview with Sergius Paulus (Acts xiii. 9), the apostle assumed that name out of courtesy to the proconsul; an opinion which, though suggested by Jerome, and adopted by Bengel, Olshausen, Meyer, and Baumgarten, does not in itself seem very probable, and is hardly in keeping with the form of Luke's statement, "Saul, who is also Paul." Others with greater probability suppose that the apostle had originally a double name, the one Hebrew and the other Latin; and that when he came to labour chiefly among the Gentiles, he dropt the former and used only the latter. So Alting, Lightfoot, Hammond, Wolf, Basnage, Schrader, Winer, De Wette, and others. In the judgment of many distinguished scholars, however, the most probable conjecture is, that the name Paulus is only a softened form of the Hebrew, Shaool, to accommodate it to western organs, just as we find Jason for Jesus, Hierosolyma for Yerushalayim, Matthæus for Mattiyah, Alphæus for Chalpai, and many others; though it must be confessed that none of these is exactly parallel to the case before us.

His father being of the sect of the Pharisees, probably devoted him from his infancy to the service of religion; and with this view Paul seems to have received such education as appeared most calculated to fit him for the duties to which he was destined. At that time Tarsus was eminently distinguished for its cultivators of philosophy, and every other department in the circle of instruction (*σπουδὴ πρὸς τε φιλοσοφίαν καὶ τὴν ἄλλην ἐγκύκλιον ἄπασαν παιδειάν*);[6] but to what extent the future apostle of Christianity was indebted to the labours of such teachers for his early education no means are left us of judging. It is probable that his obligations were not very great; for as his ultimate destination was to the office of an expounder of the Jewish law and traditions, it does not appear likely that he would be sent by his parents to occupy himself with the literature and philosophy of those whom the Jews despised as outcasts, as well from the light as from the favour of heaven. At the same time it cannot be denied that his residence in a city where the study of the liberal sciences was so assiduously and successfully prosecuted as to place it upon a par with "Athens, Alexandria, or any other place that could be named in which schools and studies are to be found,"[7] must have had a considerable influence in refining his taste and liberalizing and expanding his views; and he would doubtless here also obtain a familiarity with Greek as a spoken language which could not but be of use to him in after-life. It was at Jerusalem, however, the centre of the Jewish world, that the most important part of his education was received. At an early age, in his twelfth or fourteenth year, as is supposed,[8] he was brought to this city, and placed under the instruction of Gamaliel, one of the most famous teachers of Jewish learning at that time.[9] Here he finished his education as a Pharisee, and at the same time, according to the custom of the Jews, acquired a mechanical art, that of a *σκηνοποιός*, which some render "a mechanist;"[10] others "a haircloth-maker;"[11] others "a maker of tapestry or carpeting;" and others, with most apparent propriety, as in our version, "a tentmaker, or a maker of tent-cloth."[12] By this he probably supported himself during

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[1] Acts xxii. 3, &c. [2] Philip. iii. 5. [3] Acts xxii. 25–28.

[4] The opinion, that the natives of Tarsus enjoyed the *jus civitatis* as a birthright, is not supported by evidence. The fact of that city's having been created by Augustus an *urbs libera* (Plin. v. 27) does not lead to any conclusion as to the possession by its natives of the right of Roman citizenship; and, from Acts xxi. 39, compared with xxii. 24, 27, it may be inferred, that as the chief captain knew Paul to be a native of Tarsus, and yet was ignorant of his Roman citizenship, these two were not necessarily conjoined.

[5] So Lardner, Meyer, Fritzsche (who says, "explicatio *populares meos* absurda est"), De Wette, &c.

[6] Strabo, lib. xiv., c. v. [7] Ibid. [8] Greswell's *Dissertations*, vol. i., p. 554. [9] Acts xxii. 3.

[10] Michaelis, Introd. by Marsh; Haenlein, *Einleitung*, ch. iii., s. 301. [11] Eichhorn, *Einleit.* iii. 9; Hug. *Einleit.* ii. 213.

[12] "Persons travelling in the East, in order to shelter themselves from the rain and noxious blasts during the night, carry with them small tents made of leather or cloth; and the manufacture of these is a profitable occupation." (Winer, *Bib. Realwörterbuch*, art. *Paulus*.

the time he was engaged in the prosecution of his studies, as we know he was in the habit of doing at an after period whilst engaged as an apostle. How long he abode in Jerusalem at this time, or whether he returned to Tarsus at all before his conversion, are points on which no certain information can now be obtained. In the history of the early church, he is introduced to us for the first time[1] as "a young man,"[2] whose zeal for the religion of his fathers had prompted him to assume the character of an active persecutor of those who had forsaken that religion for the faith of Christ. On the occasion of the martyrdom of Stephen, he appears in the capacity of an abettor, and in some respects a sort of superintendent, of the act; and immediately after this he, as if rendered more ferocious by the blood he had assisted in shedding, kindled the flames of a relentless and unsparing persecution, in which all, without respect of age or of sex, who had professed the hated religion, were compelled to blaspheme the name of Jesus, or obliged to endure the utmost indignities and the most condign punishments.[3] It was whilst engaged in these cruel efforts of a dark and bigoted zeal that he was made to experience that extraordinary change of opinion and feeling which gave a new direction to all his energies, and led him to devote his life to the advancement of that cause which he at first deemed it serviceable to God to oppose and destroy. Having obtained from the rulers of his nation a commission to go to Damascus, in which city the Jews were very numerous, and where also the new religion had obtained a footing, for the purpose apparently of arresting such of the Christians as had fled to that city, and bringing them back bound to Jerusalem, he was himself arrested by a higher power, and made to feel his utter impotency when attempting to oppose the cause of Christ. Whilst crossing the plain to the south of Damascus, about noon-day, and at a short distance from that city, he was suddenly surrounded by a miraculous light from heaven, which had the effect of so paralyzing him, that he fell to the ground, whilst a voice addressed to him the thrilling question, "Saul, Saul, why persecutest thou *me?*" In answer to the inquiry which he made in return, the speaker said, "I am Jesus of Nazareth, whom thou persecutest; but arise and go into the city, and it shall be told thee what to do." Confounded, humbled, and agitated, he obeyed the heavenly vision; and as the brilliancy of the light had obscured his eye-sight, he was led by his astonished attendants into the city, where he remained in a state of deep dejection for three days and nights, during which he tasted neither meat nor drink. From this painful condition he was relieved by the visit of a man named Ananias, who, at the command of Christ, sought him out, welcomed him as a brother, and baptized him into the profession of Christianity.[4]

By the majority of Christians this narrative is accepted

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[1] Acts vii. 58.

[2] Nothing decisive, however, can be drawn from this as to Paul's age at this period, for the word νεανίας is applied with much indefiniteness to persons of from twenty-four to upwards of thirty years of age. Perhaps his age was about thirty. He would hardly have been in the confidence of the Sanhedrim had he been younger.

[3] Acts viii. 1–3, xxvi. 10, 11.

[4] Acts ix 1-18. The conversion of such a man, at such a time, and by such means, furnishes one of the most complete proofs that have ever been given of the divine origin of our holy religion. That Saul, from being a zealous persecutor of the disciples of Christ, became all at once a disciple himself, is a fact which cannot be controverted without overturning the credit of all history. He must therefore have been converted in the miraculous manner in which he himself said he was, and of course the Christian religion be a Divine revelation; or he must have been either an impostor, an enthusiast, or a dupe to the fraud of others. There is not another alternative possible. The following is the substance of Lord Lyttleton's argument on this subject.

If he was an impostor, who declared what he knew to be false, he must have been induced to act that part by some motive. But the only conceivable motives for religious imposture are, the hopes of advancing one's temporal interest, credit, or power; or the prospect of gratifying some passion or appetite under the authority of the new religion. That none of these could be St Paul's motive for professing the faith of Christ crucified, is plain from the state of Judaism and Christianity at the period of his forsaking the former and embracing the latter faith Those whom he left were the disposers of wealth, of dignity, of power, in Judea; those to whom he went were indigent men, oppressed, destitute of all means of improving their fortunes. The certain consequence, therefore, of his taking the part of Christianity was the loss not only of all he possessed, but of all hopes of acquiring more; whereas, by continuing to persecute the Christians, he had hopes, rising almost to a certainty, of making his fortune by the favour of those who were at the head of the Jewish state, to whom nothing could so much recommend him as the zeal which he had shown in that persecution. As to credit or reputation, could the scholar of Gamaliel hope to gain either by becoming a teacher in a college of fisherman? Could he flatter himself that the doctrines which he taught would, either in or out of Judea, do him honour, when he knew that "they were to the Jews a stumbling-block, and to the Greeks foolishness?" Was it, then, the love of power that induced him to make this great change? Power! over whom? over a flock of sheep whom he himself had assisted to destroy, and whose very Shepherd had lately been murdered? Perhaps it was with the view of gratifying some licentious passion, under the authority of the new religion, that he commenced a teacher of that religion. This cannot be alleged, for his writings breathe nothing but the strictest morality, obedience to magistrates, order, and government, with the utmost abhorrence of all licentiousness, idleness, or loose behaviour, under the cloak of religion. We nowhere read in his works that saints are above moral ordinances; that dominion is founded in grace; that monarchy is despotism which ought to be abolished, that the fortunes of the rich ought to be divided amongst the poor; that there is no difference in moral actions; that any impulses of the mind are to direct us against the light of our reason and the laws of nature; or any of those wicked tenets by which the peace of society has been often disturbed, and the rules of morality often broken, by men pretending to act under the sanction of divine revelation. He makes no distinctions, like the impostor of Arabia, in favour of himself; nor does any part of his life, either before or after his conversion to Christianity, bear any mark of a libertine disposition. As amongst the Jews, so amongst the Christians, his conversation and manners were blameless. It has been sometimes objected to the other apostles, by those who were resolved not to credit their testimony, that having been deeply engaged with Jesus during his life, they were obliged, for the support of their own credit, and from having gone too far to return, to continue the same professions after his death: but this can by no means be said of St Paul. On the contrary, whatever force there may be in that way of reasoning, it all tends to convince us that St Paul must *naturally* have continued a Jew, and an enemy to Christ Jesus. If *they* were engaged on one side, *he* was as strongly engaged on the other. If shame withheld them from changing sides, much more ought it to have stopped him, who, from his superior education, must have been vastly more sensible to that kind of shame than the mean and illiterate fishermen of Galilee. The only other difference was, that *they*, by quitting their Master after his death, might have preserved themselves; whereas *he*, by quitting the Jews, and taking up the cross of Christ, certainly brought on his own destruction.

As St Paul was not an imposter, so it is plain he was not an enthusiast. Heat of temper, melancholy, ignorance, and vanity, are the ingredients of which enthusiasm is composed; but from all these, except the first, the apostle appears to have been wholly free. That he had great fervour of zeal, both when a Jew and when a Christian, in maintaining what he thought to be right, cannot be denied; but he was at all times so much master of his temper as, in matters of indifference, to "become all things to all men," with the most pliant condescension bending his notions and manners to theirs as far as his duty to God would permit; a conduct compatible neither with the stiffness of a bigot nor with the violent impulses of fanatical delusion. That he was not melancholy is plain from his conduct in embracing every method which prudence could suggest to escape danger and shun persecution, when he could do it without betraying the duty of his office or the honour of his God. A melancholy enthusiast courts persecution, and when he cannot obtain it, afflicts himself with absurd penances; but the holiness of St Paul consisted only in the simplicity of a godly life, and in the unwearied performance of his apostolical duties. That he was ignorant no man will allege who is not grossly ignorant himself; for he appears to have been master

as literally true, the scene being regarded as one of a miraculous kind, in which, by supernatural means, a manifestation of Jesus Christ was made to Paul. Opposed to this is the view of those who think that the whole passed in the mind of the apostle, and was the result either of a Divine operation exerted on him, or of the mere working of his own mind under deeply-excited feeling. Of those who take the latter view, some contend that the sudden light which shone around the apostle and his companions, and the sound which they heard and took to be a voice from heaven, are to be resolved into a sudden flash of lightning accompanied by thunder, which, by some pre-established harmony, conveniently took place just as the apostle's own reflections had reached the point of overwhelming him with shame and regret for his past conduct; whilst others regard all this as the mere drapery in which the story came to be dressed in the superstitious imaginations of the Christians. If the historical truth of the narrative is to be denied, the latter is undoubtedly the preferable hypothesis; for it seems very absurd to resort to the supposition of a natural phenomenon of which there is no mention, for the purpose of saving the historical character of the narrative in a minor point, whilst, as regards its principal matter, it is to be rejected as false. But if this story is a mere myth, how came Paul to tell it as a fact? Or how came so simple a matter as the conversion of a bigoted Jew to Christianity, an event of which the instances were of almost daily occurrence, to be invested in the minds of the Christians in this particular case with so much of supernatural "drapery?" It is evident that Paul himself believed the whole transaction to have happened as it is related by Luke; for, many years afterwards, we find him not only repeating the story, but affirming that his companions were witnesses of the outward phenomena of the scene (Acts xxii. 6–10). In this case there is evidently no alternative but to admit the whole as historical, or to reject the whole as a vain hallucination or an impudent falsehood.

The first three years after his conversion were spent by Paul in Arabia,[1] where he received, "by revelation from Christ," that doctrine in all its fulness which he afterwards preached, and where, in solitude and quiet, he was doubtless engaged in training himself for the work in which he was about to engage. On his return to Damascus, he openly appeared as a preacher of Christianity, a circumstance which the Jews felt to be so injurious to their cause, that they sought, by the aid of the governor, who was in all probability himself a Jew, to put him to death. Having, by the aid of his Christian brethren, escaped their malice, he betook himself to Jerusalem, where, after the fears of the brethren, who remembered his former enmity, but had not heard of his subsequent conversion to Christianity, had been removed by the testimony of his friend and companion Barnabas, he was gladly welcomed amongst them, and permitted to occupy that rank to which Christ had called him.[2] Whilst at Jerusalem on this occasion, he fell into a trance in the temple, and had a vision of Christ, who commanded him to go forth as the apostle of the Gentiles (Acts xxii. 17–21). It is probably to this that he alludes in 2 Cor. xii. 1–9, though there are difficulties in the way of this conclusion.[3] The enmity of the Jews again compelled him to change his residence. After being fifteen days in Jerusalem, he went to Cæsarea, and thence to his native city Tarsus, where he abode for several years.[4] In the meantime, Christianity, which had hitherto been preached only to the Jews, had received some adherents from amongst the Gentiles at Antioch; and this led to the mission of Barnabas from Jerusalem, for the purpose of instructing and regulating the church that had been formed there. Barnabas, after some time, finding the need of assistance and counsel, went to Tarsus, and returned with Paul to Antioch, where they abode for a year occupied in united efforts for the promulgation of Christianity. At the close of that period, they were sent to Jerusalem by the Christians at Antioch with the contributions which had been made by them on behalf of their brethren in Judea, who were suffering from the effects of a dearth.[5] This was Paul's *second* visit to Jerusalem since his conversion. After some months, they again returned to Antioch, accompanied by John Mark, the nephew of Barnabas. The cause of Christianity by this time had begun to flourish in that city, and several persons had been received into the church who were qualified to act as teachers to the rest. This rendered it the less necessary that Paul and Barnabas should remain any longer with them; and accordingly, shortly after their return, the church received a special command from heaven to set them apart to general missionary work. In obedience to this command, they were sent forth; and, accompanied by John Mark, who, however, soon deserted them and returned to Jerusalem, they visited Seleucia, Cyprus, Perga in Pamphylia, Antioch in Pisidia, Iconium, Lystra and Derbe, cities of Lycaonia. At Lystra, in consequence of Paul's curing a cripple, the people were on the point of offering him and his companion divine honours, under the impression that the gods had come down in the likeness of men, but were restrained by the vehement expostulations of those for whom these impious honours were designed; and in a few days after, they had so completely changed their minds, that, at the instigation of the Jews, they stoned Paul, and left him for dead. Retracing their steps, they returned by way of Attalia, a

not only of the Jewish learning, but also of the Greek philosophy, and to have been very conversant even with the Greek poets. That he was not credulous is plain from his having resisted the evidence of all the miracles performed on earth by Christ, as well as those that were afterwards worked by the apostles, to the fame of which, as he lived in Jerusalem, he could not possibly have been a stranger. And that he was as free from vanity as any man that ever lived may be gathered from all that we see in his writings or know of his life. He represents himself as the least of the apostles, and not meet to be called an apostle. He says that he is the chief of sinners; and he prefers, in the strongest terms, universal benevolence to faith, and prophecy, and miracles, and all the gifts and graces with which he could be endowed. Is this the language of vanity or enthusiasm? Did ever fanatic prefer virtue to his own religious opinions, to illuminations of the Spirit, and even to the merit of martyrdom.

Having thus shown that St Paul was neither an impostor nor an enthusiast, it remains only to be inquired whether he was deceived by the fraud of others; but this inquiry needs not be long, for who was to deceive him? A few illiterate fishermen of Galilee? It was *morally* impossible for such men to conceive the thought of turning the most enlightened of their opponents and the most cruel of their persecutors into an apostle, and to do this by a fraud in the very instant of his greatest fury against them and their Lord. But could they have been so extravagant as to conceive such a thought, it was *physically* impossible for them to execute it in the manner in which we find his conversion to have been effected. Could they produce a light in the air which at mid-day was brighter than the sun? Could they make Saul hear words from out of that light which were not heard by the rest of the company? Could they make him blind for three days after that vision, and then make scales fall off from his eyes, and restore him to sight by a word? Or could they make him, and those who travelled with him, believe that all these things had happened, if they had not happened? Most unquestionably no fraud was equal to all this.

Since, then, St Paul was neither an impostor, an enthusiast, nor deceived by the fraud of others, it follows that his conversion was miraculous, and that the Christian religion is a divine revelation.

[1] Galatians i. 11–17.
[2] Acts ix. 20–28.
[3] See Meyer on the passage; and Davidson's *Introduction to the New Testament*, vol. ii., p. 82.
[4] Acts ix. 30.
[5] Ibid., xi. 22–30.

St Paul. city of Pamphylia, by sea to Antioch, where they rehearsed to the church all that God had done by them. This formed the apostle Paul's *first* great missionary tour.[1]

After some time spent at Antioch, he and Barnabas again went up to Jerusalem, for the purpose of consulting the apostles and elders in regard to some dissensions which had occurred in the church at Antioch as to the obligation on Gentile converts of the Mosaic ceremonial. This gave occasion to the holding of a council at Jerusalem, at which, after much disputing, it was at length agreed unanimously, on the suggestion of the apostle James, that they should lay no stumbling-block in the way of their Gentile brethren, by requiring of them more than simply that they should abstain from meats offered to idols, from uncleanness, from things strangled, and from blood, whether pure or mixed with anything else. A letter to this effect was written to the church at Antioch in the name of the church at Jerusalem; and with this two of the members of this church, Judas and Silas or Silvanus, were appointed to accompany Paul and Barnabas to Antioch.[2] By these means the difference of opinion amongst the brethren was removed, and the church restored to peace. This led Paul to propose to Barnabas another missionary tour, to which that faithful fellow-labourer having consented, they were on the verge of departure, when an unhappy contention, arising out of a determination on the part of Barnabas to take with them his nephew John Mark, a step which Paul firmly resisted on the ground of Mark's former conduct in deserting them, produced a rupture between these two eminent individuals, and led to their prosecuting a separate course.[3] Whilst Barnabas, in company with his nephew, went to Cyprus, Paul, attended by Silas, went towards the east, and, passing through Syria and Cilicia, revisited the scenes of his former labours and sufferings in Lycaonia. At Lystra he found Timothy, a young man, a native of Derbe (Acts xx. 4), who had been probably converted to Christianity on the occasion of the apostle's former visit, and who was so highly commended by the Christians in that district that Paul selected him as the companion of his travels, having previously ordained him by the imposition of hands.[4] Accompanied by him and Silas, the apostle next passed through the region of Phrygia and Galatia, and avoiding Asia strictly so called, which he was forbidden by the Holy Spirit to enter, as well as Bithynia, they came by way of Mysia to Troas, a city and port on the borders of the Hellespont. Here he was directed by an apparition in a vision to go into Macedonia; and accordingly, with his companions, having crossed to Samothracia, and thence to Neapolis, a seaport of Thrace, he arrived in due course at Philippi. Here they remained for some time, and made many converts; amongst others, the jailor of the prison into which Paul and Silas had been thrust after having been scourged, in consequence of a charge which had been brought against them as disturbers of the peace of the city, by a set of imposters whose trade they had destroyed by expelling an evil spirit from a female slave who brought them much gain by her skill in soothsaying. From Philippi they passed through Amphipolis and Apollonia, cities of Macedonia, to Thessalonica, where, though they abode only a short time, they preached the gospel with great success. A tumult having arisen at the instigation of the Jews, the Christian converts, fearing for their safety, sent them by night to Berea, another city of Macedonia, about 40 miles west of Thessalonica, where they were favourably received by their Jewish brethren, until a party which had followed them from Thessalonica stirred up a persecution against them. This determined Paul to go to Athens, whilst Timothy and Silas, as less obnoxious to the Jews, remained at Berea. It does not appear to have been the apostle's intention in the first instance in visiting Athens to preach the gospel there, at least until Timothy and Silas, to whom he had sent a message on his arrival, requiring them to join him, should have arrived; but as he waited for them, the sight of a city like that of Athens, entirely given to idolatry, so stirred and excited his spirit that he could no longer refrain; and accordingly, in the synagogues he disputed with the Jews, and in the market-place with such as he met. This led to his coming into contact with certain Stoic and Epicurean philosophers, by whom he was contemptuously invited to unfold his new doctrines, and describe the strange deities of which they supposed him to be the votary; and for this purpose he was taken to the Areopagus, where, with admirable tact, he exposed the follies of their idolatry, and commended to them the worship of the one living and true God, in the midst of a large assemblage of people, on some of whom a favourable impression was produced by his address.[5] Having been joined by Timothy,[6] and in all probability by Silas also,[7] he sent the former again to Macedonia, and either retaining the latter in his company, or despatching him to some other quarter, he himself passed over to Corinth.[8] On the occasion of this his first visit to that city, he supported himself by his labours as a tent-maker, in company with a pious couple named Aquila and Priscilla, who had taken refuge in Corinth after having been expelled from Rome by an edict of Claudius Cæsar against the Jews; and at the same time he availed himself of every opportunity of urging the gospel of Christ upon the acceptance both of Jews and Greeks. Here he was rejoined by Silas and Timothy, with whom he continued a year and a half in active exertion for the advancement of Christianity. By the persevering enmity of his former opponents the Jews, he was again compelled to leave Corinth, and betake himself, along with Aquila and Priscilla, to Ephesus. Here he abode at this time only a few days, having been commissioned by a divine revelation to go up to Jerusalem in time for the approaching feast of the passover. By some this, the apostle's *fourth* visit to Jerusalem after his conversion, is made to synchronize with that mentioned by himself in Gal. ii. 1. In this case we must suppose that his former friendship with Barnabas had been re-established, as he mentions him and Titus as his companions on this journey. This opinion, however, is opposed by many, who think that the visit mentioned in the Epistle to the Galatians happened at an earlier period, and was the apostle's *third* visit. After a brief residence in Jerusalem on this occasion, he returned to Antioch; and so finished his second great apostolic tour.[9]

At Antioch he abode for some time, and then commenced another extensive tour, accompanied, as is supposed, by Titus. Passing through Phrygia and Galatia, where he revisited the churches he had formerly planted, he arrived at Ephesus. This city stood in the same relation to the region of Hither Asia in which Jerusalem stood to Palestine, Antioch to Syria, Corinth to Achaia, and Rome to the West; and accordingly the apostle made it his head-quarters for three years, during which time he was occupied in making converts in the city, and in paying short visits to the surrounding places, and to Crete and other islands of the adjoining archipelago. With so much success were his labours attended in Ephesus, that the revenues of those who were interested in the support of the idolatrous worship of the tutelar goddess of the city, Diana, began to be affected; and at the instigation of one of these, by name Demetrius, a silversmith, who carried on an extensive manufacture of miniature representations of the famous temple of Diana at

[1] Acts xiii., xiv.
[2] Ibid., xv. 1–31.
[3] Ibid., xv. 36–41.
[4] 2 Tim. i. 6.
[5] Acts xvi. 17.
[6] 1 Thess. iii. 1.
[7] Greswell, vol. ii., pp. 31, 32.
[8] 1 Thess. iii. 1, 2, 6, compared with Acts xviii. 5.
[9] Acts xviii. 1–22.

Ephesus, a popular tumult was excited against the apostle, which was with difficulty appeased by the calm and sagacious conduct of the γραμματεύς, town-clerk or chamberlain, who, along with others of the chief men in the place, seems to have been friendly towards Paul. It was not on this occasion only that the safety of the apostle was endangered by popular turbulence at Ephesus; he seems to have been frequently in peril of his life in that city from the fury of the mob; and it is to this, in all probability, he alludes when he says, that "after the manner of men he had fought with wild beasts at Ephesus" (1 Cor. xv. 32); a statement which some have taken literally, but which the majority of interpreters agree to regard as figurative: "depugnavit ad bestias Ephesi, illos scilicet bestias Asiaticæ pressuræ de qua in secunda ad eosdem (sc. Corinthios, ch. i. 8.)," &c. (Tertullian, *De Resurrect. Carnis*, 48.) Whether therefore this tumult had any effect in quickening the apostle's determination to leave Ephesus may be doubted, especially as it is clear that he had come to that determination before it happened.[1] By divine direction, he had resolved to go to Macedonia; and accordingly, shortly after the tumult, he departed from Ephesus, and went by way of Troas to Philippi. There he seems to have remained a considerable while; for, during his residence at Philippi as his head-quarters, he preached the gospel in all the surrounding districts, even as far as to Illyricum, on the eastern shore of the Adriatic.[2] Leaving Philippi he paid a second visit to Corinth, where he abode three months, and then returned to Philippi, having been frustrated in his intention of proceeding through Syria to Jerusalem by the malice of the Jews. From Philippi he sailed for Troas, where he abode seven days; thence he journeyed on foot to Assos; and thence he proceeded by sea to Miletus, having visited several of the intermediate places. At Miletus he had an affecting interview with the elders of the church at Ephesus, to whom, in the prospect of seeing them no more, he gave a solemn and impressive charge, and bade them farewell. From Miletus he sailed for Syria, and, after visiting several intermediate ports, landed at Tyre, where he remained seven days. Thence he journeyed, by way of Ptolemais and Cæsarea, to Jerusalem, which he visited on this occasion for the *fifth* time since his conversion.[3]

At Jerusalem he recounted to the whole church the events connected with the progress of Christianity of which he had been witness, and, apparently to quiet the scruples of some Jewish converts, who thought he had too lax and incorrect a view of the obligation of the Mosaic ritual, he united himself, at the suggestion of the apostle James, to four persons who had taken upon them the vows of Nazarites, and, entering with them into the temple, signified to the priest that he would pay the cost of the sacrifices which were necessary to absolve them and him from the vow. Whatever effect this compliance had on the minds of his scrupulous brethren, it procured for him no mitigation of the hatred with which he was regarded by the unconverted Jews. On the contrary, so eager was their zeal against him, that, before his vow was accomplished, they seized him in the temple, and would have put him to death had not Lysias, commander of the Roman cohort in the citadel adjoining the temple, brought soldiers to his rescue. By his permission, and under his protection, Paul addressed to the infuriated mob an apology for himself, in which he set forth the main circumstances of his life from the beginning up to the period when he opened his commission to the Gentiles. At first he was listened to with attention, but as soon as he spoke of placing the Gentiles on a par with the Jews, they interrupted him with execrations, and shouted "away with such a fellow from the earth, for it is not fit that he should live."[4] The Roman commander, seeing these demonstrations of popular resentment, and being ignorant of what Paul had been saying, from the address having been uttered in the Hebrew tongue, imagined that he must be some execrable criminal, and gave orders that he should be brought into the fort, in order that he might by scourging compel him to confess his crime. From this indignity Paul saved himself by asserting his privileges as a Roman citizen, to bind or scourge whom was strictly forbidden by law. Next day the chief captain brought him before the Sanhedrim, for the purpose of hearing what it was that was urged against him; and here Paul again entered into a defence of his conduct, in the course of which he professed his attachment to the doctrine of a corporal resurrection, and thereby stirred up a fierce controversy between the two parties composing the Sanhedrim, the Pharisees and the Sadducees, the former of whom maintained, whilst the latter denied, this doctrine. So angry and vehement did this discussion become, that the chief captain, fearing for the safety of his prisoner, whom, as a Roman citizen, he was bound to protect, commanded his soldiers to go down and remove him from amongst the combatants into the fort. Upon the day following about forty of the Jews entered into a solemn engagement neither to eat nor drink until they had killed Paul, and for this purpose proposed to the chief priests to invite him to a conference, in the hope that they might have an opportunity of assaulting him on his way from the fort. This scheme was rendered abortive by intelligence of it having been conveyed to Lysias by Paul's sister's son, who, along with his mother, seems to have been an early convert to Christianity.[5] Matters assuming this desperate aspect, Lysias determined to bring the whole under the consideration of the procurator; and accordingly, placing Paul under the protection of a sufficient escort, he sent him to Cæsarea, with a letter to Felix, explaining the reasons of this step. After five days, Felix held a court, at which Paul and his accusers were brought together, and both parties heard at full length. The defence of the apostle was triumphant; but Felix, unwilling to offend the Jews, remanded him, under the pretence of obtaining farther information from Lysias. Some days afterwards, he summoned him again to his tribunal, in order that he and his wife Drusilla, who was a daughter of Herod Agrippa, might hear him "concerning the faith in Christ;" on which occasion, the apostle, with all that fearless zeal and faithfulness by which he was distinguished, expostulated so forcibly with the procurator in regard to those vices for which he was notorious, that Felix trembled, and hastily dismissed him from his presence. Shortly after this, Felix was removed from his office, and was succeeded by Porcius Festus, before whom the Jews again brought their charges against Paul. When both parties came to be heard, Paul perceived so evident a disposition in the new governor to favour the Jews, that he felt constrained to avail himself of the privilege which, as a Roman citizen, he possessed, of removing his cause from the province to the metropolis, by appealing to the emperor. This led to his being sent to Rome, but not before he had been again heard by Festus, attended by King Agrippa and his wife Bernice, by whom he was adjudged to have done nothing worthy of death or of bonds, so that he might have been set at liberty had he not appealed unto Cæsar. His voyage to Rome was long and disastrous.[6] After coasting along Syria as far as Sidon, they struck across to Myra, a port of Lysia, having passed under Cyprus; thence they sailed slowly towards Cnidus, and thence, in consequence of the wind being contrary,

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[1] Acts xix. 21. [2] Rom. xv. 19. [3] Acts xx. xxi. 15. [4] Acts xxii. 22.
[5] Acts xxiii. 16–22, compared with Rom. xvi. 7, 11, 21.
[6] See the scientific and instructive work of Mr Smith entitled *The Voyage and Shipwreck of St Paul*, 8vo, 1848.

to Crete, where they with difficulty put into a port on the southern side of that island, called the "The Fair Haven," near the city of Lasea. The season being now far advanced, Paul advised the centurion to proceed no farther; but the place not being suitable for wintering in, and the weather promising favourably, his advice was disregarded, and they again set sail, intending to reach Phœnice, a port in the same island, and there to winter. Scarcely, however, had they ventured to sea when the apostle's prediction was verified; for a boisterous wind arose and drove them at its mercy across the Mediterranean. In this state they continued for fourteen days, at the close of which they were shipwrecked on the coast of Malta, but without any loss of life. Here the apostle and his company remained for three months, during which time he was actively employed in instructing the inhabitants, and performing many miracles for their benefit. On the approach of spring, they availed themselves of a ship of Alexandria that had wintered in the island, and set sail for Syracuse, where they remained three days; thence they crossed to Rhegium; and thence along the coast to Puteoli, from which place he journeyed by land to the imperial city. Here he was delivered by the centurion, in whose charge he had come from Cæsarea, to the captain of the guard, who, with great lenity, permitted him to dwell in his own hired house, under the charge of a soldier.[1]

The sacred historian closes his narrative by informing us that Paul continued in this state of easy imprisonment for "two years, receiving all that came to him, preaching the kingdom of God, and teaching those things which concern the Lord Jesus Christ, with all confidence, no man forbidding him." Of the subsequent events of the apostle's life, consequently, we have much less direct and certain information; and from this has arisen much diversity of opinion on the subject. By many it is supposed that this his first imprisonment at Rome was his last, and that he perished in the persecution which Nero excited against the Christians by representing them as the agents in the burning of the city; whilst others contend that he was set at liberty before that event, and that he set out on another great missionary tour to the West, in the course of which he preached the gospel throughout Spain, and, according to some, in Britain also;[2] revisited Ephesus and other places in Lesser Asia, passed over to Crete, returned to Ephesus, passed through Troas into Macedonia, thence to Nicopolis in Epirus, Dalmatia in Illyricum, and back again to Asia, when he was apprehended and conveyed to Rome the second time, where he suffered martyrdom. By some who hold this latter opinion the order of places visited is completely reversed, and Paul is supposed to have commenced his tour in Asia, and ended it in Spain, whilst others omit Spain from the itinerary altogether. It would require a much larger space than this article can be permitted to occupy to enter into any examination of the arguments and evidence on both sides of this question. Suffice it to remark, that, whilst the whole subject is involved in much uncertainty, and whilst little more than probable conjecture can be furnished for the details of either hypothesis, the preponderance seems to be in favour of the latter. Our readers will probably be satisfied of this by a reference to what has been written on it by Greswell and Neander; the former of whom contends for it with all the zeal of an advocate, whilst the latter admits it with all the deliberation of a cautious and impartial judge.[3]

In the above sketch of the principal events of the apostle's life no attempt has been made to assign to each its proper date. This has resulted from the great perplexity in which this part of the subject is involved, and the consequent inexpediency of adopting any particular chronology without assigning the reasons on which it is founded; a course which would have extended this article greatly beyond its proper bounds. We have deemed it preferable, therefore, to present, in the first instance, the leading facts in the history of Paul in the order of their occurrence; and shall now furnish a table of the dates assigned to the more important of these in those systems of chronology which are most deserving of notice, leaving it with our readers to consult the works in which they are unfolded for the arguments by which they are respectively supported.

	Usher.[4]	Greswell.[5]	Eichhorn.[6]	Neander.[7]	Winer.[8]	Wieseler.
Paul's Conversion......	35	37	37 or 38	36	38(?)	40
" 1st visit to Jerusalem (Acts ix. 26)	38	41	40 or 41	39	41	43
" 2d do. do (Acts xi 30)	44	43	46	44	45	45
" 3d do. do (Acts xv. 4)	52	48	47(?)	50	51	50
" 4th do. do. (Acts xviii. 22).	56	52	56	54	54	54
" 5th do. do and apprehension... .	60	56	60	58	58	58
" arrival at Rome	63	59	63	61	60	61
" liberation.......	65	61	...	62 or 63	63	...
" martyrdom... .	67	66	65 or 68	66(?)	...	64

During the brief intervals of comparative ease which the apostle enjoyed amid his arduous and almost incessant exertions as a preacher of Christianity, he wrote several treatises, more or less elaborate, both of a doctrinal and a practical nature, in the shape of epistles to different churches. Of these, thirteen, avowedly of his composition, and one that is with great probability ascribed to him (the Epistle to the Hebrews),[10] have come down to us; and there is reason to believe that in these we have the whole of those compositions which, as an apostle of Jesus Christ, he gave to the church. It is supposed, indeed, by many distinguished biblical critics, that there is evidence, in the first of his extant epistles to the Corinthians, of his having written one to that church antecedently to either of these; but the basis of evidence on which this rests is at best very slender, and the support which it lends to what is raised on it very doubtful.[11] In what order these epistles were written, and what date is to be assigned to each, are points on which much discussion has been expended. The following lists present the results of the investigations of Greswell, Neander, and Alford:—

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1 Acts xxi. 16; xxviii. 31. 2 See Bishop Stillingfleet, *Antiquity of the British Churches*, vol. iii., pp. 25–28, ed. 1770; and others.

3 Greswell's *Dissertations*, vol. ii., pp. 78–100; Neander's *Geschichte d. Pflanzung und Leitung d. Christliche Kirche*, u. s. w., &c., pp. 410–419, 2d ed.; Eng. trans., vol. i., pp. 331–337, Bohn's edit.

4 *Annales Vet et Nov. Test.*, &c., Genev. 1722, p. 568. 5 *Dissertations*, &c., 5 vols., 1837. 6 *Einleitung ins, N. T.*, 3 bde.

7 *Geschichte d. Pflanzung*, u. s. w. 8 *Biblischen Realworterbuch*, art. "Paulus."

9 *Chronologie des Apostol. Zeitalters*, &c., Gött. 1848.

10 See Stuart's *Commentary on the Hebrews*, vol. i.; Forster's *Apostolical Authority of the Epistle to the Hebrews* London, 1838; Hug's Introduction, § 145.

11 See Blomfield, *Recensio Synoptica*, and *Greek Testament*, on 1st Cor. v. 9; and a note by the translator of Billroth's *Commentary on the Corinthians* (*Edinburgh Biblical Cabinet*, No. xxi., vol. i., p. 4). On the other side, see De Wette, Meyer, and Alford, on the place.

Greswell.

1st Thessalonians, 2d Thessalonians	from	Corinth	A.D. 50
1st Corinthians	„	Ephesus	55
2d Corinthians	„	Macedonia	55
Galatians	„	Ditto	55
Romans	„	Cenchrea	56
Ephesians	„	Rome	60
Colossians	„	Ditto	60
Philemon	„	Ditto	60
Philippians	„	Ditto	60
Hebrews	„	Puteoli	63
Titus	„	Macedonia	64
1st Timothy	„	Nicopolis	65
2d Timothy	„	Rome	66

Neander.

1st Thessalonians, 2d Thessalonians	from	Corinth.
Galatians	„	Ephesus.
1st Corinthians	„	Ditto.
2d Corinthians	„	Macedonia.
Romans	„	Cenchrea.
Colossians	„	Rome.
Ephesians	„	Ditto.
Philemon	„	Ditto.
Philippians	„	Ditto.
1st Timothy	„	Macedonia.
Titus	„	Crete.
2d Timothy	„	Rome.

Alford.[1]

1st Thessalonians	from	Corinth	A.D. 52
2d Thessalonians	„	Ditto	53
Galatians	„	Ephesus	54–57
1st Corinthians	„	Ditto	57
2d Corinthians	„	Macedonia	57
Romans	„	Corinth	58
Ephesians	„	Rome	61–62
Philemon	„	Ditto	61–62
Colossians	„	Ditto	61–62
Philippians	„	Ditto	63
1st Timothy	„	?	66–67
Titus	„	Asia	66–67
2d Timothy	„	Rome	67–68

Neander regards the Epistle to the Hebrews as of uncertain authorship, but deems it probable that it was written about the period of the apostle's martyrdom, by "some apostolic man of the Pauline school."[2]

In perusing the history and the writings of St Paul, it is impossible not to be struck with the amazing energy of thought and action by which he was characterized. The conception of *power* is impressed upon the mind by every view of his history, and the study of every page of his writings. The ease with which he threw off the prejudices of Judaism, notwithstanding the deep hold which these had taken of his mind; the rapidity with which he expanded his thoughts to embrace the vast conceptions unfolded by the free offers and unbounded claims of Christianity, so different from the narrow sectarianism of his former religion; the accuracy with which he received into his mind, almost instantaneously, and in all their multiplicity, the mutual bearings and relations of the old economy and the new; the dauntless intrepidity with which, from the very commencement of his Christian profession, he entered into discussion with the advocates of Judaism, and vanquished them with their own weapons; the unflinching perseverance with which, in spite of danger, suffering, contumely, persecution from enemies, ingratitude and desertion from friends, he prosecuted his arduous and exhausting labours; the unwearying assiduity with which he watched over the churches of which he had the care, and the promptitude and accuracy with which he adopted and executed measures for their advantage, widely scattered and variously circumstanced though they were; the resistless force of his arguments, the persuasiveness of his appeals, the keenness of his irony; all conspire to show that he possessed in a high degree those capacities for command by which men are fitted to be the leaders and directors of their fellows in enterprises of importance to the interests of the race. But it was not by attributes of strength and power alone that the mind of Paul was characterized. The sternness of these was relieved and softened by others of a more amiable and gentle cast. A vein of tenderness and sensibility flowed through his soul, which, whilst it made him the more susceptible of suffering from ingratitude or persecution, rendered him at the same time gentle and compassionate to the feelings of others. With all his freedom from Jewish prejudices, he never lost his reverence for the country and institutions of his fathers; and with all his zeal for rectitude, and all his firmness in rebuking error, he never forgot what was due to the imperfections of his brethren, or deemed that truth could be made attractive if divorced from charity. Removed alike from the extremes of fanaticism on the one hand and apathy on the other, his whole life was a noble instance of the consecration, on sound and elevated principles, of the highest powers and the most indefatigable energies to a work in which he had no personal interest apart from that of his fellow-Christians, and from the honour which was to accrue from his exertions to that Master whom it was his high ambition to serve in life, and his animating expectation to join at death. Apart altogether from his character as an apostle of Christ, his labours in the cause of human amelioration entitle him to veneration as one of the greatest benefactors of the species; whilst in his peculiar capacity as one of the founders of the Christian church, and an inspired expositor of divine truth, he stands without a rival in his claims upon our gratitude and reverence. His history is a standing evidence of the truth of our religion; to his labours we are indebted mainly for the rapid extension of Christianity both in the East and in the West; and in his writings are contained those treasures of heavenly doctrine which it has been the chosen occupation of some of the greatest minds of subsequent ages to explore and to unfold. With these irresistible claims, the more his life, character, and writings are studied, the deeper will be the veneration in which he will be held, and the more sincere will be the gratitude of every pious mind to the Author of all good for having in so remarkable a manner supplied the church with a teacher so eminently qualified to advance its best interests, and establish, to the end of time, the faith, efficiency, and blessedness of its members.

(See, besides the works referred to in this article, the splendid work of Conybeare and Howson, *Life and Epistles of St Paul*, with maps, plates, &c., 2 vols. 4to, London, 1850–52, third edition, 2 vols. 8vo, 1858; Lewin's *Life and Epistles of St Paul*, 2 vols. 8vo, London, 1851; Schrader, *Der Apostel Paulus*, 5 vols., Leipz., 1829–36; Hemsen, *Der Ap. Paulus*, &c., Gott. 1850; Baur, *Paulus der Ap. Jesu Christi*, Stuttg. 1845.) (W. L. A.)

PAUL *of Samosata*, a celebrated heresiarch of the third century, was raised to the see of Antioch in 260 A.D. His conduct in this high position was marked by an unblushing attempt to secularize the duties and doctrines of religion. No sooner had he put on the episcopal robe than he started on an eager race for the pleasures and honours of this world. His pastoral authority was exercised to supply food for his avarice. His sacerdotal character was employed to screen his sensual indulgence. He trampled on the laws of the

[1] *Greek New Testament*, vols. ii. and iii.
[2] *Geschichte*, p. 433, Eng. trans., vol. i., p. 347; see also Delitzsch, *Commentar zum Br. an die Hebräer*, p. 701.

church by accepting the secular appointment of *ducenarius procurator.* He desecrated his holy office by cringing for the favour of Zenobia, the unprincipled queen of Palmyra. In his council-chamber he sat upon a lofty throne, and assumed the airs of a civil dignitary. In public he rode with all the pomp and retinue of a prince, and pretended to be constantly reading petitions and dictating mandates. In the pulpit he ranted like an actor, and paused at intervals to invite the plaudits of his congregation. Nor did the worldly-minded bishop hesitate to extend his sacrilegious innovations to the most sacred doctrines of the Christian creed. The Divine Being, he taught, was not a Trinity but a Unity. The Logos and the Holy Ghost were not persons of the Godhead, but were parts of the Deity, in the same manner as reason and spirit are parts of man. The Logos did not become incarnate in the person of Christ. It descended to earth, communicated its influence to the man Jesus, and then re-ascended to heaven. Jesus accordingly was not God. He only attained to an extraordinary degree of wisdom and virtue, which might entitle him, in a certain sense, to be called Divine. The flagrant practices, and especially the erroneous doctrines, of Paul of Samosata, at length awoke the opposition of the church. An inveterate conflict took place. His opponents held a council in 264 or 265, condemned his opinions, and allowed him to hold his see only on the faith of a promise that he would retract his heresy. But no sooner had the assembly dispersed than he broke his promise, and began to teach his old dogmas. His opponents returned to the charge, convoked another council in 269, and deposed him from his bishopric. But backed by the influence of Zenobia, he set this sentence at defiance, and retained his benefice in the face of the whole church for no less than three years. At length, however, in 272, the overthrow of his royal patroness by the Emperor Aurelian brought about his downfall. The settlement of the controversy was referred by the conqueror to the bishops of Italy; they sustained the decision of the council of 269; and Paul of Samosata, expelled from his see, disappeared into obscurity. There were a few sectaries, who called themselves, after the name of this heresiarch, *Paulianists.* They never became numerous, and in the fifth century they had fallen out of notice. (Neander's *Church History*, and Gibbon's *Decline and Fall of the Roman Empire.*)

PAUL *the Deacon* (also surnamed, after his father, *Warnefridus*), an eminent historian of the middle ages, was born about 740 at Cividale (*Forum Julii*), and completed his education at the court of Rachis, King of the Lombards. Although he commenced life as a humble deacon of the church at Aquileia, his learning and accomplishments soon set him upon a career of distinction. He became notary or secretary to Desiderius, the last Lombard monarch. His withdrawal into a cloister, on the overthrow of that prince in 774 by Charlemagne, did not consign his merits to oblivion. In no long time the victorious sovereign had summoned him to take up his abode at the court of France. He was there employed to teach Greek to the clergymen who had been selected to conduct the emperor's daughter Rotrude to Constantinople to be wedded by the son of the Empress Irene. Yet, in spite of these high honours, his last days were spent in obscurity in his native country. He died in the monastery of Monte Casino about 799. Paul the Deacon left behind him several works. His great work, since it is the only authority on its subject, is the *De Gestis Longobardorum.* It has often been printed, and it is contained in Muratori's *Rerum Italicarum Scriptores.* His other works are *Gesta Episcoporum Metensium, a Life of St Gregory the Great,* several Latin Hymns and Poems, and a collection of Homilies for all the Sundays and holidays in the year. He also appended to the History of Eutropius a continuation of the narrative down to the reign of Justinian, which has been continued in turn by another writer, and which is now known under the name of *Historia Miscella.*

PAUL I., *Pope*, succeeded Stephen II. in 757, and died in 767.

PAUL II., *Pope*, whose original name was Pietro Barbo, succeeded Pius II. in 1464. An attempt to raise a crusade against the Turks, a persecution of the Hussites, the excommunication of Podiebrad, King of Bohemia, and the dispersion of an academy which had been instituted for the study of classical antiquities, were the most notable acts of his pontificate. He died in 1471.

PAUL III., *Pope*, whose real name was Alessandro Farnese, succeeded Clement VII. in 1534. His rule was characterized by zeal and vigour. He excommunicated Henry VIII. of England, established the Inquisition at Naples, sanctioned the new order of the Jesuits, and condemned the system of doctrine called the "Interim," which the Emperor Charles V. had ordered to be drawn up. By him also was the general council convoked which had for its object the healing of the schisms in the church, and which continued to sit long after his death in 1549.

PAUL IV., *Pope*, who was originally called Gian Pietro Caraffa, was raised to the pontificate after Marcellus II. in 1555, at the age of eighty. He had became notable while archbishop of Theate or Chieti for his attempt to revive the sinking strength of Popery by introducing among the clergy the discipline and simplicity of primitive times. It now became his object to carry out the same plan on a much larger scale. Bent upon reforming not only the ecclesiastics but the Roman Catholic community at large, he obliged bishops to reside within their own dioceses, proscribed unprincipled publications, punished blasphemers, and even expelled his own nephews from Rome on account of their debaucheries. After a reign of four years, spent in this reformation, he died in 1559.

PAUL V., *Pope*, whose previous title was Camillo Borghese of Siena, succeeded Leo XI. in 1605, at the age of fifty-three. The most notable event in his pontificate was his dispute with the Venetian Senate. The occasion was the arraignment of two priests at Venice before the magistrate; and the subject was, whether in the Venetian territory religious edifices could be erected, property could be bequeathed to the church, and ecclesiastics could be accused of any civil crime, without being liable to the interference of the government. The pope asserted the affirmative: the Senate persisted in maintaining the negative. The Pope laid the territory under an interdict: the Senate expelled from their dominions all those who showed any respect to the interdict. Baronius and Bellarmine entered the field of literary controversy to support the see of Rome: the famous Father Paul appeared to defend the rights of Venice. His holiness at length employed the mediation of the King of France; but the senators did not give up the contest until they had triumphantly carried their point. Paul was more successful in his attempts to embellish Rome. He erected several spacious edifices, enlarged the Vatican and Quirinal palaces, constructed some of the most beautiful fountains, collected some of the finest specimens of painting and sculpture, and restored some of the richest pieces of the ancient architecture of the city. The death of Paul V. happened in 1621.

PAUL I., Czar of Russia, was the son of Peter III. and Catherine II., and was born in 1754. He succeeded to the throne in 1776, and was strangled in 1801. (See RUSSIA.)

PAUL, *Father.* See SARPI.

PAUL, ST, a town in the island of Réunion or Bourbon, stands on the W. coast, 19 miles S.W. of St Denis. It is shaded by acacias, and has a better harbour than that of St Denis. This was the earliest settlement made by the

French on the island. Pop. about 10,000; of the arrondissement, 16,262.

PAUL, *St*, an island in the Indian Ocean, S. Lat. 38. 44., E. Long. 77. 38., about 9 miles long, by 5 broad. It seems to be of volcanic origin; for it contains hot springs, and an old crater, now filled with water and abounding in fish. The island is covered with a stunted vegetation, and has good anchorage at the E. side.

PAUL DE LOANDA. See LOANDA.

PAULICIANS, THE, were an ancient religious sect which sprung up in Armenia in the seventh century. Their founder was one Constantine, an inhabitant of the village of Mananalis, in the neighbourhood of Samosata. This individual happening to receive a copy of the New Testament as a present, began to search the gospel record, and to extract from it a set of opinions peculiar to himself. He then preached his new doctrines with success in his native district, in Pontus, and in Galatia. A numerous band of followers gathered round him, who, forming themselves into a distinct sect, adopted a systematic creed. A certain part of their creed was merely a revival of some of the most flagrant errors of the early Christians. Thus they held, with the Gnostics, that the Old Testament was not canonical, and that the Creator of the world and the God of heaven were two distinct beings. They also held, with the Valentinians, that Christ's body was not a material body formed in the womb of the Virgin Mary, but an ethereal body brought along with him from heaven. Yet the greater part of their doctrine was a direct protest and a thorough-going polemic against the growing superstitions of the church. According to them, the holy cross was a piece of common or perhaps rotten wood; the wonder-working relics were a heap of offensive dust; the consecrated priesthood was a Jewish institution; the efficacious sacraments were mere symbols, the one denoting the baptism of the Spirit, and the other denoting the feeding upon the word of Christ; Mary, the mother of God, and the immaculate Virgin, was a frail mortal woman, and the parent of several mortal children; and even the great St Peter, the first bishop of Rome, was an unworthy apostle, whose two epistles ought to be expunged from the pages of the New Testament. This severely simple code of doctrine was accompanied by a severely simple rule of practice. It became the aim of the new sect to realize, even in the minutest accessories, the condition of the primitive church under St Paul. They listened to the precepts of the great apostle of the Gentiles as if he were speaking to them with a living voice, and they called themselves *Paulicians*, as if he were their founder and sole teacher. Their pastors were surnamed after the apostle's fellow-labourers, and their pastorates were named after the apostle's congregations. The sharp reproof which the Paulicians thus gave to both the creed and government of the church soon roused a vindictive persecution. For one hundred and fifty years each successive emperor, whether an image-worshipper or an iconoclast, deemed it either his duty or his interest to endeavour to suppress the harmless Armenian sect. Their teachers were martyred, their faith was assailed both by argument and force, and they were proscribed in all the provinces of the empire. The Empress Theodora brought the persecution to a climax, and provoked the persecuted to retaliate. Aiming at the total extirpation of the Paulicians, she beheaded, hung, drowned, and burned no less than one hundred thousand. The remnant, finding a refuge and a home in that part of Armenia which belonged to the Saracens, formed a league with the khalif for the purpose of inflicting retribution upon their common enemy. One of their number, Carbeas, a valiant soldier, was appointed to organize an expedition. At the head of an army composed of his fellow-sectaries and of Moslems, he invaded the provinces of the empire, and defeated the Emperor Paul under the walls of Samosata. Still more victorious was his successor Chrysocheir. Sweeping before him all opposition, he overran the whole of Asia, and pillaged Nice and Nicomedia, Ancyra and Ephesus. In vain did the Emperor Basil, the Macedonian, try both arms and negotiation. It was not until Chrysocheir had been surprised and slain that the invaders were driven back into their own district, and forced to defend their independence among the mountains. The Paulicians, however, were destined to be placed in a scene of more prosperous activity. About the middle of the eighth century, the Emperor Constantine Copronymus transplanted a large body of them from Armenia to Thrace; in the tenth century the Emperor John Zimisces increased the colony by a fresh number of emigrants; and in a short time they had obtained a firm footing in Philippopolis, and other cities in that part of the empire. As they grew in power and importance, they grew also in proselytizing zeal. Travelling westward as far as Germany and France, their missionaries made many converts, and fostered that spirit of opposition to the corruptions of the church which ultimately issued in the Reformation. (Gibbon's *Decline and Fall*, Mosheim's *Ecclesiastical History*, and Neander's *History of the Church.*)

PAULINUS, MEROPIUS PONTIUS ANICIUS, Bishop of Nola, was born in Bourdeaux, or its neighbourhood, about 353. The career of the future ecclesiastic began amid bright prospects of worldly preferment. His parents left him a munificent fortune; his opening taste for letters was fostered by the tuition of the poet Ausonius; he was raised to the rank of *consul suffectus;* and he won the hand of a wealthy and accomplished lady named Therasia. Yet the latter part of his life was characterized by an abandonment of all earthly cares and honours. In the course of a few years, his conversion to the truth of the gospel led him to distribute part of his possessions among the poor. Then a domestic affliction which he suffered while residing in Spain tended to increase this spirit of religious devotion. Becoming a presbyter in 393, he removed immediately to Campania to devote his remaining days to the duties of piety. He first spent nearly fifteen years in monk-like seclusion, practising acts of charity and self-mortification, and writing sacred poetry and theological treatises. At length, in 409, he entered upon the duties of the see of Nola, a post which he held till his death in 431. The works of Paulinus which have come down to us are fifty epistles, thirty-two poems, and a brief tract entitled *Passio S. Genesii Arelatensis*. They were first printed in an imperfect state by Badius, 8vo, Paris, 1516. The standard edition is that of Le Brun Desmarettes, 4to, Paris, 1685.

PAULUS ÆGINETA. See ÆGINETA.

PAULUS ÆMILIUS. See ÆMILIUS, *Paulus*.

PAULUS, *Heinrich Eberhard Gottlob*, a learned German divine, was born at Leonberg in Wurtemberg in 1761. The chief part of his attention during his educational course was directed to theology. He studied the oriental languages and the other branches of a divinity course at Tübingen and Gottingen, and then proceeding to England, completed his education at London and Oxford. On his return to his native country, Paulus entered upon a distinguished professorial and literary career. In 1789 he was appointed to the chair of oriental languages at Jena; in 1804 he became professor of theology at Würzburg, and in 1811 he began to teach exegesis and philosophy at the university of Heidelberg. At the same time, his pen was busily employed in theological literature. Among other works, he published *Philologisch-kritischer Commentar über das Neue Testament*, in 2 vols., Lubeck, 1800–5; *Das Leben Jesu*, in 2 vols., Heidelberg, 1828; and *Exegetisches Handbuch über die drei ersten Evangelien*, in 3 vols., Heidelberg, 1830–33. The death of Dr Paulus took place at Heidelberg in 1851.

PAULUS, *Julius*, one of the most eminent of the Roman

Pausanias.

jurists, flourished in the third century. The only facts of his biography that are known with any degree of certainty are, that Elagabalus banished him; that Alexander Severus recalled him, and made him *præfectus prætorio;* that he was a contemporary of Ulpian and Papinian; and that he was a most voluminous writer on laws. All that we know regarding his qualities as an author is derived from 2083 excerpts in the *Digest* of Justinian. He was concise in style, subtle in thought, and comprehensive in judgment.

PAUSANIAS, a celebrated Greek general, was the son of Cleombrotus, and nephew of Leonidas. The first important event in his life was the distinguished part which he played in repelling the second Persian invasion in 479 B.C. In that year the task of leading the Spartan contingent northward to the scene of war in Bœotia was entrusted to him. The other Peloponnesian allies joined him at the Isthmus of Corinth; the Athenian troops fell in at Eleusis; and the command of the assembled forces was then conferred upon him. Crossing Mount Cithæron at the head of 110,000 men, he confronted an army of 350,000 Persians on the banks of the River Asopus. After delaying several days, and changing his position twice, he came to a general engagement with the enemy at Platæa. Of all his forces, the Spartans fought most bravely; and of all the Spartans, he himself achieved the greatest feats of valour. The Persians were completely routed; their camp was stormed; and all their remaining troops, with the exception of a few thousands that escaped, were remorselessly butchered. This brilliant exploit secured for Pausanias another high post of honour. Not long afterwards, by the unanimous voice of the Greeks, he was placed in command of a fleet, and charged with the task of following up his former successes, and driving the Persians completely out of Europe. Sailing first to Cyprus, he liberated the cities in that island. Then steering his course to the Propontis, he finished his enterprise by capturing Byzantium. Here ended the distinguished career of Pausanias: the rest of his life was nothing else than a course of the most infatuated folly. Intoxicated with military success, his brain began to be filled with the most extravagant ideas. The Spartan mode of life, he thought, would no longer suit him: it was necessary to surround himself with the luxury and splendour of a Persian satrap. These foolish aspirations soon resulted in a deliberate attempt to sell his country to the Persians for a fortune and the hand of the daughter of Darius. His recall to Sparta to answer for his conduct did not make him abandon this treacherous design. He continued to correspond with the King of Persia until the interception of one of his letters brought his guilt to light and himself to punishment. Having taken refuge in the temple of Minerva, the ephori unroofed that edifice, built up the door, and allowed him to die of cold and hunger. His demise took place at some date between 471 and 466 B.C. The Life of Pausanias has been written by Cornelius Nepos.

PAUSANIAS, a celebrated Greek antiquary, has been supposed, from a passage in his own work, to have been a native of Lydia. The exact period of his birth and death is unknown, but he was employed on a part of his book in the reign of Hadrian, who died A.D. 139, and was writing the *Antiquities of Elis*, A.D. 174, in the fourteenth year of the reign of M. Aurelius (v. 1, 1). He must thus have been contemporary with Aulus Gellius, Ptolemy the geographer, Fronto the philosopher, Apuleius, and Lucian, though his pursuits were not likely to bring him in contact with any of them. The work which he has left is entitled Τῆς Ἑλλάδος Περιήγησις (*The Itinerary of Greece*). It is divided into ten books, containing an account of the antiquities in each of the provinces of Greece, in the following order:—Attica, Megaris, Corinthia, Sicyonia, Phliasia, Argolis, Laconica, Messenia, Elis, Achæa, Arcadia, Bœotia, and Phocis. He must have examined minutely every part of these provinces; and it is observed by Sir John Hobhouse, in his *Journey through Albania*, "that the exact conformity of present appearances with the minute descriptions of the *Itinerary* is no less surprising than satisfactory." Nothing escaped his observation. Mountains, rivers, fountains, temples, statues, and pictures are all described. He evidently took every means in his power to be accurate in his descriptions, as he constantly refers, as a corroboration of his statements, to inscriptions on ancient monuments and works of art, and to gifts dedicated in the temples of the gods. Poets and historians also furnished him with materials to illustrate the antiquities of the places he visited. He is accused, however, like the Latin historian Livy, of credulity, and of narrating many stories which have no pretension to credibility. But, aware that such an accusation might be brought against him, he states (vi. 3, 4) that he thought himself bound to give these traditions of the Greeks, though there was no reason why he should believe them. In his style he is thought to have imitated Herodotus, but by no means successfully.

Pausias ‖ Pauw.

The Greek text of Pausanias was first published at Venice in 1516 by Aldus; but this edition, which is in folio, is very incorrect, having been printed from a bad manuscript. That of Leipsic, 1696, in folio, published by Kuhn, is accompanied by the Latin translation of Amaseo, which had appeared separately at Rome in 4to, 1547. The edition of Clavier, Paris, 1814–1821, in 6 vols. 8vo, is accompanied by a new French translation. The latest edition is that of Schubart and Walz, in 3 vols. 8vo, Leipsic, 1838–40. It is only necessary further to indicate the Italian translation of Bonaccinoli, Mantua, 1597, in 4to; and that which appeared at Rome, 1792–1793, in 5 vols. 4to; the English translation of Taylor, London, 1793–1794, in 3 vols. 8vo; and the German translation of E. Wiedasch, in 4 vols. 8vo, Munich, 1826–29.

PAUSIAS, a distinguished Greek painter, was a native of Sicyon, and flourished in the fourth century B.C. His training was received under very favourable circumstances. He learned his first lessons in art from his father Brietes; he was then subjected to the thorough educational system of Pamphilus; and at the same time he was the fellow-disciple of such artists as Melanthius and Apelles. Accordingly his professional career was marked by surpassing excellence. He brought the art of painting in encaustic with the *cestrum* to an unprecedented pitch of perfection. By him was introduced the custom of decorating the walls and ceilings of private apartments with historical representations. He was also remarkable for his successful imitations of nature, and for his skill in foreshortening, as the portrait of "Glycera the Flower-Girl," and the picture of the "Ox about to be Sacrificed," sufficiently testified.

PAUW, CORNELIUS DE, sometimes called *Nicolas*, a moral philosopher and historian, born at Amsterdam in 1739. He is better known as the uncle of the revolutionist Anacharsis Clootz than by the ancestors from whom he was descended; they are, however, reported by his nephew to have distinguished themselves in the revolutions of Holland in the sixteenth century. It appears, from the same authority, that his name was Cornelius, and not Nicolas, but that he was not related to Cornelius de Pauw, the critic and the rival of Dorville; and that it was upon the marriage of his sister to Clootz's father that he obtained, through the interest of his brother-in-law, a Catholic canonicate at Xanten, in the territory of Cleves. He was afterwards appointed reader to Frederic, King of Prussia, perhaps as an advocate of the new doctrines and principles which that sovereign was disposed to patronize; but he is said to have declined the offer of the place of an academician of Berlin, and a bishopric at Breslau. His attacks on the Jesuits, whom he accused of gross misrepresentation and exaggeration in their historical and geographical memoirs, rendered

him unpopular with the Catholic clergy, though his learning and talents commanded a certain portion of their respect. He was simple in his manners, and somewhat negligent of his appearance. The close of his life was embittered by a tedious and painful disease; and he died on the 7th of July 1799.

His principal publications are—1. *Recherches sur les Américains*, Berlin, 1770 and 1772, in 8vo; a work intended to show the "degraded state of the savage Americans," and forming a contrast to the speculations of some contemporary writers of celebrity: 2. *Défense des Recherches*, Berlin, 1771, 8vo. 3. *Recherches sur les Egyptiens et les Chinois*, Berlin, 1774, in two vols. 8vo, Philosophical Dissertations on the Egyptians and Chinese, translated by Captain J. Thomson, London, 1795, in two vols. 8vo. The investigation was undertaken, he observes, to show "that no two nations ever resembled each other less than the Egyptians and the Chinese;" and it must be admitted that he has sufficiently established his proposition. There is, indeed, one argument that he has employed which appears to be founded on a mistake of the Greek historians of Egypt, who have asserted that the Egyptians had long been in the use of alphabetical characters; and the want of any alphabet amongst the Chinese is stated by M. de Pauw as affording a marked distinction from the Egyptians. There is, however, scarcely a shadow of resemblance in the particular hieroglyphical characters employed by the two nations, although the general system of beginning with a representation of a visible object, and departing more and more, by degrees, from the fidelity of the delineation, must necessarily have been common to both. But it so happens that, out of about seventy Egyptian characters, which are compared by the Jesuits and Dr Morton with the Chinese in the *Philosophical Transactions* for 1769, there are about twenty of which the sense has been ascertained with tolerable accuracy by Dr Young; and of these there is only one that happens to have been rightly determined by the comparison with the Chinese, excepting two or three which are obviously mere pictures, as the moon and a bow. There is also amongst the old Chinese characters a figure of a chain, which agrees remarkably in its form with the Egyptian hieroglyphic employed as a copulative conjunction; but there is a still more striking coincidence which M. Jomard has noticed between the Egyptian and Chinese characters for a thousand, both of which he derives from the seed-vessel of the lotus, as containing a multitude of seeds; and if the older Chinese characters be found to preserve this resemblance as perfectly as they ought to do, it must be confessed that the suspicion of a common origin will be much strengthened by the argument. Both the Egyptians and the Chinese were condemned, M. de Pauw observes, "to an eternal mediocrity;" and the weight of this observation is certainly not diminished by anything that has been inferred from the study of the hieroglyphics of the Rosetta stone and other monuments.

There are several papers of M. de Pauw on antiquarian subjects in the Memoirs of the Society of Cassel, and in particular one on the Temple of Juno Lacinia, vol. i., 1780. *Recherches sur les Grecs* were published at Berlin, 1787, in two vols. 8vo; *Philosophical Dissertations on the Greeks*, translated by Thomson, London, 1793, in two vols. 8vo. This work is principally devoted to the Athenians, amongst whom their boasted liberty is shown to have been confined to a very small number of citizens, who tyrannized over the rest of the inhabitants of their country. The Lacedæmonians, the Ætolians, the Thessalians, and the Arcadians, are separately discussed, but considered as comparatively contemptible; the Lacedæmonians in particular, and their successors, the Mainotes, are treated with great severity, as a worthless race of dishonourable vagabonds. The athletic education of the Athenians is, however, highly applauded, from a visionary theory of the importance of the physical perfection of the body to the operations of the mind. An edition of the author's three principal works appeared at Paris, in 7 volumes octavo, 1795. (See Dorsch, *Chardon-Larochette*, and Clootz, *Magaz. Encycl.* 1799; An. V., vol. ii., Widdigen, *Westph. Nationalk.* 1801, p. 215; *N. Allg. T. Bibl.* lxxiv., p. 77; Denina, *Prusse Littéraire*, iii., *N. Dict. Hist.* ix., 8vo, Par. 1804; Chalmers's *Biographical Dictionary*, xxiii., 8vo, Lond. 1815.) (T. Y.)

PAVIA, a frontier city of Austrian Italy, capital of a province of the same name, stands on the left bank of the Ticino, about 2 miles above its confluence with the Po, and 19 S.S.W. of Milan. On the opposite side of the river stands the suburb of Borgo Ticino, connected with Pavia by a handsome covered bridge of eight arches. The ancient walls which surround the city, being about 3 miles in circuit, inclose a much larger area than is required for the present population; and thus the numerous unoccupied spaces and uninhabited or ruinous dwellings give to the town a somewhat desolate look. It is, however, in general well built, and contains many venerable and splendid edifices. The chief thoroughfare is the Strada Nuova or Corso, extending from the bridge over the Ticino through the middle of the town, and terminating at the other end in a handsome gate. Along this street are erected the chief buildings, consisting of palaces, colleges, and churches, intermingled with theatres, shops, and coffee-houses. The smaller streets branch off from this at right angles; some leading to squares lined with stately but often neglected palaces. Among the churches the chief place is occupied by the cathedral, a large but unfinished building, begun in 1488. It is surmounted by a dome, and contains some good pictures, though these cannot be well seen, from the darkness of the interior. In a side chapel is the tomb of St Augustine, adorned with 290 figures in all, and remarkable both for the beauty of the design and the delicacy of the workmanship. The church of San Michele is the oldest in Pavia, and perhaps in all Italy, having been built probably in the beginning of the seventh century, though the precise date is unknown. It is in the style adopted by the Lombards, and is richly ornamented both in the interior and exterior. A specimen of architecture more approaching the English-Gothic than that of most Italian churches is to be found in Santa Maria del Carmine, which is beautifully built of brick, and has several fine windows and doors in the west front. Another church built of brick is that of San Francesco, a fine specimen of the Italian-Gothic style. The celebrated San Pietro in Cielo d'Oro, which is alluded to by Dante, is now partly in ruins and partly used as a storehouse. It contains the tomb of the famous Boethius. Several of the churches which formerly existed at Pavia have been demolished; and although before the reign of Joseph II. there were numerous large and wealthy convents, few of these now remain. The citadel of Pavia, which was completed in 1469, consisted, when entire, of a square court with towers at the corners, and surrounded by a double cloister; but one side of it was destroyed in 1527, and it was still further injured by the French in 1796; although it still presents a fine appearance. The treasures of art and literature that it formerly contained were carried to France by Louis XII. in 1499; and the place is now used for barracks. The university of Pavia gives to the town no small portion of its celebrity. It is of great antiquity, having been founded, it is said, by Charlemagne in 774, and restored in 1361 by Galeazzo Visconti, to whom it owes many of its privileges. It contains 13 colleges, 3 of which support gratuitously about 120 students; and there are faculties of law, medicine, philosophy, and mathematics. There were in the session 1853–4, 35 professors and 21 assistants; and the number of students was 1423. This university has long been celebrated for its medical and surgical teaching; and among the distinguished men who have been connected with it are Spallanzani and Volta, who were both professors of natural history here. Attached to the university are a library of 50,000 volumes, a museum, and a botanic garden. The buildings are extensive and regular, composing five quadrangles; and there are four square towers from 200 to 250 feet high. Similar towers once adorned Pavia in such numbers that the town was called *Civitas Turrigera*. Besides the university, there is an ecclesiastical seminary, several superior and elementary schools, an institute of fine arts, &c. The charitable establishments include an hospital for foundlings, two for orphans, a reformatory institution, and others. About 5 miles from Pavia, on the road to Milan, stands the Certosa, a splendid Carthusian convent, with a fine Gothic church. No manufactures of any consequence are carried on at Pavia; but the trade, though confined to the produce of the adjacent country, is in these articles considerable. Ticinum, the ancient city which

occupied the site of Pavia, was never of much consequence under the Romans; but the Lombard kings, who gave it the name of *Papia*, made it their capital. It is chiefly notable in history for the battle fought in its vicinity in 1525 between Francis I. of France and the army of Charles V., under the viceroy Lannoy, when the former was defeated and taken captive. Pop. 25,750.

The province of Pavia, which has an area of 400 square miles, is one of the most fertile parts of Lombardy, lying entirely in the plain of the Po, containing good pasture-land, and producing corn, wine, fruit, and hemp. Pop. (1853) 173,879.

PAVILION. See Glossary to ARCHITECTURE.

PAVLOGRAD, a town of Russia, capital of a circle of the same name, in the government of Yekaterinoslav, on the Voltscha, an affluent of the Dnieper, 30 miles E.N.E. of Yekaterinoslav. It contains two churches, a school, a benevolent institution, and several manufactories. Pop. (1851) 6929.

PAWNBROKER. See BROKER.

PAWTUCKET, a town of the United States of North America, partly in Rhode Island and partly in Massachusetts, stands on both sides of the River Pawtucket, 4 miles N.N.E. of Providence. It contains eight or nine churches, a masonic temple, and a public hall; the last two being very fine buildings. The town is chiefly remarkable for its manufactories; and these are supplied with abundant water-power by the river, which, within a short distance, falls about 50 feet. The first cloth factory moved by water in America was established here in 1790. Machinery and cotton fabrics are now the goods principally produced, though boots and shoes, carriages, and cabinet-ware are also made. The trade is considerable; and during the year 1852, 141 vessels arrived here, with a tonnage of 12,798. Pawtucket is connected by railway with Boston and Providence. Pop. (1853) about 10,000.

PAXO. See IONIAN ISLANDS.

PAZ DE AYACUCHO, LA, a town of Bolivia, capital of a department of the same name, stands on both sides of the deep ravine Quebrada-de-Choquehapu, 12,195 feet above the level of the sea, but 620 below that of Lake Titicaca, from which it is not far distant; S. Lat. 16. 30., W. Long. 68. 30. The streets are irregular, and some of them very steep; but there is a very handsome public square. Nine elegant bridges cross the stream, which flows through the ravine, and which forms one of the sources of the Amazon. Of the 15 churches, the chief is the cathedral, a large and noble edifice. There is also a university, a school of law, college of sciences, school of mechanical arts, and other seminaries. A large proportion of the inhabitants are Indians, who live in mud huts, and retain their primitive language and mode of life. La Paz is the principal commercial town in Bolivia, European goods being brought hither from Peru, and exchanged for gold, bark, and other commodities of the country. It was founded in 1548, under the name of *Nuestra Señora de la Paz*, and soon became a place of much importance. Since 1605 it has been the seat of a bishopric. In 1825 the name was changed to that which it now bears, in honour of the victory of Ayacucho, which secured the freedom of the country. Pop. 42,000.

PAZ, *La*, a department of Bolivia, bounded on the N. and E. by that of Beni, S. by those of Cochobamba and Oruro, and W. by Peru, has an extent of 36,418 square miles. It comprises those valleys of the Cordilleras through which the head streams of the Rio Beni flow. Pop. 346,000.

PEA, the English name applied to the seed of several leguminous plants, but chiefly to those of the cultivated pea (*Pisum sativum*, Linn.), an annual plant, and a native of the south of Europe. It has been cultivated as a culinary vegetable from a very early period; but from the slight mention made of it by Pliny, it does not appear to have been valued so much by the Romans as by the Greeks, who prized it very highly, and cultivated it extensively. It is not known when the pea was first cultivated in Britain; but long after its introduction it was rare, and in the time of Elizabeth it was imported from Holland, probably in a ripe state. Dr Fuller, writing of peas at that time, said they were "fit dainties for ladies, they came so far and cost so dear." Either as a horticultural or as an agricultural product, the pea is a vegetable of great importance. The seeds in a green state are regarded as one of our most esteemed vegetables when boiled; and when ripe, are much used in forming a favourite and nutritious soup, acceptable to all classes. Those produced in fields are allowed to ripen, and are of great value in feeding swine; the haulm is also cut up with other kinds of fodder, and is much relished by cattle. The garden pea is often cultivated in fields near large towns, where the demand for it, as a green vegetable, is considerable; it is, however, a very distinct variety from the field pea.

Few vegetables have rewarded the care of the cultivator more than the garden pea, of which there are now at least fifty varieties, which have been produced by a careful hybridization of the following well-marked botanical varieties of the plant:—1. Var. α. *saccharatum*, having round distant seeds, with coriaceous pods, called Sugar Pea, and in France *petits-pois* and *pois-sucres*.—2. Var. β. *macrocarpum*, a strong-growing large kind, with flattened falcate-formed pods containing large and distant seeds. The most remarkable peculiarity of this variety is, that the legumes are destitute of the hard membrane with which others are lined, in consequence of which this sort is cooked and eaten in the pod. The French call it *pois-goulons*, *pois-sans-parchemin*, and *pois-mange-tout*.—3. Var. γ. *umbellatum*. The stipules in varieties α. and β. are entire and rounded, but in the present one they are quadrifid and acute. The peduncles are surmounted with a rather compact cluster of flowers; hence it is called in English Crown-Pea, and in French *pois-à-bouquet*. It has been suggested that this is a true species.—4. Var. δ. *quadratum*. The seeds are of moderate size, and so closely packed in the legume that they become square when full grown. The French call it *pois-carré*.—5. Var. ε. *humile*. A dwarf, weak-growing kind, with round seeds closely placed in the legume. The varieties raised from these are valued according to their hardiness and early bearing, the size and sweetness of the seeds, their abundant bearing, &c. They may be arranged in four groups: those which have *yellow* seeds round when ripe, and those which have square wrinkled seeds; those which have *green* seeds round when ripe, and those which have square and wrinkled ones. All the varieties of the true garden pea have white flowers; but the field pea has red and purple flowers, and the seed when ripe is of a yellowish-brown mottled colour. The pea, as an agricultural crop, is in favourable situations a very useful one, and is so soon off the ground that a crop of turnips can usually be realized after it. In England this crop is usually found most abundant in the midland counties. Large quantities of peas are also imported in a ripe state. These are of the round and yellow kind, and are used chiefly for making soup. The quantity imported in 1857 was, in quarters,—from Denmark, 21,763; Prussia, 8265; Hanse Towns, 4870; Holland, 2630; Morocco, 9000; United States, 6200; British North America, 36,000; other parts, 2000;—the total value of which was nearly L.200,000. (T. C. A.)

PEACE RIVER, in British North America, rises to the west of the eastern chain of the Rocky Mountains, within 300 yards of Frazer River, which takes an opposite course, and flows through the mountains and the plains beyond, first eastward, and then N.E. Near the foot of Lake Athabasca it joins the Slave River, which issues from this lake,

and flows northward to the Great Slave Lake. Its whole length is estimated at 800 miles; and it is navigable for boats even above the Rocky Mountains. The Peace River gives its name to an extensive division of the Hudson's Bay Company's territory.

PEARCE, ZACHARY, D.D., Bishop of Rochester, was the son of a distiller in High Holborn, and was born in 1690. He received his education at Westminster school, where he was elected a king's scholar. At the age of twenty he entered Trinity College, Cambridge; and during the first years of his residence there, he occasionally amused himself with lighter compositions, some of which are inserted in the *Guardian* and *Spectator*. In 1716 he published his edition of Cicero *De Oratore*, and dedicated it to Lord Chief-Justice Parker, afterwards Earl of Macclesfield, a prudent step, which laid the foundation of his future fortune. In 1717 Pearce was ordained, and during the following year became chaplain to Lord Parker. In 1719 he was installed in the rectory of Stappleford Abbots in Essex; in 1720, in that of St Bartholomew; and in 1723, in that of St Martin's-in-the-Fields, London. Besides Lord Parker, Pearce could now reckon amongst his patrons or friends Mr Pulteney (afterwards Earl of Bath), Archbishop Potter, Lord Hardwicke, Sir Isaac Newton, and many other eminent personages. In 1724 the degree of Doctor of Divinity was conferred on him by Archbishop Wake. The same year he dedicated to his patron the Earl of Macclesfield his edition of Longinus *On the Sublime*, with a new Latin version and notes. The deanery of Winchester having become vacant, Dr Pearce was appointed to it in 1739; in the year 1744 he was elected prolocutor of the Lower House of Convocation for the province of Canterbury; and on the 12th of February 1748 he was made bishop of Bangor. Upon the death of Bishop Wilcocks, he was promoted to the see of Rochester and deanery of Westminster in 1756. In the year 1763 his lordship, being then in the seventy-third year of his age, and finding himself less fit for the business of his station as bishop and dean, expressed a desire to resign. His Majesty was inclined to favour his wishes, but the bishops disliked the proposal. He obtained leave, however, to resign the deanery in 1768, and in 1774 he died.

In addition to the works already alluded to, this learned prelate wrote numerous sermons and tracts, published on various occasions. Four volumes of his posthumous sermons were given to the world by his chaplain, John Derby, in 1778. He likewise wrote *Miracles of Jesus Vindicated*, 1727 and 1728; *A Review of the Text of Milton*, 1733, containing an able refutation of Bentley's chimerical emendations; *Two Letters against Dr Middleton*, occasioned by the doctor's letter to Waterland, on the publication of his treatise, entitled *Scripture Vindicated*, 1752. But the work which above all others displays the solid learning and ripe judgment of the author is *A Commentary, with Notes, on the Four Evangelists and the Acts of the Apostles*, &c., 2 vols. 4to, Lond. 1777. This work contains also an autobiography of the author, together with additions from the pen of Dr Samuel Johnson.

PEARL is produced by a secretion peculiar to the Mollusca, and chiefly employed in the formation of their shells. (See MOLLUSCA.) In a few species pearl attains an economic importance, and gives rise to considerable branches of industry. Its normal development is as a slimy excretion from the exterior surface of the mantle, which being applied to the inner surface of the shell increases its thickness by the deposition of successive layers. It is abnormally developed for the purpose of covering grains of sand or other foreign bodies, which, by getting accidentally between the delicate mantle and the shell, would, but for this protection, cause irritation and disease to the former. Man takes advantage of both circumstances. By the former process he is supplied with mother-of-pearl, and by the latter with the precious pearls used in jewellery. These are generally spherical in form, and unconnected with the shell of the animal. Linnæus showed that by perforating a living pearl oyster, and introducing a grain of sand, a nucleus is formed for the development of a pearl.

Precious pearls have been ranked as gems from a very early period; and then, as well as now, the finest both in size and colour were obtained from the Indian Ocean, and are produced by the bivalve *Meleagrina margaritifera*, Lam. The famous wager between Cleopatra and Marc Antony gives us an insight into the value of pearls. At that time the two pearl ear-drops which the luxurious queen proposed to dissolve in vinegar, and serve up at the promised costly repast, were valued at 10,000,000 of sesterces, or about L.76,000. The pearl belonging to A. J. B. Hope, Esq., M.P., the largest known in modern times, and far too large to be used as an ear-drop, is not worth a fourth of that sum. It weighs 1800 grains, or 3 ounces, and has a circumference of 4½ inches, and a length of 2 inches. The most usual dimensions of good oriental pearls is from the size of a pea to about three times that size. When much below the size of a pea they are called *seed pearls*. These seed pearls, as well as the larger kinds, were in great request in the time of Pliny; for he says, "And now at the present day the poorer classes are even affecting them, as people are in the habit of saying that a pearl worn by a woman in public is as good as a lictor walking before her" (the size bespeaking the importance of the person). "Nay, even more than this, they put them on their feet, and that not merely on the laces of their sandals, but all over the shoes; it is not enough to wear pearls, but they must tread upon them, and walk with them under foot as well." (Bohn's edit.) Small pearls are also yielded by other bivalves, as the common oyster, mussel, and more particularly by the pearl-mussel (*Unio margaritiferus*), which was also known to the Romans; for Pliny says, "It is a well-ascertained fact that in Britannia pearls are found, though small and of a bad colour; for the deified Julius Cæsar wished it to be distinctly understood that the breast-plate which he presented to Venus Genetrix, in her temple, was made of British pearls." (Bohn's edit.) They are also mentioned by Tacitus in his Life of Agricola as indigenous products of Britain; he describes them "as not very orient, but pale and wan." (See MOLLUSCA.) Strangely enough, these seed pearls, the collection of which was eagerly pursued as a branch of profitable industry by the ancient Britons, is still followed by their descendants in the principality. The traveller who sojourns in the neighbourhood of Conway is sure to be solicited to purchase British pearls, which may be obtained from 5s. to 10s. per ounce. They are of little value except as curiosities.

The finest oriental pearls are obtained from Ceylon and the Persian Gulf, the seed pearls chiefly from Kurrachee, on the Bombay coast, where they are washed ashore, and are collected by coolies, under contractors, who pay 40,000 rupees (L.4000) to the Julpore government for the privilege. The seed pearls are chiefly used by the natives of India and Persia, who attribute important medicinal virtues to them. Pearls of good size and colour are sometimes collected in the West Indies and on the coast of South America. Imports were received from the following places in 1856:—Egypt, value L.32,570; St Thomas, L.20,744; New Granada, L.1000; British West India Islands, L.500; other parts, L.348.

The same animal (*Meleagrina margaritifera*) which yields the precious pearl produces also the mother-of-pearl shells of commerce. They are often very large, nearly circular in form, and very slightly convex externally. Specimens are occasionally seen 12 inches in diameter. Generally the *nacre*, or pearly material, constitutes the chief

part of the shell, only a thin, worn, dark-coloured crust forming the outside coating or epidermis. They are principally collected on the shores of Madagascar, Ceylon, Manilla, Panama, &c. There are three principal kinds:—1*st*. The *silver-lipped*. These have a yellowish pearly lustre, generally very clear and bright. The largest shells also occur amongst them. Their value ranges from L.80 to L.130 per ton. They are imported chiefly from Manilla and China. 2*d*. *Blue-edged* or *black-lipped*, from South America or other places, worth from L.30 to L.40 per ton. 3*d*. The *Panama* or *bullock-shell*, a small kind from Panama, worth from L.18 to L.21 per ton. The quantity imported in 1856, of all sorts, was 2102 tons, of the value of L.76,544. They are used for a variety of purposes—for the manufacture of buttons, for knife-handles, for inlaying, &c. Great numbers are sent to the Holy Land, where the monks carve upon them religious pictures, often of great artistic merit, which are sold to visitors as souvenirs of their visits to the holy places. Many tons are annually consumed in this way, and in making rosary beads and other small articles. The beautiful opalescence of these shells appears to depend upon "minute undulations of the layers, which has been successfully imitated upon steel buttons." (Woodward, *Manual of Mollusca*.) Other shells are occasionally imported and used by the button-maker and inlayer in consequence of the brilliancy of their nacreous layers, as *Turbo marmoratus*, Linn., from China, and the beautiful *Haliotis gigas* from the Indian Seas. (T. C. A.)

Pearl Fisheries. Owing to the circumstance of the pearl-oyster being found congregated, like the common oyster, in great abundance in certain localities, regular fisheries are established, some of which have furnished pearls for many centuries. Ceylon, still the most famous of the pearl fisheries, was celebrated for the same valuable product in the time of Pliny, when that island was called *Tabrobane*. The same writer also mentions the island of Stoidis as one of the places in the Persian Gulf especially celebrated for its pearl fishery. The same method of procuring pearls was practised in the time of the Romans as in modern times,—viz., by diving and dredging, but especially by the former. As the exertion demanded from divers is exceedingly violent, they are generally said to be unhealthy and short-lived. The best fishery ground is at a depth of 6 or 8 fathoms water, where the divers remain under water from 50 to 80 seconds, but rarely longer. Percival, in his *Ceylon*, tells of a diver who came from Anjango in 1797, and who could absolutely remain under water for full six minutes. They seldom use any precaution to prevent the water from injuring them, and make forty or fifty descents daily, bringing 100 oysters in their bag on each occasion. The fishing season seldom lasts above a month, beginning about the 5th of March. The pearl fisheries of the present day are situated on the west coast of Ceylon, especially in the Bay of Condatchy, the coast of Coromandel, the Bahrein Islands in the Persian Gulf, the coast of Algiers, the Sooloo Islands, the Gulf of Panamá, and the island of Margarita. The finest oriental pearls are obtained from Ceylon and the Coromandel coast. These fisheries are in the hands of the government, by whom they are regulated and farmed out. The beds are annually surveyed, and their condition reported to the government. They are divided into four equal portions, one only of which is allowed to be worked in each year. By this means a three years' rest is insured after each fishing, thus affording the growing meleagrinas, which are free and active in their young state, an opportunity of settling down on the bed, from which the weight of their full-grown shell prevents them from moving in the adult state. As perhaps no fishery of any kind produces such a vast amount of wealth, and gives so much scope for speculation in so short a space of time, the shores of the Bay of Condatchy in the months of February, March, and April present a very animated spectacle. Here are found Indians and Jews—merchants, boatmen, divers; conjurors to chain the sharks, so dreaded by the divers; Brahmins and Roman Catholic priests, many of the Malealie divers being Roman Catholics. The merchants and jewellers are busy and excited with their trade, often speculating upon the contents of their favourite boats before their arrival. The fleet of boats leaves the shore at ten o'clock at night upon the firing of a signal-gun, and returns at noon the following day. As soon as they appear, the gun is again fired, and the flags are hoisted; the shore is quickly crowded with anxious faces, and a perfect Babel is witnessed when the boats touch the strand, inquiries in twenty or more languages being shouted out by the eager crowd as to the result of the cruise. The cargo of each boat is quickly landed and taken possession of by its owners, who immediately commence opening the shells and searching for the pearls. These pass into other hands as soon as found; and the excitement is greater than ever, caused by the hawkers and others engaged in the purchase and preparation of the gems for other markets, as they are all drilled and cleaned on the spot. (See Percival's *Ceylon*.) It is almost impossible to tell the exact value of the produce of pearls, as there is no arrangement for the purpose, and the contracts taken by the government (about L.45,000 per annum) afford no criterion, as they barely pay the working expenses.

The pearl fisheries of the Bahrein Islands, belonging to Persia, are said to yield annually from L.200,000 to L.240,000 sterling. A considerable fishery exists at Kurrachee, on the Bombay coast, which is let by the Indian government to contractors for about 40,000 rupees (L.4000) annually. The pearls are, however, of little value, being very small. They are called *seed pearls*, and are chiefly used in medicine by vytians and hakims (Hindu and Mohammedan doctors). According to Dr Ainslie, the powder of pearls is supposed to have the virtue of strengthening weak eyes, and to have considerable efficacy in palpitations, nervous tremors, hemorrhage, and other affections. Hence the fishery for seed pearls is kept up with vigour; but they are obtained from the shells thrown on the coast by the surf, and not by diving.

The South American pearl fisheries are carried on with great activity; but the quality of the pearls is not equal to those of the East. In 1587, 697 lb. weight of pearls were imported from Colombo and Margarita into Spain. Philip II. obtained a pearl from Margarita in 1574 which weighed 250 carats, and was worth 150,000 dollars (L.31,875). In 1824 Messrs Rundell, Bridge, and Rundell obtained the exclusive right of using these fisheries for ten years.

Notwithstanding the great value of the pearls yielded by the various fisheries, it is probable that the shells of the animals now yield a far more profitable return than the jewels. In 1856 the total value of pearls imported into the United Kingdom was L.56,162; whereas the imports of 2102 tons of the shells were valued at L.76,544. (T. C. A.)

Pearl Islands, a small group of islands belonging to New Granada, in the Bay of Panamá, 60 miles S.E. of the town of Panamá. They consist of S. Miguel, S. José, Pedro Gonzales, and other smaller ones; and derive their name from the pearls that are obtained there.

PEARSON, Edward, D.D., a learned divine of the English Church, was descended from the famous Dr John Pearson, Bishop of Chester, and was born at Norwich on the 7th November, 1756. He was educated at Sidney College, Cambridge, of which he afterwards became fellow and tutor. No sooner had he been appointed rector of Rempstone in Nottinghamshire in 1796, than he began a career of great professional activity. His zeal was manifested with marked effect in the inculcation of practical re-

Pearson. ligion. He preached numerous sermons on special occasions, edited prayer-books and catechisms, and wrote tracts and discourses for the special enlightenment of the lower classes. Nor were his faculties less willingly exerted against schismatics. He published *Three Plain Reasons against Separating from the Established Church, Three Plain Reasons for Infant Baptism,* and *An Admonition against Lay-Preaching.* But it was for his bold attack on supposed heresies among the Anglican hierarchy that Dr Pearson was chiefly famous. In 1800 and 1801 successively he attacked the theoretical and the practical part of Paley's *Moral and Political Philosophy;* and in 1802 he published *Remarks on the Controversy between the Arminian and the Calvinistic Ministers of the Church of England.* He assailed the Calvinism of the evangelical party in the person of Overton of York in 1802, and of Simeon of Cambridge in 1810. His death happened in 1811, three years after he had been elected master of Sidney College, Cambridge. (See *A brief Memoir of the Life, Writings, and Correspondence of the Rev. Ed. Pearson, D.D.*, by W. P. Hunt, 1845, to which is appended a complete list of the author's writings.)

Pearson, *John,* D.D., a learned English bishop, was born at Great Snoring in the county of Norfolk, on the 28th of February 1613. After his education at Eton and Cambridge, he entered into holy orders in 1639, and was the same year collated to the prebendary of Netherhaven, in the church of Sarum. In 1640 he was appointed chaplain to the Lord-Keeper Finch; and was presented to the living of Thorington in Suffolk during the same year. In 1650 he was made preacher of St Clement's, Eastcheap, in London. In 1657 he and Peter Gunning had a dispute with two Roman Catholics upon the subject of schism, a very unfair account of which was printed at Paris by one of the disputants, named Tyrwhitt, in 1658. In 1659 he published at London his celebrated *Exposition of the Creed,* dedicated to his parishioners of St Clement's, Eastcheap, to whom the substance of that excellent work had been preached several years before, and by whom he had been desired to make it public. The same year he likewise published the *Golden Remains of the ever-memorable Mr John Hales of Eton,* to which he prefixed a preface containing a character of that eminent man, with whom he had been acquainted for many years, drawn up with great elegance and force. Pearson had also a principal share in the editing of the *Critici Sacri,* first published in 1660. Soon after the Restoration he was presented by Juxon, then bishop of London, to the rectory of St Christopher's in that city; created doctor of divinity at Cambridge, in pursuance of the king's letters mandatory; installed prebendary of Ely, archdeacon of Surrey, and made master of Jesus College in Cambridge, all before the end of the year 1668. In 1661 he was appointed Margaret professor of divinity in that university; and on the first day of the ensuing year he was nominated one of the commissioners for the review of the Liturgy in the conference held at the Savoy. On the 14th of April 1662 he was admitted master of Trinity College in Cambridge; and in August resigned his rectory of St Christopher's and his prebend of Sarum. In 1667 he was admitted a fellow of the Royal Society. In 1672 he published at Cambridge *Vindiciæ Epistolarum S. Ignatii,* in 4to, in answer to Daillé; to which is subjoined *Isaaci Vossii Epistolæ Duæ adversus Davidem Blondellum.* Upon the death of the celebrated Dr Wilkins, Pearson was appointed his successor in the see of Chester, to which he was consecrated on the 9th of February 1672–1673. In 1682 his *Annales Cyprianici* were published at Oxford, with Fell's edition of that father's works. Pearson was disabled from all public service by ill health a considerable time before his death, which happened at Chester on the 16th of July 1686. Pearson's last work, the *Two Dissertations on the Succession and Times of the First Bishops of Rome,* formed the principal part of his *Opera Posthuma,* edited by Henry Dodwell in 1688. (See a Memoir of Bishop Pearson, prefixed to the edition of his *Minor Theological Works,* by Edward Churton, 2 vols., Oxford, 1844.)

Peat. PEAT is formed by the partial decay of vegetable matter, especially of various species of mosses. It exists in most parts of Northern Europe. The vast peat-bogs of Ireland, amounting probably to not less than three million English acres, of an average depth of 19¼ feet, represent an amount of raw material which is now being looked to by economists as a source of wealth, instead of being the exponent of sterility. Peat may be made valuable in various ways; *first,* as a source of fuel. At present, however, while coal is abundant and cheap, peat will probably be unable to compete with it. The time may come when the country will look with eagerness to Ireland for the supply of fuel, which is a necessary element in our greatness and prosperity; and that time may not be so far distant as is generally supposed, when we consider the fact that our present annual consumption of coal is about seventy million tons. In the year 1856 the quantity of coal raised in the United Kingdom amounted to 66,645,450 tons.

In the article Fuel, some details are given respecting peat as a source of heat, and we may here give a few additional particulars. The heating power depending on the per-centage of pure carbon found in the peat, the source of the supply becomes a matter of importance, seeing how very variable is the value of the peat in different localities. Dr Sullivan states that "the variation in the quality of peat is so great, that no statements as to its economical value can be relied on which do not give the per-centage of ash, the per-centage of water, and the specific gravity. The variation in the latter amounts to 0·3 to 1·1 for air-dried turf from the great centre bogs."[1] Mr W. Longmaid states that "the best samples of peat contained, when dried, about 70 to 75 per cent. of carbon; but other samples were contaminated with earthy matters to the extent of from 5 to 10 per cent.; the average impurities may be taken at from 4 to 5 per cent., and we have found some samples of peat charcoal yielding 94 per cent. of fuel."[2]

Messrs Gwynne & Co. have taken out several patents for the preparation of peat fuel. In one of their patent processes, the peat, as dug from the bog, is deprived of much of its moisture by being placed in a large centrifugal machine, after which it is ground to powder, and passed through a series of cylinders revolving in a heated chamber, where the remaining moisture is got rid of, and the powder raised to the proper temperature for compression; it is carried from the last cylinder by two pockets to the compressing tables, and having passed through them, the solidified peat is ready for use. In another process the moisture is got rid of by passing the peat between cylinders containing, at equal distances along their outer surfaces, projections equal to the thickness of the slabs of peat. The drying of these is completed in the hot chamber, or they are at once converted into charcoal. It is found that when the peat powder has been dried at a temperature of about 180°, and in that state allowed to enter the hopper of the compressing engine, the tarry properties of the turf are just sufficiently developed to form a good cementing compound, and the brick of compressed turf, when cold, forms a dense and very pure fuel. Dr Letheby, who has examined this patent solidified peat fuel, reports that its specific gravity is as high as 1·140, its structure hard and dense, and the stowage weight of one cubic foot of the fuel is 71·24 lb., that of

[1] Private communication to Professor Miller of King's College, London.

[2] Lecture before the Society of Arts, January 1855.

Newcastle coal being about 49·69 lb. 100 parts of the peat contain 9 of hygroscopic moisture; they yield 55 parts of volatile matter, much of which is condensable, and 36 of charcoal. The charcoal contains 3·8 of ash. 7000 grains of the peat were distilled in an iron retort, and the volatile products were conducted through a red-hot iron tube, under the impression that the paraffine, &c., of the tar would be converted into a gaseous hydrocarbon of high illuminating power. The results were 2520 grains of peat coke, or charcoal; 1320 of ammoniacal liquor; 360 of thick tar; and 2800 of combustible gas: the gas occupied 625 cubic feet, and when burnt at the rate of 5 cubic feet an hour, from an Argand burner, with 15 holes, and a 7-inch chimney, it yielded a light equal to that of 7 sperm candles, each burning at the rate of 120 grains per hour. According to this analysis, 100 parts of the peat furnish

Porous charcoal	36·00
Ammoniacal liquor	18 86
Thick tar, containing paraffine	5·14
Gas having the illuminating power of 7 candles	40 00
	100·00

Although the illuminating power of the gas is not very high, the quantity is considerable (a ton of the material furnishing as much as 14,000 cubic feet), and as much of the gas and paraffine had been rendered gaseous by their passage through a red-hot tube, they might probably be further decomposed and converted into gases of high illuminating power. When the gas had been purified, by passing it through an alkaline mixture, it was found to be free from sulphur, in which respect it has an advantage over coalgas.

In using the solidified peat as fuel, no opaque smoke is evolved, no sulphurous acid is set free, the heat is quickly raised and quickly diffused, the ashes do not form clinkers, and the peat does not contain any metallic sulphuret, or other substance that is likely to produce spontaneous combustion.

Messrs Gwynne propose to apply their prepared peat to the reduction of ores by combining it with the proper fluxes; and having formed the furnace charge of fuel, flux, and ore, by powerful compression into globular masses, these are piled up in the furnace, the spaces between them admitting a sufficient quantity of air for maintaining the combustion. Peat charcoal is of great value in the manufacture of iron, on account of its being almost free from sulphur. Its deodorizing and purifying qualities are also high.

According to Mallet (whose experiments on Irish peat have been generally confirmed by those of Brix on Prussian peat), the heating power of good dry turf, as compared with that of the coke of bituminous coal of good quality, is as 1 : 7·61, and air-dried peat will convert about its own weight of water, at 60°, into steam at 212°. In Bavaria peat is dried artificially to a large extent as fuel, for the use of locomotive engines; and at Kœnigsbrunn it has for many years been employed in the puddling furnaces for the conversion of cast into wrought iron.

Peat has thus been shown to be valuable, *first*, as a fuel; *secondly*, as a source of illuminating gas; and we have now to refer to it in the *third* place, as a source of various products obtained from its destructive distillation. The ultimate elements of peat are essentially the same as those of wood and of coal, namely,—carbon, nitrogen, hydrogen, and oxygen. If, therefore, peat be distilled in close vessels, the resulting products will resemble those of a similar operation on wood or coal. In the Great Exhibition of 1851, Mr Oxland exhibited the products obtained by the destructive distillation of Dartmoor peat in cast iron retorts; but as the expense of the process was too great for its adoption in Ireland, it occurred to Mr Reece to make use of a blast-furnace similar to that employed in the smelting of iron ore, with an additional contrivance for collecting the products of combustion. By this means peat has been made to yield ammonia, acetic acid, pyroxylic spirit, tar, naphtha, oils, and paraffine, all useful products in the arts. The ammonia which is fixed and separated by the addition of sulphuric acid, forming sulphate of ammonia, is employed in the preparation of carbonate and hydrochlorate of ammonia, of caustic ammonia, and in the production of manures and composts. The acetic acid, which is fixed and separated by the addition of lime, forming acetate of lime, is a useful source of acetic acid, and of various acetates consumed by the calico-printer. Pyroxylic spirit, or wood alcohol, may be separated by distillation, and is used in vapour-lamps, and in the preparation of varnishes. Naphtha is also used in making varnishes, and for dissolving caoutchouc. The heavy and more fixed oils may be used as cheap lamp oils, and for making lamp-black, or, mixed with other unctuous substances, they are well fitted for the lubrication of machinery. Paraffine, either alone or mixed with sperm or stearine, forms excellent candles. Paraffine is a crystalline substance of the specific gravity 0·870. It is destitute of taste, colour, and odour; at 112° it is a transparent oily liquid, and at a higher temperature it boils and distils without change; its vapour burns with a white sootless flame. It resists the action of acids, alkalies, chlorine, and potassium, and cannot be united by fusion with camphor, naphthaline, benzole, or pitch. It is on account of this inertness as a chemical agent, or want of affinity, that it derives its name from *parum affinis*. It unites, however, with stearine, cetine, bees'-wax, and colophony, and dissolves in oil of turpentine and in naphtha. Mr Bagot states, that 100 tons of peat yield 10,000 gallons of liquor containing ammonia, carbonic acid, acetic, and pyroligneous acids, pyroxylic spirit, and 1000 gallons of tar, containing paraffine, heavy oil and light oil. The inflammable gas is economically used by being passed under the steam-boiler. The 1000 gallons of liquor yield one ton of sulphate of ammonia, sufficient acetic acid to produce 13 cwt. of grey acetate of lime, and 52 gallons of pyroxylic spirit. The tar yields 300 lb. of paraffine, 200 gallons of naphtha, or light hydrocarbonaceous oil, and 100 gallons of heavy oils.

The above results are, however, much too favourable for constant practice. Dr Sullivan has ascertained that none of the paraffines of commerce are definite bodies; but mixtures of different isomeric hydrocarbons. In relation to the distillation of peat, he says:—"Now that a ready market exists, I have no doubt that 3 lb. of paraffine per ton of good dry peat could be separated, especially by keeping over the summer oils until winter; in cold winters, perhaps even more. Gas enough can be produced to work the factory (heating stills, &c.), but it has now been satisfactorily determined that the larger the supply of gas, the less will be the yield of tar, and *vice versâ*. The yield of tar when the temperature has been carefully attended to, has fully reached the anticipated quantity; but neither the ammonia nor the wood spirit has. The real source of profit, therefore, is the tar. Tar about 3·5 per cent., paraffine 0·13 per cent." (*Private communication.*)

Thus it will be seen that whether we regard peat as a fuel, as a source of charcoal, of gas, or of the various other products named, it cannot, except for the sake of the tar, be worked at a profit, until the manufactures connected with it can compete in price with similar products already in the market. It must, however, be remembered, with respect to peat as a source of fuel, that while coal would cost the Irish labourer three times as much as it costs the Northumbrian cottager; the peat is at hand, and can be had almost for nothing. (C. T.)

PECK, Francis, a laborious and learned antiquary, was born at Stamford, in Lincolnshire, on the 4th of May 1692, and educated at Cambridge, where he took the degrees of

Bachelor and Master of Arts. After several unsuccessful flights in poetical composition, he, in 1727, published in folio his *Academia tertia Anglicana, or the Antiquarian Annals of Stamford, in Lincoln, Rutland, and Northampton Shires*, inscribed to John, Duke of Rutland. Peck had before this time obtained the rectory of Godeby, near Melton, in Leicestershire, the only preferment he ever enjoyed. In 1732 he published the first volume of *Desiderata Curiosa*, or a collection of various scarce and curious pieces relating chiefly to matters of English history. This volume was dedicated to Lord William Manners, and was followed, in 1735, by a second volume, dedicated to Dr Reynolds, Bishop of Lincoln. In the year 1735 Peck printed a complete catalogue of all the discourses written for and against Popery in the time of King James II., containing in the whole an account of 457 books and pamphlets, with references after each title, and an alphabetical list of the writers on each side. After editing Dr Hammond's *Letters* in 1739, he next year produced *Memoirs of the Life and Actions of Oliver Cromwell, as delivered in Three Panegyrics of Noll, written in Latin, and supposed to have been composed by John Milton, Latin Secretary to Cromwell;* also, *New Memoirs of the Life and Poetical Works of Mr John Milton, with an Examination of Milton's Style, and Explanatory and Critical Notes on different passages in Milton and Shakspeare*, together with sundry poetical effusions, "in imitation of Milton." At his death in 1743, this singularly industrious author is said to have had no fewer than nine different works in contemplation.

PECKHAM, a large suburban hamlet of London, in the county of Surrey, 4 miles S.S.E. of the metropolis, consists of a long line of handsome edifices. Among its numerous churches belonging to different sects there are some handsome buildings. It has several schools, a lunatic asylum, and a large silk factory. Pop. (1851) 19,444.

PEDAL (*pedale* in Italian) is a musical term of various meanings. For example, *pedal* means one of the largest pipes, or one of the foot-keys, of an organ; or the foot-piece attached to a piano-forte, a harp, or the like, and by which, in the former, the intensity of the sound is modified, and, in the latter, the chromatic changes of intonation are produced. It also signifies a particular sort of passage in the course of a piece of music, where the harmony moves upon a sustained sound, which is either the dominant or the tonic of the key. (See MUSIC.) (G. F. G.)

PEDESTAL. See Glossary to ARCHITECTURE.

PEDIMENT. See Glossary to ARCHITECTURE.

PEDOMETER (πούς, *a foot*, and μέτρον, *a measure*), an ingenious instrument in the form of a watch, designed to ascertain the space of ground over which one has travelled. Of the various contrivances of this sort, that of Payne, watchmaker in Bond Street, London, is decidedly the most convenient. The instrument is so arranged that when the body of the traveller is raised by the spring of his foot in walking, or by the motion of his horse, a small lever is jerked downwards which communicates its motion to the wheel-work of the machine. The distance passed over is pointed out in miles on a dial-plate, by means of an index. In adapting the pedometer to carriage travelling, the ordinary horizontal position of the lever becomes perpendicular, and the instrument is allowed to oscillate like a pendulum.

PEEBLESSHIRE, or TWEEDDALE, a county in Scotland, situated between 55. 24. and 55. 50. N. Lat., and between 2. 45. and 3. 23. W. Long. It is bounded on the N. by Mid-Lothian or Edinburghshire, E. by Selkirkshire, S. by Dumfriesshire, and W. by Lanarkshire. Its greatest extent from N. to S. is about 30 miles, and its greatest breadth from E. to W. about 22; the area being 354 square miles, or 226,488 English acres, of which only about an eighth part is fit for cultivation. It is divided into sixteen parishes, twelve of which form the presbytery of Peebles, and four belong to that of Biggar; but all are under the synod of Lothian and Tweeddale.

The surface of this county is hilly, and towards the S. mountainous, the principal high grounds in that quarter being Hartfell, 2635, Broadlaw, 2740, and Dollarlaw, 2790 feet above the level of the sea. None of the southern counties of Scotland have so great a general elevation as Peeblesshire; yet, with few exceptions, the hills are covered with green herbage, and afford good sheep pasture. On the banks of its streams are many pleasant and fertile spots, and the large extent of young plantation has added greatly to the amenity of the district, which was formerly very bare of timber. The soil of the cultivated land, lying chiefly on the sides of the lower hills and the banks of the streams, is for the most part a light loam, with clay, moss, and moor on the high grounds. Graywacke, both massive and slaty, is the prevailing rock in the S. and middle of the county, and there are many good quarries in the neighbourhood of Peebles, though in other places it is too laminated in its structure to be good for building. In the northern parts old red sandstone is the principal formation. Coal, limestone, and freestone abound in the parishes of Linton and Newlands, on the N. side of the county, and are profitably worked in the former of these parishes; in the latter ironstone is also found. At Stobo, slate of a good quality is quarried, and sold with advantage to the proprietor. In the parish of Traquair there is also a slate quarry, but the increased use of Welsh slates has affected the demand. The river Tweed, from which this district is often called Tweeddale, rises from a well of the same name, in the parish of Tweedsmuir, in the south-western extremity of the county, about 1500 feet above the level of the sea, and, flowing first N.E. and then E., dividing the county into two nearly equal parts, it passes into Selkirkshire at Gatehope Burn, after a winding course of about 36 miles. The Annan and the Clyde have their source in the same hill. Of the other streams, here called *waters*, the most considerable are Biggar, Lyne, Peebles or Eddlestone, Leithen, Manner, and Quair, which fall into the Tweed; and the North and South Esks, which pursue their course into Mid-Lothian. The lakes or lochs are St Mary's, Waterloch, and Slipperfield. These, as well as the rivulets, abound in the common fresh-water fish, and most of the streams are occasionally visited by a few salmon; but these are not found in such numbers during the fishing season, even in the Tweed, within the bounds of this county, as to afford a fishery that will pay rent.

The climate of Peeblesshire, owing to its elevation, is sharp and bracing, but as regards its other characteristics is similar to the rest of the south of Scotland.

As this is almost exclusively a pastoral country, the farms are in general large, most of them being from 1000 to 4000 acres. On the arable land they are small, the greater number being below 100 acres. These are in general held on leases for nineteen years, as in other parts of Scotland. The average rental in 1843 was above 6s. an acre. This is chiefly derived from live stock, especially sheep, of which there may be about 120,000. These were formerly of the black-faced heath variety, sometimes called Tweeddale sheep, from the name of the county, or Linton sheep, from the name of a village on the northern side of the district, where great fairs are held for the sale of them; but for a number of years the Cheviot breed, which bears a much more valuable fleece, has been established on many of the lower hills, and the majority of those now fed in the county are of this variety. The crops are the same as in other parts of Scotland, excepting that wheat is cultivated only upon a very small scale. A variety of oats, called the *red oat*, and sometimes the *Magbiehill oat*, from its being first cultivated here on that estate, is very well adapted to

Peebles.

high and exposed situations, both because it ripens earlier than the common kind, and is less liable to be beaten out by wind, whilst on good land it is found to be highly productive.

Peeblesshire contains numerous noblemen's and gentlemen's seats, some of which are remarkable for antiquity or beauty. The principal of these are:—Nidpath Castle, belonging to the Earl of Wemyss; Traquair House, to the Earl of Traquair; Darnhall, to Lord Elibank; King's-Meadows, to Sir Adam Hay, Bart.; Stobo Castle, to Sir Graham-Graham Montgomery, Bart., and others. The old valued rental was L.4328; the new valuation for 1858–9 was L.78,361. The number of proprietors is 193. The principal remains of antiquity are rude monumental stones at Stobo and Gatehope; Roman camps at Lyne, Linton, and Manner; and British chesters, or hill forts, in various places. Drochil Castle in the parish of Newlands, which, however, was never finished, and Nidpath Castle in the parish of Peebles, are the only two which are in tolerable preservation; but vestiges of ancient castles or towers abound in the whole valley of the Tweed. The remains of the Castle of Tinnes or Thanes are 6 feet in thickness, and the mortar is as hard as the stone.

The county is traversed by numerous roads, which are kept in good repair. The principal are those which lead from Peebles to Edinburgh, Glasgow, Dumfries, and Melrose. The town of Peebles is also connected by railway with Edinburgh. The principal towns or villages in Peeblesshire are, Peebles, Linton, Eddlestone, Skirling, Broughton, and Innerleithen. At this last place there is a mineral well, which annually attracts numerous visitors to the village; and both Peebles and Innerleithen have become favourite resorts for summer visitors. Several woollen manufactories are in operation in Innerleithen.

According to the census of 1851, Peeblesshire contained in all 31 places of worship, of which 13 belonged to the Established Church, 8 to the Free Church, 5 to the United Presbyterians, 2 to the Episcopalians, and 1 to the Independents. There were at the same time 28 day-schools, with 1526 scholars; and 19 Sunday schools, with 879 scholars. The county, including the town of Peebles, returns one member to the House of Commons. The parliamentary constituency in 1857 was 389. Pop. (1811) 9935; (1821) 10,046; (1831) 10,578; (1841) 10,499; (1851) 10,738.

PEEBLES, the county town of Peeblesshire, stands on the left bank of the river Tweed, here crossed by a bridge of five arches, 22 miles S. of Edinburgh, with which it is connected by railway. The Eddleston Water, which here joins the Tweed, flows through the town, dividing it into an old and a new portion. The latter contains many substantial buildings; and since the completion of the railway numerous elegant villas have been built for summer residences. Peebles possesses a parish church, a Free church, and places of worship for United Presbyterians, Episcopalians, and Roman Catholics; also a town-house, jail, grammar-school, and scientific institute. The Chambers' Institution, the gift of William Chambers, Esq., to his native place, is a picturesque suite of buildings, containing reading-room, gallery of art, library, museum, and public hall. Peebles is not noted for any particular trade or manufacture. It was long a hunting residence of the Scottish kings, and Alexander III. founded here in 1260 a monastery for Red Friars, some remains of which still exist. In 1357 it sent two members to Parliament. It was destroyed by the English in 1545, but was afterwards rebuilt and surrounded by walls, which continued standing till 1707. The burgh is governed by a provost, 2 bailies, a treasurer, dean of guild, and 7 councillors: municipal constituency, 97. The annual revenue of the burgh property is about L.300. The annual value of real property in the burgh in 1858–9 was L.4592. Pop. (1851) 1982; inhabited houses, 310.

Peel.

PEEL, THE RIGHT HONOURABLE SIR ROBERT, *Bart.*, twice prime minister, and for many years the leading statesman of England, was born on the 5th of February 1788 in a cottage near Chamber Hall, the seat of his family, in the neighbourhood of Bury—Chamber Hall itself being at the time under repair. He was a scion of that new aristocracy of wealth which sprang from the rapid progress of mechanical discovery and manufactures in the latter part of the eighteenth century. His ancestors were Yorkshire yeomen in the district of Craven, whence they migrated to Blackburn in Lancashire. His grandfather, Robert Peel, first of Peelfold, and afterwards of Brookside, near Blackburn, was a calico-printer, who, appreciating the discovery of his townsman Hargreaves, took to cotton-spinning with the spinning-jenny, and grew a wealthy man. His father Robert Peel, third son of the last named, carried on the same business at Bury, with still greater success, in partnership with Mr Yates, whose daughter Ellen he married; made a princely fortune; became the owner of Drayton Manor, and member of Parliament for the neighbouring borough of Tamworth; was a trusted and honoured, as well as ardent, supporter of Mr Pitt; contributed magnificently towards the support of that leader's war policy; was rewarded with a baronetcy; and founded a rich and powerful house, on whose arms he emblazoned, and in whose motto he commemorated, the prosperous industry from which it sprang. The great minister was always proud of the self-won honours of his family; and as a public man his heart strongly felt the bias of his birth. He was sent, however, to be educated with the sons of the old nobility and gentry at Harrow, one of the most aristocratic of English schools, and at Christ Church, then the most aristocratic of English colleges. At Harrow, according to the accounts of his contemporaries, he was a steady, industrious boy; the best scholar in the school; fonder of solitary walks than of the games of his companions, but ready to help those who were duller than himself; and not unpopular among his fellows. At Christ Church, where he entered as a gentleman commoner, he studied hard, and was the first who, under the new examination statutes, took a first class both in classics and in mathematics. His examination in the Schools for his B.A. degree in Michaelmas term 1808 was an academical ovation in presence of a numerous audience, who came to hear the first man of the day; and a relation who was at Oxford at the time has recorded that the triumph, like both the triumphs and reverses of after-life, was calmly borne. From his classical studies Sir Robert derived not only the classical, though somewhat pompous character of his speeches, and the Latin quotations with which they were often happily interspersed, but something of his lofty ideal of political ambition. Nor did he ever cease to love these pursuits of his youth; and in 1837, when elected lord rector of Glasgow university, he, in his inaugural speech, passed a glowing eulogy on classical education. To his mathematical training, which was then not common among public men, he no doubt owed in part his method, his clearness, his great power of grasping steadily and working out difficult and complicated questions. His speeches show that, in addition to his academical knowledge, he was well versed in English literature, in history, and in the principles of law. In after-life he had a taste for art, though none for music, and took an interest in science, though he had no scientific education. While reading hard, he did not neglect to develop his tall and vigorous frame, and fortify his strong constitution, by manly and gentlemanlike exercises; and though he lost his life partly through his bad riding, he was always a good shot and an untiring walker after game. Sprung from the most religious class of English society, he grew up and remained through life a religious man; and from that source drew deep conscientiousness and tranquillity under all difficulties and in all fortunes.

His Oxford education confirmed him in the principles of the Protestant Church of England. His practical mind remained satisfied with the doctrines of his youth; and he never showed that he had studied the great religious controversies, or that he understood the great religious movements of his day.

In 1809, being then in his twenty-second year, he was brought into Parliament for the close borough of Cashel, which he afterwards exchanged for Chippenham; and commenced his parliamentary career under the eye of his father, then member for Tamworth, who fondly saw in him the future leader of the Tory party. Pitt, Fox, and Burke were gone. Sheridan shone with an expiring ray. But in that House of Commons sat Wilberforce, Windham, Tierney, Grattan, Perceval, Castlereagh, Plunkett, Romilly, Mackintosh, Burdett, Whitbread, Horner, Brougham, Parnell, Huskisson, and above all, George Canning. Lord Palmerston entered the House at the same time, and Lord John Russell a few years afterwards. Among these men young Peel had to rise. And he rose, not by splendid eloquence, by profound political philosophy, or by great originality of thought, but by the closest attention to all his parliamentary duties, by a study of all the business of Parliament, which made him at length perfect master of all public questions and of all public interests, and by a style of speaking which, owing its force not to high flights of oratory, but to knowledge of the subject in hand, clearness of exposition, close reasoning, and tact in dealing with a parliamentary audience, backed by the character and position of the speaker, improved with his information, practice, station, and experience, till it gave him an unrivalled command over the House of Commons. The Tory party was then all-powerful at home; while abroad Europe was at the feet of Napoleon. But Napoleon's fortune was about to turn; and with the close of the struggle against revolutionary France, political progress in England was soon to resume the march which that struggle had arrested. Young Peel's lot, however, was cast, through his father, with the Tory party. In his maiden speech, seconding the Address, he defended the Walcheren expedition, which he again defended soon afterwards against the report of Lord Porchester's committee. It is said that even then Lord Liverpool discerned in him a dangerous tendency to think for himself, and told his father that he must be put at once into the harness of office. Into the harness of office, at all events, he was put, being made Under-Secretary for the Colonies by Mr Perceval in 1811. In 1812, being then only in his twenty-fifth year, he was transferred by Lord Liverpool to the more important but unhappy post of Secretary for Ireland. There he was engaged till 1817 in maintaining, by insurrection acts and other repressive measures, English and Protestant ascendancy over a country heaving with discontent, teeming with conspiracy, and ever ready to burst into rebellion. A middle course between Irish parties was impossible. Mr Peel became by the necessity of his situation "Orange Peel," and plied the established engines of coercion and patronage with a vigorous hand. At the same time, it was his regular task to combat Grattan, Plunkett, Canning, and the other movers and advocates of Catholic emancipation in the House of Commons. He, however, always spoke on this question with a coolness of temper wonderful in hot youth, with the utmost courtesy towards his opponents, and with warm expressions of sympathy and even of admiration for the Irish people. Nor was the ground he took against the Catholics that of religious principle never to be abandoned, but that of political expediency, which political necessity might overcome. He also, thus early, did his best to advocate and promote secular education in Ireland as a means of reconciling sects and raising the character of the people. He materially improved the conduct of ordinary business in his office, and gave great satisfaction to merchants and others with whom he had to deal. But his greatest service to Ireland as secretary was the institution of the regular Irish constabulary, nicknamed after him "Peelers," for the protection of life and property in a country where neither life nor property were secure. His moderation of tone did not save him from the violent abuse of O'Connell, whom he, young, hot-tempered (though his temper was generally under perfect control), and sensitive on the point of honour, was ill-advised enough to challenge,—an affair which covered them both with ridicule at the time, and left O'Connell his bitter enemy for life. In 1817 he obtained the highest parliamentary distinction of the Tory party, by being elected member for the university of Oxford—an honour for which he was chosen in preference to Canning on account of his hostility to Catholic emancipation, Lord Eldon lending him his best support. In the following year he resigned the Irish secretaryship, of the odious work of which he had long been very weary, and remained out of office till 1822. But he still supported government with official zeal, even in the question of the "Peterloo massacre." In the affair of Queen Caroline, however, he stood somewhat aloof, not approving the cause of government, and sensitive to popular opinion; and when Canning retired on account of this affair, he declined Lord Liverpool's invitation to take the vacant place in the cabinet. During this break in his tenure of office he had some time for reflection, which there was enough in the aspect of the political world to move. But early office had done its work. It had given him excellent business habits, great knowledge, and a high position; but it had made him somewhat stiff, somewhat punctilious, somewhat too cold and reserved to win the hearts of those whose confidence he might command, and somewhat over anxious for formal justifications when he had better have left the essential patriotism and probity of his conduct to the judgment of men of honour and the heart of the people. At the same time he was no pedant in business; in corresponding on political subjects he loved to throw off official forms, and communicate his views with the freedom of private correspondence; and where his confidence was given, it was given without reserve.

At this period he was made chairman of the Bullion Committee, on the death of Mr Horner. He was chosen for this important office by Mr Huskisson, Mr Ricardo, and their fellow Economists, who saw in him a mind open to conviction, though he owed hereditary allegiance to Pitt's financial policy, and had actually voted with his Pittite father for a resolution of Lord Liverpool's government denying the existence of any depreciation in the paper currency. The choice proved judicious. Mr Peel was converted to the currency doctrines of the Economists, and proclaimed his conversion in a great speech on the 24th of May 1819, in which he moved and carried four resolutions embodying the recommendations of the Bullion Committee in favour of a return to cash payments. His financial reputation was made, and his currency doctrines were fixed, from that hour; and his co-operation with the Economists on this occasion gave a liberal turn to his commercial principles. At the same time, he somewhat diverged from his party, and particularly from his father, who remained faithful to Mr Pitt's depreciated paper, and between whom and his schismatic son a solemn and touching passage occurred in the debate. The author of the Cash Payments Act had often to defend his policy; and he generally defended it firmly, though he may be said to have given way in being a party to the Small Notes Respite Act of 1822. The act has been often said to have been hard on the debtor interest, including the nation as debtor, because it required debts to be paid in cash which had been contracted in depreciated paper; and Mr Peel, as heir to a great fundholder, was even charged with being biassed by his personal inter-

ests. But it is answered that the Bank Restriction Acts, under which the depreciated paper had circulated, themselves contained a provision for a return to cash payments six months after peace.

In 1820 Mr Peel married Julia, daughter of General Sir John Floyd, who bore him five sons and two daughters. One of his sons, Frederick, he lived to see a rising man in the House of Commons; while another, William, the sailor, has run a bright course in another sphere, and found a glorious grave. The writers who have most severely censured Sir Robert Peel as a public man, have suspended their censures to dwell on the virtues of his private and domestic life. It was virtuous and it was happy, drawing happiness from the purest source. He was not only a most loving husband and father, but a true and warm-hearted friend. In Whitehall Gardens or at Drayton Manor he gladly opened his mind, wearied with the cares of state, to the enjoyments of a circle in which it was his pleasure and his pride to gather some of the most distinguished intellects of the day. He loved free and cheerful talk, in which he showed a keen sense of the ridiculous, and a dry, sarcastic humour; which often broke out also in his speeches in the House of Commons. He loved the conversation of men of science; he loved art, and was a great collector of pictures; he loved farming and agricultural improvements; he loved promoting useful works, and the advancement of knowledge; he loved making his friends, dependents, tenants, and neighbours happy. And, cold as he was in public, even to those whom he desired to win, yet in his gay and social hour, few men whose minds were so laden could be gayer or more social than Sir Robert Peel.

In 1822 Mr Peel consented to strengthen the enfeebled ministry of Lord Liverpool by becoming Home Secretary; and in that capacity he had again to undertake the office of coercing the growing discontent of Ireland, of which he remained the real administrator, and had again to lead in the House of Commons the opposition to the rising cause of Catholic emancipation. In 1825, being beaten on the Catholic question in the House of Commons, he wished to resign office; but Lord Liverpool pleaded that his resignation would break up the government. He found a happier and more congenial task in reforming and humanizing the criminal law, especially those parts of it which relate to offences against property and offences punishable by death. The five acts in which Mr Peel accomplished this great work, the first step towards a complete and civilized code, as well as the great speech of March 9, 1826, in which he opened the subject to the House, will form one of the most solid and enduring monuments of his fame. Criminal law reform was the reform of Romilly and Mackintosh, from the hands of the latter of whom Peel received it. But the masterly bills in which it was embodied were the bills of Peel,—not himself a creative genius, but, like the founder of his house, a profound appreciator of other men's creations, and unrivalled in the power of giving them practical and complete effect. This great measure, beyond the sphere of party, was probably also another step in the emancipation of Mr Peel's mind.

In 1827 the Liverpool Ministry was broken up by the fatal illness of its chief; and under the new premier, George Canning, Mr Peel, like the Duke of Wellington and other high Tory members of Lord Liverpool's cabinet, refused to serve. Mr Canning and Mr Peel were rivals; but we need not interpret as mere personal rivalry, that which was certainly in part at least a real difference of connection and opinion. Canning took a Liberal line, and was supported by many of the Whigs; the seceders were Tories, and it is difficult to see how their position in Canning's cabinet could have been otherwise than a false one. Separation led to public coolness and occasional approaches to bitterness on both sides in debate. But there seems no ground for saying that Mr Peel "hunted Canning to death." Canning himself said to a friend, who reported it to Sir Robert Peel, that "Peel was the only man who had behaved decently towards him." Their private intimacy remained uninterrupted to the end; and Canning's son afterwards entered public life under the auspices of Peel. The charge of having urged Catholic emancipation on Lord Liverpool in 1825, and opposed Mr Canning for being a friend to it in 1827, made against Sir Robert Peel in the fierce corn-law debates of 1846, has been withdrawn by those who made it.

In January 1828, after Canning's death, the Duke of Wellington formed a Tory government, destined to be the last, in which Mr Peel was Home Secretary, leader of the House of Commons, and probably virtual prime minister. Of this cabinet, Tory as it was, the impracticable Lord Eldon was not a member, and Mr Huskisson and four more of Canning's friends were. Its policy was to endeavour to stave off the growing demand for organic change by administrative reform, and by lightening the burdens of the people. The civil list was retrenched with an unsparing hand, and the public expenditure was reduced lower than it had been since the Revolutionary war, or has been since. Mr Peel also introduced into London the improved system of police which he had previously introduced with so much success into Ireland. But the tide ran too strong to be thus headed. First the government were compelled, after a defeat in the House of Commons, to acquiesce in the repeal of the Test and Corporation Acts, Mr Peel bringing over their High Church supporters, as far as he could, through Dr Lloyd, Bishop of Oxford, his tutor at Christ Church, and now his beloved friend and the partner of his counsels in political matters affecting the interests of the Church. Immediately afterwards, the question of Catholic emancipation was brought to a crisis by the menacing power of the Catholic Association and the election of O'Connell for the county of Clare. Mr Peel expressed to the Duke of Wellington his conviction that the Catholic question must be settled. The Duke consented. The consent of the king, which could scarcely have been obtained except by the Duke and Mr Peel, was extorted, withdrawn (the ministers being out for a few hours), and again extorted; and on the 5th of March 1829, Mr Peel proposed Catholic emancipation in a speech of five hours and a half, which was listened to with unflagging attention, and concluded amidst cheers which were heard in Westminster Hall. The apostate was overwhelmed with obloquy. Having been elected for the University of Oxford as a leading opponent of the Catholics, he had thought it right to resign his seat on being converted to emancipation. His friends put him again in nomination, but he was defeated by Sir R. H. Inglis, though the great majority of distinction and intellect was on his side. He took refuge in the close borough of Westbury, whence he afterwards removed to Tamworth, for which he sat till his death—preferring that secure and friendly connection to the offers of larger constituencies. Catholic emancipation was forced on Mr Peel by circumstances; but it was mainly owing to him that the measure was thorough, and unclogged by invidious conditions. This great concession, however, did not save the Tory government. The French Revolution of July 1830 gave fresh strength to the movement against them, though, schooled by the past, they promptly recognised King Louis Philippe. The parliamentary reform movement was joined by some of their offended Protestant supporters. The Duke of Wellington committed them fatally against all reform, first by cashiering Mr Huskisson for voting in favour of giving the forfeited franchise of East Retford to Birmingham, and then by a violent anti-reform declaration in the House of Lords. The elections went against them on the demise of the Crown; they were compelled, by popular feeling, to

put off the king's visit to the city; they were beaten on Sir H. Parnell's motion for a committee on the civil list, and resigned.

While in office, Mr Peel succeeded to the baronetcy, Drayton Manor, and a great estate, by the death of his father, May 3, 1830. The old man had lived to see his fondest hopes fulfilled in the greatness of his son; but he had also lived to see that a father must not expect to fix his son's opinions,—above all, the opinions of such a son as Sir Robert Peel, and in such an age as that which followed the French Revolution.

The ability and obstinacy of Sir Robert Peel's opposition to the Reform Bill won back for him the allegiance of his party. His opposition was able and obstinate; but it was temperate, and not such as to inflame the fierce passions of the time, delay the return of civil peace, or put an insurmountable barrier between his friends and the more moderate among their opponents. Once only he betrayed the suppressed fire of his temper. It was in the famous debate of the 22d April 1831, when his speech was broken off by the arrival of the king to dissolve the Parliament which had thrown out reform. He refused to join the Duke of Wellington in the desperate enterprize of forming a Tory government at the height of the storm, when the Grey ministry had gone out on the refusal of the king to promise them an unlimited creation of peers. By this conduct he secured for his party the full benefit of the reaction which was sure, and which he no doubt knew was sure, to ensue. The general election of 1832, after the passing of the Reform Bill, left him with barely a hundred followers in the House of Commons; but this handful rapidly swelled under his management into the great Conservative party. He frankly accepted the Reform Act, stamped it as final, taught his party to register instead of despairing, appealed to the intelligence of the middle classes, whose new-born power he appreciated, steadily supported the Whig ministers against the Radicals and O'Connell, and gained every moral advantage which the most dignified and constitutional tactics could afford. The changes which the Reform Bill necessarily drew with it, such as municipal reform, he rather watched in the Conservative interest than strongly opposed. To this policy, and to the great Parliamentary powers of its author, it was mainly due that, in the course of a few years, the Conservatives were as strong in the reformed Parliament as the Tories had been in the unreformed. It is vain to deny the praise of genius to such a leader, though his genius may have been of a practical, not of a speculative or imaginative kind. Nor is it wonderful if the skill of such a pilot, and a pilot who had steered for many years over such waters, sometimes resembled craft. His skill sometimes resembled craft; but the Duke of Wellington's emphatic eulogy on him was, "Of all the men I ever knew, he had the greatest regard for truth." The Duke might have added that his own question, "How is the King's government to be carried on in a reformed Parliament?" was mainly solved by the temperate and constitutional policy of Sir Robert Peel, and by his personal influence on the debates and proceedings of the House of Commons during the years which followed the Reform Act.

In 1834, on the dismissal of the Melbourne ministry, power came to Sir Robert Peel before he expected or desired it. He hurried from Rome at the call of the Duke of Wellington,—whose sagacious modesty knew his superior in politics, and yielded him the first place,—and became Prime Minister, holding the two offices of First Lord of the Treasury and Chancellor of the Exchequer. He vainly sought to include in his cabinet the two recent seceders from the Whigs, Lord Stanley and Sir James Graham. A dissolution gave him a great increase of strength in the House, but not enough. He was beaten on the election of the Speaker at the opening of the session of 1835, and, after struggling on for six weeks longer, was finally beaten, and resigned on the question of appropriating the surplus revenues of the Church in Ireland to national education. His time had not yet come; but the capacity, energy, and resource he displayed in this short tenure of office raised him immensely in the estimation of the House, his party, and the country. Of the great budget of practical reforms which he brought forward, the plan for the commutation of tithes, the ecclesiastical commission, and the plan for settling the question of dissenters' marriages, bore fruit, then or afterwards. His scheme for settling the question of dissenters' marriages, framed in the amplest spirit of liberality, was a striking instance of his habit of doing thoroughly and without reserve that which he had once made up his mind to do.

From 1835 to 1840 he pursued the same course of patient and far-sighted opposition, the end of which, sure, though distant, was not only office, but power. In 1837 the Conservative members of the House of Commons, with victory now in sight, gave their leader a grand banquet at Merchant Taylors' Hall, where he proclaimed, in a great speech, the creed and objects of his party. In 1839, the Whigs being beaten on the Jamaica question, he was called on to form a government, but failed, through the refusal of the Queen, by advice of Lords John Russell and Palmerston, to part with the ladies of her bedchamber, whom he believed, or professed to believe it essential to replace by ladies not connected with his political opponents. His time was not even yet fully come. In 1840 he was hurried, it is believed, by the ardour of his followers, into a premature motion of want of confidence, which was brought forward by Sir John Yarde Buller, and failed. But in the following year a similar motion was carried by a majority of one, and the Whigs were compelled to appeal to the country. The result was a majority of ninety-one against them, on a motion of want of confidence in the autumn of 1841; upon which they resigned; and Sir Robert Peel becoming First Lord of the Treasury, with a commanding majority in both Houses of Parliament, the country in his favour, and a staff of colleagues and subordinates unrivalled perhaps in the annals of English administrations, grasped with no doubtful grasp the reins of power.

The crisis called for a master-hand. The finances were in disorder. For some years there had been a growing deficit, which for 1841 was upwards of two millions, and attempts to supply this deficit by additions to assessed taxes and customs duties had failed. Distress and discontent reigned in the country, especially among the trading and manufacturing classes. The great financier took till the spring of 1842 to mature his plans. He then boldly supplied the deficit by imposing an income-tax on all incomes above a certain amount. He accompanied this tax with a reform of the tariff, by which prohibitory duties were removed and other duties abated on a vast number of articles of import, especially the raw materials of manufactures and prime articles of food. The increased consumption, as the reformer expected, countervailed the reduction of duty. The income-tax was renewed, and the reform of the tariff carried still further on the same principle, in 1845. The result was, in place of a deficit of upwards of two millions, a surplus of five millions in 1845, and the removal of seven millions and a half of taxes up to 1847, not only without loss, but with gain to the ordinary revenue of the country. The prosperous state of the finances and of public affairs also permitted a reduction of the interest on a portion of the national debt, giving a yearly saving at once of L.650,000, and ultimately of a million and a quarter to the public. In 1844 another great financial measure, the Bank Charter Act, was passed, and, though severely controverted, and twice suspended at a desperate crisis, has ever since regulated the currency of the country. In Ireland, O'Connell's agi-

tation for the repeal of the Union had now assumed threatening proportions, and verged upon rebellion. The great agitator was prosecuted, with his chief adherents, for conspiracy and sedition; and though the conviction was quashed for informality, Repeal was quelled in its chief. At the same time a healing hand was extended to Ireland. The Charitable Bequests Act gave Roman Catholics their fair share in the administration of charities, and legal power to endow their own religion. The allowances to Maynooth were largely increased, notwithstanding violent Protestant opposition. Three queen's colleges, for the higher education of all the youth of Ireland, without distinction of religion, were founded, notwithstanding violent opposition, both Protestant and Roman Catholic. The principle of toleration, once accepted, was thoroughly carried out. The last remnants of the penal laws were swept from the statute-book, and justice was extended to the Roman Catholic Church in Canada and Malta. In the same spirit acts were passed for clearing from doubt Irish Presbyterian marriages, for quieting the titles of a large number of Dissenters' chapels in England, and removing the municipal disabilities of the Jews. The grant for national education was trebled, and an attempt was made, though in vain, to introduce effective education clauses into the factory bills. To the alienation of any part of the revenues of the Established Church, Sir Robert Peel, a Conservative to the last, never would consent; but he had issued the Ecclesiastical Commission, and he now made better provision for a number of populous parishes by a redistribution of part of the revenues of the church. The weakest part of the conduct of this great government, perhaps, was its failure to control the railway mania by promptly laying down the lines on a government plan. It had prepared a palliative measure in 1846, but was compelled to sacrifice this, like all other secondary measures, to the repeal of the Corn Laws. It failed also, though not without an effort, to avert the great schism in the Church of Scotland. Abroad it was as prosperous as at home. It had found war in China and disaster and disgrace in Affghanistan. It speedily ended the war in China with success, and that in Affghanistan with honour. By the hand of its Governor-General of India, the invading Sikhs were destroyed upon the Sutlej. M. Guizot has said that the objects—not only the ostensible, but the real objects—of Sir Robert Peel's foreign policy were peace and justice among nations. The angry and dangerous questions with France touching the right of search, the war in Morocco, and the Tahiti affair, and the angry and dangerous questions with the United States touching the Maine boundary and the Oregon territory, were happily settled by frank and patient negotiation. In this, and in other parts of his administration, Sir Robert Peel was well seconded by the ability of his colleagues; but the Premier himself was the soul of all.

But there was a canker in all this greatness. There were malcontents in Sir Robert Peel's party whose presence often caused embarrassment, and twice collision and scandal. The Young Englanders disliked him because he had hoisted the flag of Conservatism instead of Toryism on the morrow of the Reform Bill. The strong philanthropists and Tory Chartists disliked him because he was a strict economist and an upholder of the new poor law. But the fatal question was protection. That question was being fast brought to a crisis by public opinion and the Anti-Corn Law League. Sir Robert Peel had been long in principle a free trader. Since his accession to power a new responsibility had fallen on him, which compelled him to think less of a class and more of the people. He had expressed to M. Guizot a deep, nay, a passionate conviction that something must be done to relieve the suffering and precarious condition of the labouring classes. He had lowered the duties of the sliding scale, and thereby caused the secession from the cabinet of the Duke of Buckingham. He had alarmed the farmers by admitting foreign cattle and meat under his new tariff, and by admitting Canadian corn. He had done his best in his speeches to put the maintenance of the corn laws on low ground, and to wean the landed interest from their reliance on protection. But to protection the landed interest remained wedded; and it is hard to say how far Sir Robert Peel himself dreaded the consequences of repeal to the steadiness of prices and to mortgaged estates. The approach of the Irish famine in 1845 decisively turned the wavering balance. The ports must be opened, and being opened, they could not again be closed. The Clare election and Catholic Emancipation were played over again. Sir Robert proposed to his cabinet the repeal of the corn laws. Lord Stanley and the Duke of Buccleuch dissented, and Sir Robert resigned. But Lord John Russell failed to form a new government. Sir Robert again came into office; and now, with the consent of all the cabinet but Lord Stanley, who retired, he, in a great speech on the 27th January 1846, brought the repeal of the Corn Laws before the House of Commons. In the long and fierce debate that ensued he was overwhelmed, both by political and personal enemies, with the most virulent invective, which he bore with his wonted calmness, and to which he made no retorts. His measure was carried; but immediately afterwards the offended Protectionists, goaded by Lord George Bentinck and Mr Disraeli, coalesced with the Whigs, and threw him out on the Irish Coercion Bill. He went home from his defeat, escorted by a great crowd, who uncovered as he passed, and immediately resigned. So fell a Conservative government, which would otherwise have probably ended only with the life of its chief. Those who overthrew Sir Robert Peel have dwelt on what they naturally believe to have been the bitterness of his fall. It is certain that he was deeply pained by the rupture with his party; but it is doubtful whether otherwise his fall was so bitter. For evening had begun to steal over his long day of toil; he had the memory of immense labours gone through, and of great things achieved in the service of the state; he had a kingly position in the country, great wealth, fine tastes, and a happy home.

Though out of office he was not out of power. He had "lost a party, but won a nation." The Whig ministry which succeeded him leant much on his support, with which he never taxed them. He joined them in carrying forward free trade principles by the repeal of the Navigation Laws. He joined them in carrying forward the principle of religious liberty by the bill for the emancipation of the Jews. One great measure was his own. It was the Encumbered Estates Bill for Ireland, which transferred the land of that country from ruined landlords to solvent owners capable of performing the duties of property towards the people. While in office he had probed, by the Devon Commission of Inquiry, the mortal sore which the Encumbered Estates Act healed. On the 28th of June 1850 he made a great speech on the Greek question against Lord Palmerston's foreign policy of interference. This speech being against the government, was thought to show that he was ready to return to office. It was his last. On the following day he was thrown from his horse on Constitution Hill, and mortally injured by the fall. Three days he lingered in all the pain which the quick nerves of genius can endure. On the fourth (July 2, 1850) he took the sacrament, bade a calm farewell to his family and friends, and died; and a great sorrow fell on the whole land. All the tributes which respect and gratitude could pay were paid to him by the Sovereign, by parliament, by public men of all parties, by the country, by the press, and, above all, by the great towns and the masses of the people to whom he had given "bread unleavened with injustice." He would

have been buried among the great men of England in Westminster Abbey, but his will desired that he might be laid in Drayton church. It also renounced a peerage for his family, as he had before declined the garter for himself when offered him by the Queen through Lord Aberdeen.

Those who judge Sir Robert Peel will remember that he was bred a Tory in days when party was a religion; that he entered parliament a youth, was in office at twenty-four, and secretary for Ireland at twenty-five; that his public life extended over a long period rife with change; and that his own changes were all forwards and with the advancing intellect of the time. They will enumerate the great practical improvements, and the great acts of legislative justice of those days,—Catholic emancipation, freedom for Dissenters, free trade, the great reforms in police, criminal law, currency, finance, the Irish Encumbered Estates Act, even the encouragement of agricultural improvement by loans of public money,—and consider how large a share Sir Robert Peel had, if not in originating, in giving thorough practical effect to all. They will consider, that of what he did nothing has been undone. They will reflect that, as a parliamentary statesman he could not govern without a party, and that it is difficult to govern at once for a party and for the whole people. They will compare his administration with those that preceded and those that followed, and the state and fortunes of his party when he was at its head, with its state and fortunes after his fall. They will think of the peace and good-will which his foreign policy diffused over Europe. They will think of his ardent love of his country; of his abstinence from intrigue, violence, and faction; of his boundless labour through a long life devoted to the public service. Whether he was a model of statesmanship may be doubted. Models of statesmanship are rare, if by a model of statesmanship is meant a great administrator and party leader, a great political philosopher, and a great independent orator, all in one. But if the question is, whether he was a ruler loved and trusted by the English people, there is no arguing against the tears of a nation.

Those who wish to know more of him will consult his own posthumous Memoirs, edited by Lord Mahon and Mr Cardwell, his literary executors; the four volumes of his Speeches; M. Guizot's *Sir Robert Peel;* Künzel's *Leben und Reden Sir Robert Peel's;* Mr Disraeli's *Life of Lord George Bentinck;* and *The Right Honourable Benjamin Disraeli, M.P., a Literary and Political Biography*, by an anonymous author; as well as the general histories of the time, particularly those of Sir Archibald Alison and Miss Martineau. (G. S.)

PEEL, a market-town and seaport on the west coast of the Isle of Man, 15 miles W.N.W. of Douglas, N. Lat. 54. 14., W. Long. 4. 42. The cathedral of St Germains in the town is now only used as a burying-place; but there is a modern parish church, a Methodist chapel, a grammar-school, and other educational establishments. On a small rocky island, separated from the town by a narrow channel, very shallow at low-water, stands an ancient castle, which occupies a large extent of ground, and contains within its area an old church of St Patrick. The harbour has a pier and a lighthouse; but it is now much neglected. Pop. (1851) 2342.

PEELE, George, an English dramatist of the Elizabethan age, is said to have been born in Devonshire in 1552 or 1553. He was a member of Broadgates Hall (now Pembroke College), Oxford, in 1564. He took his bachelor's degree in 1577; and was made Master of Arts in 1579. Soon after this date, and with the reputation, according to Anthony Wood, of being "a most noted poet in the university," young Peele repaired to the metropolis, adopted the profession of authorship, and occasionally tried his hand at the histrionic art. He seems to have enjoyed a tolerable share of the distinction ordinarily accorded to poets of his time,—viz., extreme poverty. He associated with Marlowe, Greene, Nash, Lodge, and Watson, and seems to have mingled as eagerly in the dissipations of the metropolis as the most dissolute of those gifted men. Peele's character has doubtless suffered, however, from the absurd and obviously fictitious tract entitled *The Merrie Conceited Iests of George Peele*, which represents him as a low and vulgar sharper, rejoicing in rascality, and glorying in the meanest frauds. It is doubtless a counterpart to *Ben Johnson's Jests*, or the yet more preposterous *Merry and Diverting Exploits of George Buchanan, commonly called the King's Fool.* Honest old Dekker introduces us to Peele and his set in the Elysian fields amid the "Grove of Bay Trees," where, seated amid thick laurel, by a stream "that made music in the running," "from them came forth such harmonious sounds that birdes build nests onely in the trees there to teach tunes to their young ones prettily." Peele was not the sweetest singer there, however, for young Kit Marlowe was among them. The date of Peele's death is unknown. He was dead in 1598, as appears from the *Palladis Tamia* of Francis Meres, who informs us, with what truth it is difficult to say, that his end was hastened by his vices.

The earliest of Peele's productions known to us is a copy of verses prefixed to Watson's Ἑκατομπαθία, published about 1581. Besides a number of miscellaneous poems, some of them possessing very great merit, speeches for pageants, &c., we find in Mr Dyce's collection of Peele's writings six dramas in all, but forming not more, in the estimation of that judicious critic, than one-half of his entire dramatic works. In 1584 his pastoral drama of the *Arraignment of Paris* was printed anonymously; but the allusion to it by Peele's friend Nash, in the Preface to Greene's *Arcadia*, 1587, leaves no doubt as to the authorship. *The Famous Chronicle History of King Edward I.* appeared in 1593, and possesses much interest, as well from its extravagance as from its occasional tragic energy. In 1594 was published the anonymous tragedy of *The Battle of Alcazar*, which Malone and Dyce, with some hesitancy, agree in ascribing to Peele. *The Old Wives Tale, a pleasant conceited Comedie*, had been frequently performed before 1595, when it was first published; and possesses the interest of having partly furnished Milton with the plan and character of his *Comus.* It is highly imaginative, but disfigured by buffoonery and extravagance. Peele's greatest performance, *The Love of David and Fair Bethsabe, with the Tragedy of Absolon*, was first printed in 1599, and is characterized by Thomas Campbell (*Spec. of Brit. Poets*, vol. i.) as "the earliest fount of pathos and harmony that can be traced in our dramatic poetry." Charles Lamb, while not quite so enthusiastic about "this canticle of David," has nevertheless rendered the "kingly bower, seated in hearing of a hundred streams," familiar to all readers. (See *Specimens of Eng. Dram. Poets.*) *The Historie of the Two Valiant Knights Sir Clyomon and Sir Clamydes*, printed anonymously in 1599, is attributed to Peele by Mr Dyce, partly on the faith of a manuscript marking on the title-page of an old copy, and partly on internal evidence. Such are the remains of what gained Peele his fame as a dramatist among his contemporaries. "His comedies and tragedies," says Wood, "were often acted with great applause, and did endure reading with due commendation many years after their author's death." (*Athenæ Oxonienses*, vol. i., p. 688.) Peele's close relation to Marlowe and Greene naturally provokes comparison with them. While not to be named beside Marlowe in respect to the depth and power of his tragic genius, and while decidedly below Greene in comic power, he nevertheless deserves a higher place than either as a felicitous versifier. Thomas Campbell alleges,—"There is no such

sweetness of versification and imagery to be found in our blank verse anterior to Shakspeare." (See *The Works of George Peele, with some Account of his Life and Writings*, by Rev. Alex. Dyce, 2 vols., 1828. Improvements and additions appeared with the reprint of 1829; and in 1839 a third volume was added by the same editor.)

PEERS. See NOBILITY, and PARLIAMENT.

PEGASUS. See BELLEROPHON.

PEGAU, a town of Saxony, in the circle of Leipsic, on the left bank of the Elster, 14 miles S.S.W. of Leipsic. It is surrounded by walls; and its chief public building is the handsome church of St Lawrence, containing several monuments. Pop. 3946.

PEGO, a town of Spain, in the province of Alicante, 44 miles N.E. of the town of that name. It is generally clean and well built, and has a court-house, church, schools, hospitals, &c. Woollen stuffs are manufactured here; and there are mills for rice, flour, and oil. Pop. 5565.

PEGU, a British province of Eastern India, lying between N. Lat. 15. 49. and 19. 30., E. Long. 94. 11. and 96. 55., is bounded on the N. by the Burmese empire, E. by the Tenasserim provinces (from which it is separated by the River Sitang), S. by the Gulf of Martaban, and W. by the Bay of Bengal and the province of Arracan; the latter divided from it by the Youmadoung Mountains; length, from N. to S., about 240 miles; breadth, 170. The country is in general level, though it is traversed by several chains of hills. It is watered by the Irawaddy, which flows southwards from Burmah, and falls into the Gulf of Martaban, forming a large delta. The soil is fertile; but agriculture has been much neglected since the conquest of Pegu by the Burmese. Rice is the principal crop raised; and teak timber is also obtained. Tigers, elephants, buffaloes, and deer are the animals that mostly throng the forests and jungles of Pegu. Iron, tin, and lead, as well as rubies, sapphires, and other jewels, are obtained in this country. The government of Pegu is similar to that of the adjacent provinces of Tenasserim and Arracan. The province is divided into six districts, and contains 570,180 inhabitants.

The early history of Pegu consists of little more than a narrative of barbarous and cruel contests between that country and the kingdom of Ava, in which the latter was finally successful, and reduced Pegu to a province of that kingdom, or, as it is generally called, the Burman Empire. The most important events in these wars, as well as those which led to the more recent contests of Burmah with Great Britain, and the addition of Pegu to the British empire, are narrated in the article BURMAH.

The principal towns in the province are Pegu, Prome, and Rangoon, all of which are fortified. Martaban stands on the E. bank of the Salween, 10 miles N.W. of Moulmein. It is built on the slope of a hill, and has several large temples. Though surrounded with a wooden stockade, and protected by a stone battery near the river, the place is not of great strength. It was taken by the British in the Burmese war in 1852, being the first town that fell in that war. Pop. about 6000.

PEGU, the chief town of the above district, stands on the left bank of a river of the same name that flows into the Irawaddy, 58 miles N.E. of Rangoon. It is built in the shape of a quadrangle, and the streets are broad and regular, crossing each other at right angles. The streets are paved with bricks, and the houses, which are built of wood, are elevated on posts above the ground. Of the buildings in the town, the most important is the temple of Shoemadoe, a brick structure, octagonal at the base, and rising in the form of a pyramid or spire. Pegu was destroyed in 1757 by the Burmese, on their final triumph over the country, but it was subsequently rebuilt. In 1824 it was captured by the British, but restored on the conclusion of the first war with Burmah. In 1852 it was again taken, and has since that time been retained. It is said to have contained at one time 150,000 inhabitants.

PEILAU, a town of Prussian Silesia, government of Breslau, and 33 miles S.S.W. of that town. The inhabitants, amounting to 5235, are mostly Moravians, and are chiefly employed in the manufacture of linen and woollen goods.

PEINE FORTE ET DURE (Lat. *pœna fortis et dura*) signifies a species of torture inflicted by English law on those who, being arraigned of felony, refuse to put themselves on the ordinary trial, but stubbornly stand mute.

PEINT, with HURSOOL, a small native state of India, in the presidency of Bombay, is bounded on the N. by the states of Dhurrumpore and Daung, E. by the British district of Ahmednuggur, S. by that of Tannah, and W. by those of Tannah and Surat; length, 46 miles; breadth, 28; area, 750 square miles. As the last rajah died leaving only a daughter, the state is at present managed by the British in trust for her and her children. Pop. 55,000.

PEIPUS. See LIVONIA.

PEIRESC, NICOLAS-CLAUDE-FABRI, *Seigneur de*, born in 1580 at Beaugensier in Provence, was descended from an ancient and noble family which had been originally established at Pisa in Italy. From Avignon, where he had spent five years at the Jesuits' college, he was in 1595 removed to Aix, and entered upon the study of philosophy. It was here, while in the eager pursuit of literature, that his attention was first directed to antiquarian studies by accidentally meeting with a medal of the Emperor Arcadius. On removing to the Jesuits' college at Tournon in 1596, for the study of cosmography, he enjoyed the valuable assistance of Petrus Rogerus, a skilful numismatist. Being recalled by his uncle in 1597, he returned to Aix, and there entered upon the study of the law, relieving the tedium by frequent visits to Bagarr, a most skilful antiquary, afterwards master of the jewels to Henri IV. He visited Italy in 1599, proceeded to Montpellier in 1602, and thence to Aix in 1603, to receive the senatorial dignity just vacated by his uncle.

In the year 1605 he visited Paris, whence he, in 1606, proceeded to England in company with the king's ambassador. He was very graciously received by King James I.; and having seen Oxford, and visited Camden, Sir Robert Cotton, Sir Henry Saville, and other learned men, he passed over to Holland. During his residence in that country he made the acquaintance of Joseph Scaliger at Leyden, and Hugo Grotius at the Hague. On his return to Aix, he was chosen a councillor of the Parliament of that city, where he remained till his death, which occurred in 1637. The death of the "Procureur Géneral de la Littérature," as Bayle calls him, was lamented wherever letters were esteemed, and *eloge* upon *eloge* celebrated his merits in half the languages of Europe. A collection of these panegyrics has since been made, under the title of *Panglossia*. While no work at all proportioned to the learning and ability of the author remains to us, he nevertheless left behind him a vast mass of incomplete manuscripts on all manner of subjects. A catalogue of these MSS., 700 in all, is preserved in the British Museum among the papers of Sir Hans Sloane. A considerable number of the inedited letters of Peiresc appeared in the *Magasin Encyclopédique*, and were afterwards published separately, Paris, 1815. We have an elegant *Vita Nic. Claudii Fabricii de Peiresc*, by his warm friend Gassendi, 4to, Paris, 1641; translated into English by W. Rand, 1657; and into French by Requier in 1770. The Eloge of Peiresc by Lemontey was crowned by the Academy of Marseilles in 1785.

PEKALONGAN, a province of Java, bounded on the N. by the Java Sea, E. by the province of Samarang, S. by that of Banjoemas, and W. by that of Tegal; length,

 from E. to W., 30 miles; breadth, 18 miles. Though level near the coast, the interior of the province is hilly. The soil is well watered, and produces, among other things, coffee and rice. Manufactures of indigo and sugar are carried on. The province contains three seaports,—Pekalongan, Batang, and Pabean,—between which and Batavia a considerable trade is carried on. Pop. 224,000.

The town of Pekalongan, which stands on the coast at the mouth of a river of the same name, contains many well-built stone houses, and has an open roadstead. The Dutch have a government-house and a fort here.

PEKING, or PEKIN, the capital of the Chinese empire, and of the province of Chihli, stands in a sandy plain about 12 miles S.W. of the River Pei-ho, and about 100 W.N.W. of its mouth; N. Lat. 39. 54., E. Long. 116. 27. It is, in the opinion of the Chinese, one of their most ancient cities, and is known under various names. Previous to the conquest of the country by the Mongols it was called *Shuntien-fu*, or "The City obedient to Heaven;" but after that event, when it was made the capital, the name of *Khan-palik*, or "The City of the Khan," was given to it. The name *Peking* signifies "Northern Capital;" but it is generally designated on Chinese maps as *King-oz*, or "Capital of the Court." A tributary of the Pei-ho, called Tung-hwui-ho, flows through the city from the N.W., and supplies it with water. The circumference of the city and suburbs is estimated at 25 miles, and the area at 27 square miles; though other accounts limit the area to 14 square miles. The latter estimate probably includes only the city itself, and not the suburbs. Peking consists of two parts: the northern or Tartar city, called *Nui-ching;* and the southern or outer city, called *Wai-ching,* in which the Chinese live. Both these divisions are surrounded by walls 30 feet high, and about 20 feet broad at the base; but as the inner face is sloping, they are only 12 feet wide at the top. They consist for the most part of mounds of earth or rubbish faced with bricks. According to most of the plans, Peking is also surrounded with ditches; but this, though perhaps partially true, is certainly not the case with the N.E. portion. At intervals of about 60 yards along the outside of the walls stand square towers, projecting about 30 feet from the wall; and similar erections stand at each side of all the gates, connected by a semicircular rampart in front. The gateways consist of strong arches surmounted by wooden buildings several storeys high. The appearance of Peking from the outside is dull and uniform, as there are no spires, minarets, or pillars rising above the mass of the houses, which are roofed with yellow, green, or red tiles; and the only prominent objects are clumps of trees and the flag-staffs that rise in front of the houses of the officials. The roofs of the houses, however, present an appearance by no means unpleasing, as their sides and ridges are gently curved, and are adorned with various fantastic figures; and the whole glitters like gold in the rays of a bright oriental sun. The northern city consists of three separate inclosures, one within the other. The innermost, in which the imperial palace is situated, is called *Kin-Ching*, or the "Prohibited City." Within are the palaces and pleasure-grounds of the emperor and empress. The ground in this inclosure is not level, but is raised in artificial hills, on which the principal palaces are built. There are also large and deep artificial lakes, of irregular form, and interspersed with small islands. The buildings and grounds within the Prohibited City are said to be, in architecture and arrangement, far superior to anything else of the kind in China. To Sir George Staunton, who, when passing through Peking on an embassy to the imperial park of Yuen-ming-yuen, caught a glimpse of this portion of the city through the northern gates, the whole had the appearance of enchantment. Besides the imperial palaces and pleasure-grounds, the Prohibited City contains two halls and a fine marble gateway 110 feet high, ascended by five flights of stairs, where the emperor stands on certain occasions to receive the homage of his courtiers. On the east side stand the offices of the cabinet, the treasury, and the imperial library, consisting of 12,000 works; while towards the west is situated a variety of public and private buildings. The government of the palace is in the hands of a special council, which is divided into seven sections, having different duties. Attached to the court of Peking are three great scientific establishments: the National College, for the sons of the great dignitaries; the Imperial College of Astronomy, by which the annual almanacs are prepared; and the College of Medicine. There is published daily at Peking an official gazette of 60 or 70 pages. It is entirely under the control of the emperor, to whom everything that is printed in it must be presented. The population of the Prohibited City is not very great, and it consists principally of Manchoos. Outside of this inclosure is another called *Hwang-Ching*, or the "Imperial City," not so sacred as the former, but entered only by authorized persons. It is about 2 square miles in extent, and is surrounded by a wall covered with yellow tiles, and known as the Imperial or Yellow Wall. From the southern gate a broad street leads up to the Prohibited City, on the right of which stands the *Tai-Miau*, or "Temple of the Imperial Ancestors," an extensive collection of buildings surrounded by a wall; and on the left an altar of a peculiar construction dedicated to the gods of land and grain, on which the emperor alone is allowed to sacrifice. The Imperial City also contains numerous temples to various subordinate Chinese deities; and it has been calculated that there are in this and the interior inclosure upwards of 200 palaces, all of great size. The Tartar city, lying outside of the divisions already described, has several broad and straight streets crossing each other at right angles. Near the southern gate of the imperial wall are the principal tribunals and government offices in the city; and not far off is the college of the Russian mission, which consists of ten members sent periodically from St Petersburg. On the wall at the S.E. corner of this part of the city stands the observatory, provided with instruments by the Emperor Kanghi, under the direction of Roman Catholic missionaries, and now under the care of Chinese astronomers. Not far from this building is the hall for literary examinations, where the candidates for degrees assemble. In the north part of the town is a lofty tower, forming one of the most conspicuous objects in Peking, and containing a huge cylindrical bell and a large drum, both of which are used to mark the watches of the night. The town contains many places of worship belonging to different religions and sects, including a Greek and a Latin church, and a Mohammedan mosque, besides numerous temples of the various forms of Budhism. Among the last is one where the deceased kings and emperors are worshipped; and another called the White Pagoda, a tastefully-ornamented building, having a fine obelisk in front of it. The outer or Chinese city, which is about the same size as the other, though more populous, is not in general so well built, and contains few large buildings. Two extensive portions of the area are occupied by the large inclosures surrounding the altars to Heaven and to Agriculture, which stand, the one to the right and the other on the left of the central street leading from the south gate to the Tartar city. The former, on the east side, consists of three circular terraces, each 10 feet high, and in succession 120, 90, and 60 feet in diameter. They are all paved with marble, and surrounded with balustrades. In connection with this altar is the Palace of Abstinence, where the emperor, who is the priest of the altar, fasts for three days before offering the annual sacrifice at the winter solstice. On the opposite side of the street from this altar is another inclosure containing four altars, dedicated respectively to the spirits of heaven, to those of the earth, to the planet

Jupiter, and to the monarch Shinnung, who is regarded as the inventor of agriculture. To the west of these altars is an artificial pool, called the Black Dragon Pool, dedicated to the spirits of the waters, which also occupies a large space. Beyond the walls of the city stands, on the east side, an altar to the sun, and on the west, one to the moon; while about eight miles to the N.W., in an undulating country, is the park of Yuen-ming-yuen, containing numerous imperial residences and a hall of audience. In one of the most beautiful situations near Peking is a French burying-ground; but this has been much defaced by the Chinese. The principal streets of Peking, which are generally straight, leading from one gate across the city to another, are about 100 feet broad, and the lowness of the houses with which they are lined serves to increase their apparent width. They are unpaved, probably on account of the difficulty of obtaining stone in the vast plain in which the city stands. During the summer they are kept well sprinkled with water, but in wet weather they are exceedingly muddy. The smaller thoroughfares, like those of most Chinese cities, are mere narrow lanes. The principal streets are lined with shops, which are entirely open in front during the day, and have on each side sign-boards fastened in stone bases, and reaching as high as the eaves, painted with large ornamental characters, and sometimes decorated with flags of various colours. The fronts of the houses are also frequently painted in brilliant colours, which gives the streets a very gay and lively appearance. At the intersections of the principal streets there are tablets and portals erected in honour of distinguished persons. The main thoroughfares are feebly lighted during the night by lanterns hung in front of the houses; and those who go about in the dark carry lanterns or torches. People belonging to all the various tribes of Central Asia, in their various costumes, throng the streets of Peking; and the number of Manchoo women who are to be seen in the streets, on foot and on horseback, gives to the city an appearance different from that of those in the south of China. Horses and carriages are used as means of conveyance, and are to be had for hire; but sedans, which are elsewhere in China the usual conveyances, are not permitted so near the emperor, except for privileged persons. The streets, though broad, are much blocked up by the moveable workshops of various mechanics, the tents and booths filled with all kinds of merchandise, and the various wares laid out in front of the shops; so that there is only a narrow road left in the middle, along which there are continually passing official, funeral, and bridal processions; strings of dromedaries, with coals from Tartary; carts and wheel-barrows laden with vegetables. The sides of the streets are also filled with crowds of people buying and selling, whose varied appearance and confused sounds give to the place a busy and animated appearance. Few manufactures and no trade is carried on at Peking: the city is supplied with provisions chiefly from the southern provinces, and from the flocks raised in the northern part of Chihlí; and the adjacent country produces but a small quantity of the provisions required. The government of Peking is not subordinate to the provincial magistrate, but only to the emperor himself. There is a regular police, who patrol the streets by night beating together two hollow bamboos to mark the time. The climate is colder in winter than that of most other places in the same latitude; and the houses are warmed by flues under the rooms; but fuel is very scarce and dear. A large proportion of the inhabitants of Peking are poor, and they frequently rise in mobs, and pillage the granaries to supply themselves with food. To keep the capital quiet is an object of much care to the government, as the state of the whole empire depends very much on that of Peking. The population of Peking is variously estimated from 1,300,000 to 3,000,000. It probably amounts to 2,000,000, or nearly that of London. (Barrow's *Travels;* Gutzlaff's *China Opened; The Middle Kingdom,* Williams; Davis' *China,* new edition, 1857.)

PELAGIUS, the founder of the sect of the *Pelagians*, is supposed to have been a native of Britain, and first appears on the stage of history as a monk, residing at Rome, about the beginning of the fifth century. He was at that time a man of great moral earnestness. His adherence to the monkish rules was rigid, his efforts to reform both clergy and laity assiduous, and his sanctity well spoken of in all the churches. Yet it was this same deep regard for morality which was the occasion of Pelagius's lapse into error. Looking down from the height of his own self-righteousness, he was scandalized to see the majority of professing Christians grovelling carelessly and contentedly in every kind of sensuality. With all the intensity of his reforming zeal, he set himself to discover the cause and remedy of this moral disease. The cause, it occurred to him, was the trust which was placed throughout the church in the efficacy of the sacraments, and the sufficiency of faith. The remedy, he thought, would be a creed which should hold man's salvation to be dependent upon his own exertions. To develop such a creed into a regular and consistent form became his next endeavour. As the foundation of his system, he assumed that a just God could not visit the iniquities of one man upon the heads of others. On this was established the dogma, that the effects of Adam's first sin were confined to himself, and did not descend to his posterity. Accordingly death, and the other evils of life, were not the signs of a blighted spirit, but the necessary incidents of a body made of dust. Men therefore came into the world pure and innocent. Baptism, though needful to admit them into the kingdom of heaven, was not needful to cleanse them from moral pollution, or to insure their eternal blessedness. Nor was inward grace necessary to predispose them to love and obey the commandments of God. All the grace that they required was the privilege of exercising their natural faculties, of using the advantages of the gospel and the church, and of receiving forgiveness for any sins they might commit. With these aids alone they could confidently address themselves to the observance of the law. Their own free-will was able to choose the good, and their own strength was able to accomplish it. If they should step aside from the right path through ignorance or forgetfulness, they would not be culpable. Even if they should really become corrupt, they could convert themselves by their own exertions. Thus was a man's own righteousness, and not his faith, declared to be the means of his salvation.

This flagrant heresy being propagated in Palestine by Pelagius himself, and in Africa by his friend and disciple Cœlestius, soon provoked opposition. Cœlestius was excluded from the fellowship of the church by a synod held at Carthage in 412. Pelagius was arraigned before two ecclesiastical councils, held respectively at Jerusalem and Diospolis in 415. Although at both of these tribunals he succeeded in baffling his accusers, and deceiving his judges with sophistry and equivocation, yet he could not altogether lull the suspicions of the orthodox. The North African bishops, led on by Augustine, commenced a deadly attack with books, letters, and edicts. In 417 they induced Pope Innocent I. to anathematize the rising heresy; in 418 they issued a formal edict against it from an assembly held at Carthage; and not long afterwards they prevailed upon the emperor to promulgate several decrees threatening the new sect with confiscation and banishment. The result was, that Pope Zosimus was forced to condemn the obnoxious doctrine; several ecclesiastical councils throughout Europe approved the sentence; Pelagius retired into exile, and went off the arena of history; and Pelagianism was nipt

in the bud, and was deprived of all existence as a formal confession of faith.

Of the numerous works of Pelagius, the following alone have been authenticated:—*Expositionum in Epistolas Pauli Libri XIV.; Epistola ad Demetriadem*, and *Libellus Fidei ad Innocentium Papam.* They are all included in the best editions of Jerome. (For an account of Pelagius and Pelagianism, see Augustine's *De Gestis Pelagii;* G. J. Vossius' *Historia Controversiarum Pelagianarum;* the Church Histories of Neander, Milner, Gieseler, and Waddington; Hagenbach's *History of Doctrines;* Patouillet's *Vie de Pélage*, 1751; N N. Leutzen's *Dissertatio de Pelagianorum Doctrinæ Principiis*, Colon. Agr., 1833; and Wiggers' *Pragmatische Darstellung des Augustinismus und Pelagianismus*, 2 vols., Hamb. 1833. This last work has been translated into English by Professor Emerson, 8vo, New York, 1840.)

PELAGIUS I., Pope, succeeded Virgilius in the Roman see in 555, and died in 560.

Pelagius II., *Pope*, succeeded Benedict I. in 578, and died in 590.

PELASGI (Πελασγοί), an ancient race, believed to have been widely spread over Greece and Italy in pre-historic times, but of whom scarcely anything definite is known. The name *Pelasgi* owes its derivation, according to tradition, to Pelasgus, father of Lycaon, King of Arcadia, and reputed ancestor of the race. (Strabo, vii., p. 321.) Some maintain, however, that the genuine form of the word was Πελαργοί, which is variously derived (1.) from Ἄργός, *a plain*, in old Greek, and πέλω; (2.) from Ἀγρός, *a field*, and πελω; and, finally, from πελαργοί, *storks*, in allusion (3.) either to their wandering life, or (4.) to their rudeness of speech. Krase (*Hellas*) favours the first derivation, O. Muller (*Die Etrusker*) the second, Strabo and Myrsilus the third, and a writer in the *Philological Museum*, vol. i. ("On the names of the Antehellenic Inhabitants of Greece"), the fourth. Schwegler, the most recent writer who has ably taken up the entire question, is in considerable doubt whether the name Pelasgi is to be regarded as an ethnographic distinction, or as an epithet equivalent to *autochthones*, or aborigines (*Röm. Gesch.*) Nor is the origin of the Pelasgians better ascertained than their name. They are generally supposed to have immigrated from somewhere beyond sea, most probably from Asia Minor, by the Propontis and the Hellespont. The whole of Greece during the ante-Hellenic period was occupied by a number of barbarous tribes, of whom the most important were the Pelasgi, both as occupying a larger portion of the country than any other tribe, and from their wide diffusion into other territories. The whole of Hellas during this pre-historic age is said to have been more or less overrun by the Pelasgi. (Strabo, v., p. 220; Herodotus, ii. 56; viii. 44; Thucydides, i. 3.) The earliest notice of them, however (Homer, *Iliad*, ii. 681), represents them as having their chief abode in "Pelasgian Argos" in Thessaly. "That part of Thessaly," says Strabo, "is called Pelasgian Argos which extends from the coast between the outlet of the Peneus and Thermopylæ as far as the range of Pindus, because the Pelasgians were masters of that region." Epirus also, and especially Dodona, is made a chief abode of the Pelasgi by Homer, Hesiod, and Æschylus; the former informing us that Zeus was worshipped as the "Pelasgian king." Moving southward, we next find traces of the Pelasgi in Bœotia, and especially in Attica, where, according to Herodotus (vi. 137), Thucydides (ii. 17), and Strabo (ix., p. 401), they took up their abode at Athens, under Mount Hymettus, from which they were, however, afterwards expelled. Apart from the legend already referred to of the Arcadian origin of the Pelasgi, we find frequent mention, especially in Herodotus, Æschylus, and Strabo, of their presence in the Peloponnesus, and particularly of their intimate relation to Argolis. Two conflicting centres of emanation are thus assigned to this race,—that of Thessaly and Epirus, and that of Arcadia; but there are no satisfactory means of determining whether the one account or the other be correct. Another curious contradiction with respect to this race is noticed by Wachsmuth (*Hell. Alt.*, vol. i., part i.) Herodotus represents them as fixed and stationary (i. 56); while Strabo describes them as a moveable and migratory people (xiii. 3, § 3). Passing from the mainland of Greece we find marks of the presence of the Pelasgi in numerous islands of the Ægæan Sea. Homer alludes to them in Crete (*Odys.* xix. 175); Herodotus in Samothrace (ii. 51); Herodotus (v. 26), Strabo (v., p. 220), Thucydides (iv. 109), and Pausanias (vii. 2), in Lemnos and Imbros; Dionysius (i. 18) traces them to Lesbos; Herodotus (vii. 95) says that seventeen of the Ionian Islands were inhabited by Pelasgi; and Menecrates (Strabo, xiii., p. 621) assigned to them not only the islands of Ionia, but also the coast of Asia Minor. The latter portion of his statement is likewise confirmed by Homer, Herodotus, Strabo, and Dionysius. Herodotus (i. 57) found, in his own time, two Pelasgian cities, Scylace and Placia, on the Hellespont, and a place called Creston, probably in Macedonia, speaking similar dialects, differing from their neighbours around them, but not ordinary Greek (βάρβαρον γλῶσσαν ἱέντες). The historian quotes this fact in order to prove that the ancient language of the Pelasgi was a barbarous language, or distinct from that of the Hellenes. This passage in Herodotus has been the source of not a little controversy. Bishop Thirlwall is of opinion that the statement of Herodotus respecting the "barbarous" language of these Pelasgic communities simply means that they spoke a very bad Greek. "Nothing more," he says, "can be safely inferred from it, than that the Pelasgian language which Herodotus heard on the Hellespont and elsewhere sounded to him a strange jargon, as did the dialect of Ephesus to a Milesian, and as the Bolognese does to a Florentine. (*Hist. of Greece*, vol i., c. ii., p. 60.) Mr Grote, on the other hand, asserts that the meaning of Herodotus is unmistakeable as to the substantial difference of the Pelasgic language and the ordinary Greek. "The affirmation," he says, "of Herodotus is distinct and twice repeated, that the Pelasgians of these towns, and of his own time, spoke a barbaric language; and that word appears to me to admit but of one interpretation. To suppose that a man who, like Herodotus, had heard almost every variety of Greek in the course of his long travels, as well as Egyptian, Phœnician, Assyrian, Lydian, and other languages, did not know how to distinguish bad Hellenic from non-Hellenic, is in my judgment inadmissible." "I think it therefore certain," he again remarks, "that Herodotus pronounces the Pelasgians of his day to speak a substantive language different from Greek; but whether differing from it in a greater or less degree (*e.g.*, in the degree of Latin or of Phœnician), we have no means of deciding." (*Hist. of Greece*, vol. ii., pp. 351–353.) Mr Ellis, in an ingenious pamphlet (*Contributions to the Ethnography of Italy and Greece*, by Robert Ellis, B.D., London, 1858), adopts a similar interpretation of the Greek historian. He says at p. 5, "In describing, then, the Pelasgian language as barbarous, Herodotus gives us to understand to what language—namely, the Greek—he considered the Pelasgian to be substantially foreign." Grote simplifies the vexed Pelasgian question, by not presuming "to determine anything in regard to the legendary Pelasgians and Leleges, the supposed ante-Helenic inhabitants of Greece." "Whoever has examined," he says again, "the many conflicting systems respecting the Pelasgi, from the literal belief of Clavier, Larcher, and Raoul Rochette (which appears to me at least the most consistent way of proceeding), to the interpretative and half-incredulous processes applied by abler men, such as Niebuhr, or O. Müller, or Dr Thirlwall,

will not be displeased with my resolution to decline so insoluble a problem." (Vol. ii., pp. 347, 351.) In the opinion of the Rev. George Rawlinson (*History of Herodotus*, London, 1858, vol. i., p. 665), the statement of Mr Grote regarding the radical difference of the Greek and Pelasgic languages "is one of undue and needless scepticism. . . Anglo-Saxon is a barbarian or foreign tongue to a modern Englishman, and so is Gothic to a modern German, Provençal to a Frenchman, Syriac to a Chaldee or Mosul. The diversity between the Hellenic and the Pelasgic was probably of this nature, as Niebuhr, Thirwall, and C. O. Müller suppose. The nations were essentially of the same stock, the Hellenes having emerged from among the Pelasgi; and we may confidently pronounce on the Indo-European character of the latter from the fact, that the language of the former belongs to this family."

Traditions of the presence of the Pelasgi are not, however, limited to Greece; they are intimately connected likewise with the Italian peninsula. The fullest account of the primitive population of Central Italy is given by Dionysius. This writer represents (i. 11) Œnotrus, son of Lycaon, leading a colony into Italy seventeen generations before the Trojan war. He further informs us that Pelasgians came from Thessaly by sea, and landed in Italy at the mouth of the Po. Thence they moved southwards, taking some cities from the Umbrians, and were only withheld from attacking the aborigines by a response given to the Pelasgi by the Dondonian oracle. Becoming conciliated to the aborigines, the Pelasgi had a territory assigned them near Velia, and they subsequently aided their benefactors in expelling the Siceli or Siculi into the island Sicily, to which they gave their name. After a time, the historian continues, the Pelasgians returned to Greece in separate bodies, and from the name Tyrrhenia by which the western coast of Italy was known to the Greeks this race acquired the appellation of Tyrrhenian, and were designated Tyrrhenian Pelasgians. "These testimonies in Dionysius," says Clinton (*Fasti Hellenici*, vol. i., p. 28), "establish the *fact* that Pelasgi from Greece emigrated to Italy; but the *circumstances* and the *time* of that earliest migration are lost in remote antiquity." On this observation Sir G. C. Lewis comments by affirming, "The fact itself seems as uncertain as the circumstances and the time. Mr Clinton does not advert to the statement of Dionysius respecting a migration of Pelasgians back to Italy, which is an essential part of his narrative." (*On the Credibility of Early Roman History*, vol. i., p. 282, note.) Lewis further remarks that "this portion of the narrative of Dionysius is merely an ethnological legend. No authentic record of the migrations or acts of the Pelasgian people appears to have been accessible to the historians of antiquity." (Vol. i., p. 282.) Other testimonies besides that of Dionysius go to confirm the tradition of the immigration of the Pelasgians into Latium, and even assert the name of Rome itself to be Pelasgian. (See Lewis, vol. i., p. 395.) Indeed the whole of Italy, according to legendary record, was inhabited in ancient times by the Pelasgi. Founding on these genealogical and mythical traditions, Niebuhr has come to the conclusion, "not as an hypothesis, but with full historical conviction," that the Pelasgians were the primitive population both of Greece and of Italy. He says, "There was a time when the Pelasgians, perhaps the most extended people in all Europe, were spread from the Po and the Arno to the Bosphorus." (*Hist. of Rome*, vol. i., p. 25.) This race, he maintains, gradually disappeared because they became Hellenized. The Greek element in the Latin language he holds to be Pelasgic. Schwegler, who agrees in the main with Grote respecting the unauthentic character of the Pelasgic traditions, condemns the hypothesis of Niebuhr as entirely untenable. Lewis likewise maintains that the alleged records of the Pelasgians rest on no historical basis, and he rejects the conclusions both of Niebuhr and Otfried Muller respecting "this unknown and undiscoverable period." (Vol. i., p. 297.) Niebuhr's hypothesis is likewise assailed by Clinton in his *Fast. Hell.*, vol. i., p. 97. The grounds of Schwegler's condemnation, which is the most thorough-going, is as follows:—"1. The absence of any indigenous name for the Pelasgians in Italy. 2. The evident traces of Roman writers on the subject having obtained their information from the Greek logographers. 3. The contradictory accounts given by different writers of the migrations of the Pelasgians, according as they follow Hellanicus and Pherecydes or Myrsilus. 4. The absence of any historical monument of the Pelasgi in Italy, whether literary or of another kind." If unsound in his hypothesis, Niebuhr was not far wrong when he wrote the following sentence regarding this tangled question:—"The name Pelasgi is odious to the historian who hates the spurious philology out of which the pretences to knowledge on the subject of such extinct people arise." (*Hist. of Rome*, vol. i.)

In addition to the works already cited, the reader may consult Kruse's *Hellas*, vol. ii., for a copious collection of passages bearing on the Pelasgi; also the criticisms of that work by Thirlwall in the *Philological Museum*, vol. i., p. 305, and Clinton in the *Fasti Hellenici*, vol. i.; also Mommsen's *Rom. Geschichte.*

PELESTRINA, a town of Austrian Italy, in the government of Venice, stands on an island of the same name, 11 miles S. of Venice. The island is about 7 miles in length by 1 in breadth; and the town contains several churches and a town-hall. Pop. 7000.

PELEUS, the King of Phthia, and the father of Achilles, was the son of Æacus of Ægina. He was twice married. His first wife, Antigone, the daughter of Eurytion, the sovereign of the Phthians, brought him as her dowry the third part of her father's kingdom. His second wife, the Nereid Thetis, became by him the mother of the great Achilles. Peleus outlived his son.

PELEW ISLANDS, a group of small islands lying in the North Pacific Ocean, between 8. and 9. N. Lat., and 130. and 136. E. Long. They extend from S.S.W. to N.N.E., and are surrounded on all sides except the south by coral reefs. The group comprises in all about twenty islands, the largest of which, Baubelthoup, is nearly 60 miles in circumference. The islands, when seen from the sea, present a rugged and mountainous aspect. They are well covered with trees of various kinds, and the soil is in general rich. The bread-fruit tree, the cocoa-nut, banana, orange, and lemon abound, as also the sugar-cane. There is nothing that deserves the name of river on these islands; and the inhabitants derive their supplies of fresh water from small rivulets and ponds. They belong to the Malay race.

PELIGNI, The, a people of ancient Italy, inhabited the upland valley of the *Gizio*, in the heart of the Apennines, and were bounded on the N. by the Vestini, on the W. by the Marsi, on the S. by the Samnites, and on the E. by the Frentani. The character of the country they inhabited was determined by its situation. The winds from the snow-clad mountains on every side cooled the atmosphere down to the verge of severity. At the same time, the melting wreaths on the hill-sides sent down gentle streams to water and fertilize the valley. Accordingly, grapes and corn, abundant in quantity, though inferior in quality, were raised on the soil. The history of the Peligni contains no events of any very special interest. Sprung as they were from the same Sabine stock as the Marsi and Marrucini, they shared in all the important changes which befell these tribes under the dominant power of the Romans. Like them, they were defeated by Fabius in 308 B.C.; they revolted at the outbreak of the Social War in 91 B.C.; and they were ultimately included in the Fourth Region of Augustus. The principal towns of the Peligni were Corfinium, Superæquum,

and Sulmo. The last of these was the birthplace of Ovid.

PELION, a mountain in Thessaly, extending along the coast of Magnesia, and rising to the S. of Mount Ossa, with which it is joined by a low ridge. It attains to its greatest height (nearly 5000 feet) above Iolcos. Its eastern side rises precipitously from the sea, rendering the coast exceedingly dangerous, as the destruction of Xerxes' fleet can testify. It is still covered with venerable forests of oak, ash, beech, elm, and pine, as of old, when Homer gave it the epithet of εἰνοσιφυλλον, "quivering with leaves" (*Il.* ii. 632, &c.); and when its ashen spear-shafts were so famous that *Pelias* was the usual name by which the celebrated spear of Achilles was designated, and which no arm but his own could wield. The timber of which the ship "Argo" was built is likewise said to have been felled in the forests of this mountain. In the wars of the giants and the gods, the former are said to have piled Ossa upon Pelion in order to scale Olympus. The N.W. summit of Pelion is called *Plessidhi;* and the whole mountain frequently gets the name of the town *Zagora*, built on its eastern side. (See Leake's *Northern Greece.*)

PELL, JOHN, an erudite mathematician, was the son of a clergyman, and was born at Southwick in Sussex in 1610. His youth was full of high mental promise. At the school of Steyning he soon became a proficient in Latin, Greek, and Hebrew; by the age of thirteen he was ready to enter Trinity College, Cambridge; during his university course he made himself an accomplished linguist; and in 1630, the year in which he took the degree of M.A., he was holding a learned correspondence with several eminent mathematicians. This promise soon began to be fulfilled; for Pell, from this time till his death, devoted all his attention to the promotion of mathematical science. He occupied the chair of mathematics at Amsterdam from 1643 to 1646, and the same chair at Breda from 1646 to 1652. It is true that after this he was employed by Cromwell in the political office of agent to the Protestant cantons of Switzerland. It is true, also, that after the Restoration he took holy orders, and was presented by Sheldon, Bishop of London, to several rich benefices. Yet all the while the single-minded bookworm was immersed in his favourite study, publishing several works, and writing those almost innumerable letters and pamphlets which are now preserved in nearly forty folio volumes in the British Museum. He even carried his mathematical abstraction to the extent of altogether neglecting his personal affairs. His friends cozened him out of the profits of his benefices, and then left him a prey to merciless creditors. He lived in extreme indigence till his death in 1685. Dr Pell's principal works are,—*A Controversy with Longomontanus concerning the Quadrature of the Circle*, 4to, Amsterdam, 1646; *An Idea of the Mathematics*, 12mo, London, 1650; *Branker's Translation of Rhonnius' Introduction to Algebra, much altered and augmented*, 4to, London, 1668; and *A Table of Ten Thousand Square Numbers*, fol., London, 1672.

PELLA, the capital of Macedonia, was situated on a hill in the midst of an impassable marsh which was connected with the River Lydias. Its strong and secure position, and its easy communication with the sea, did not fail, in course of time, to make it a place of importance. Philip made it the metropolis of the kingdom and the seat of the royal palace. It continued to retain this dignity, and to be a prosperous city, until Macedonia was subjugated by the Romans, and ceased to be a kingdom. From that time Pella seems to have gradually declined. Its name, applied to a fountain which rises on the site of the ancient town, is almost the only record which remains of the birthplace of Alexander the Great.

PELLERIN, JOSEPH, an eminent numismatist, was born in 1684 at Marli-le-Roi, near Versailles, and received his education at Paris. His proficiency as a linguist procured for him employment in connection with the navy. At first he was engaged in the navy office in making extracts and translations from English, Spanish, and Italian. Then his merits came to be better appreciated; and the successive offices in the navy of one of the commissioners, commissioner-general, and first clerk were conferred upon him. But it was not until he had retired from public service in 1745 that the great business of Pellerin's life commenced. He then set himself to read, interpret, and classify a great variety of coins which he had collected. In doing this, it was his good fortune to light upon a plan which may be said to have given a definite form to the science of numismatics. Instead of following the arbitrary modes of preceding numismatists, he arranged his coins according to the geographical position of their countries. His system was explained and illustrated in his *Recueils de Médailles de Rois, Peuples, et Villes*, in 10 vols. 4to, Paris, 1762–78. A supplemental volume, entitled *Additions*, &c., was published shortly before his death in 1782.

PELLICO, SILVIO, an eminent Italian, celebrated for his genius and his misfortunes, was born at Saluzzo in Piedmont in 1789. His education, though irregular, was well adapted to develop his fine talents. In his father's house, which was furnished with all the luxuries of an easy fortune, his love for poetry was kindled by the sight of private theatricals. In Turin, to which the family removed about 1795, his studies were prosecuted under a clergyman. At Lyons, where he resided with a wealthy cousin for four years, he tasted all the refining pleasures which affection could suggest or money could supply. At Milan, where he settled in 1810 as a teacher of French, he devoted himself to the study of the literature of his own and of other countries. Nor was the society in which he mingled in this last city less propitious to his mental culture. Monti and Foscolo loved and cherished him. Count Porro also received him into his house as tutor to his sons, and introduced him to the celebrated men, both native and foreign, who gathered round his hospitable table. Inspired and stimulated by all these influences, Pellico set himself to enlighten and elevate his enslaved countrymen, as well as to gratify his own aspirations. In a short time his tragedy of *Francesca da Rimini* delighted all Italy with its grace and tenderness. In 1819 he was the chief agent in establishing a national periodical called *The Conciliator*. About the same time, also, he consecrated his life to the cause of Italian freedom by enrolling himself in the revolutionary society of the Carbonari. It was this activity that brought Pellico under the relentless suspicions of Austrian despotism, and entailed upon him a long and cruel persecution. Arrested in October 1820 for political offences, he was lodged in the cells of Santa Margherita at Milan. Removed to Venice soon afterwards, he lay awaiting his trial in the dreary state prison called "The Leads." His trial came on in February 1822, and resulted in a sentence of death which was commuted for a severe incarceration of fifteen years in the fortress of Spielberg, near the Moravian city of Brünn. In that distant dungeon the weary term of durance passed heavily along, inflicting pains and agonies unspeakable. At length, when it had dragged the poor prisoner almost to death's door, it was prematurely brought to a close, by the command of the emperor, on the 1st August 1830. Silvio Pellico spent his remaining years in literary pursuits at Turin. He produced the tragedy of *Ester d'Engaddi* not long after his release; *Le Mie Prigioni, Tre Nuove Tragedie*, and the tragedy of *Tommaso Moro* in 1832; and his *Opere Inedite* in 1837. He also acted as librarian to the Marchesa Barolo. His death took place on the 1st January 1854 at Moncaglieri, the villa of his patroness near Turin. Of Pellico's account of his own imprisonment, under the title of *Le Mie Prigioni*, there have been

five German translations, one English, three Spanish, and fourteen French. The narrative has charmed every reader by its unaffected and graphic story, its tender pathos, and its pervading tone of Christian faith and charity. The Life of Pellico has been written by Dumast Loménie, 1842; by Chiala, 1852; by Nollet-Fabert, 1854; and by Giorgio Briano, 1854.

PELLISSON-FONTANIER, PAUL, was born at Beziers in 1624, and after studying with success the Latin, Greek, French, Spanish, and Italian languages, he applied himself to law at Castres, and subsequently to general literature at Paris. In 1652 he purchased the post of secretary to the king; and five years afterwards became first deputy to M. Fouquet. He suffered by the disgrace of that minister; and in 1661 was confined in the Bastille, whence he was not discharged till four years afterwards. During his confinement he applied himself to the study of religious controversy; and in 1670 he abjured the Protestant religion. Louis XIV. bestowed upon him an annual pension of two thousand crowns, besides bestowing on him numerous marks of royal favour. Having taken orders, he, in 1676, received the abbey of Gimont, and some years afterwards the priory of St Orens in Auch. He died in 1693.

The best remembered work of this once popular writer is a diffuse *Histoire de l'Académie Française*, Paris, 1653. The best edition is Olivet's, Paris, 1730. He also wrote a courtly *Histoire de Louis XIV*, Paris, 3 vols, 1749; a panegyric entitled *Abrégé de la Vie d'Anne d'Autriche*, 1666; a *Histoire de la Conquête de la Franche Comté*, in 1668, given in the seventh vol. of the *Mémoires* of Father Desmolets; *Lettres Historiques et Œuvres Diverses*, Paris, 3 vols., 1749; *Recueil des Pièces Galantes*, 5 vols, 1695; *Réflexions sur les Différends de la Religion*, 4 vols., 1687, in which the author attempts a reply to Jurieu and Leibnitz on religious toleration; also an unfinished *Traité de l'Eucharistie*. Other issues of his works are *Œuvres Diverses de Pellisson*, 3 vols., Paris, 1739; and *Œuvres Choisies de Pellisson*, 2 vols., 1805. (See Bayle's *Dict.*; also De Feller's *Dict. Historique*.)

PELOPIDAS. See THEBES.

PELOPONNESUS (the modern *Morea*), a celebrated peninsula, forming one of the great general divisions of ancient Greece, was situated to the S. of Greece Proper. Owing to its peculiar form and position, it came to be regarded under several curious aspects. The old Greeks, considering it an island, and using the name of the mythical king of Pisa, called it the Isle of Pelops. Strabo and other classical writers likened it to the leaf of a vine or plane tree. On account of its natural facilities for defence, it was likewise named the Acropolis of Greece. The Peloponnesus was divided into six provinces: Arcadia in the middle, Achaia on the N., Elis on the W., Argolis on the E., and Messenia and Laconia on the S. The history and physical geography of the peninsula are given under the heads of these several states. (See also GREECE, and Leake's *Morea*. A work entitled *Peloponnesus—Notes of Study and Travel*, by W. G. Clark, M.A., appeared in London, 1858.)

PELOPS, the son of Tantalus, and grandson of Jupiter, was famous in classical fable for the singular events of his life. While still young, he was butchered, boiled, and served up at a feast which his father gave to the gods. Ceres, in a trance of melancholy abstraction, immediately fell to, and made a hearty meal on the cannibal fare. The other divinities, however, discovering the nature of the dish, shrunk from touching it, and in course of time ordered Mercury to restore the mangled body to life. Accordingly, the dead fragments were put into a cauldron. The limbs, under the action of some particular process, resumed their former positions; a shoulder of ivory was substituted for the shoulder of flesh which Ceres had eaten; and the young man came forth alive and entire. In spite of this patched-up constitution, Pelops conducted himself boldly and successfully in his after-career. Becoming a suitor for the hand of Hippodamia, the beautiful daughter of Œnomaus, king of Pisa, he agreed to prosecute his suit on the hard condition that he should either conquer the father in a chariot-race or suffer death. The contest began. By the aid of Neptune, or of Myrtilus, a treacherous servant of the king, he became the victor, and gained both the daughter and the kingdom of Œnomaus. The tomb of Pelops was preserved on the banks of the Alpheus, and a sanctuary was dedicated to him in the grove Altis at Olympia. Atreus and Thyestes were his sons. The Peloponnesus is said to have been named after him.

PELTA, a small light shield, sometimes attributed to the Amazons, but used by numerous nations of antiquity, such as the inhabitants of Thrace, Spain, and Mauritania, before its general introduction among the Greeks. It consisted mainly of a frame of wood or wickerwork covered with skin or leather, without the metallic rim, and of a great variety of shapes. It was sometimes round, as in the special case of the *cetra*, sometimes elliptical, sometimes variously sinuated round the rim, sometimes even quadrangular, but most commonly crescent-shaped or lunated, as alluded to in the "Amazonidum lunatis agmina peltis" of Virgil. (*Æneid*, i. 490.) Soldiers bearing the pelta were called *peltastæ*.

PELUSIUM (πηλος, *mud*), a frontier city of Lower Egypt, situated on the easternmost bank of the Nile, called the Ostium Pelusiacum, between the marshes of the delta and the sea. Its original distance from the Mediterranean was about 2½ miles; but, by the gradual deposition of sand along the coast-line, it is now more than double that distance inland. It was the Sin of the Hebrews (Ezek. xxx. 15), and the Peremoun or Peromi of the Copts—epithets all agreeing in origin with the Greek designation, and with the modern name *Tineh*, as "the city of ooze or mud." It was celebrated in the time of Pliny for its flax (*Linum Pelusiacum*), but its situation as the key of Egypt has gained for it a yet more noisy fame. Sennacherib and his Assyrians had their bow-strings and shield-straps gnawed in sunder by field-mice while they slept under its walls (B.C. 720–715); Cambyses, the Medo-Persian, won the crown of the Pharaohs near Pelusium, B.C. 525; the Persians re-took it, B.C. 456; it opened its gates to Alexander the Great, B.C. 333; and it was taken and retained by Antiochus Epiphanes, B.C. 173, after routing the forces of Ptolemy Philometor near its gates. The invasion of Egypt by Amrou in 618 A.D., proved the ruin of Pelusium. After making it their own, the khalifs neglected its harbours and its industry, and the city gradually disappeared from history. Its site is now marked by mounds and a few broken columns. (See the works of Champollion and Dénon *sur L'Egypte*; also, Murray's *Handbook for Egypt*, by Sir Gardner Wilkinson.)

PELWORM, an island of Denmark, 8 miles off the W. coast of Schleswig. Its area is about 15 square miles, and the soil is good, but the surface is so low that the continual efforts of the inhabitants are necessary to prevent it from being inundated by the sea. On the E. shore is the harbour of Ostersiel. Pelworm was formerly joined to the large island of Nordstrand, from which it was separated by a flood in 1634. Pop. 4000.

PEMBA, an island off the E. coast of Africa, N. of Zanzibar, S. Lat. (of the N.W. end) 4. 52., E. Long. 39. 44; length about 40 miles, breadth 10. It is low, fertile, and well wooded. Rice is extensively cultivated; and the island serves as the granary to the adjacent country. There are several creeks and indentations in the island, and an excellent harbour.

PEMBROKE, a municipal and parliamentary borough and seaport town of Pembrokeshire, South Wales, is situated on a branch of Milford Haven, 250 miles W. by N. from London, and 10 from Haverfordwest, the county town. It consists chiefly of one long irregularly-built street, ascending gradually to the castle, which stands on a bold rocky promontory. The castle is a Norman struc-

Pembrokeshire. ture of great interest, and even in its present dilapidated condition is a magnificent pile. The keep or principal tower, which is nearly perfect, is lofty and of beautiful proportions. Some remains of the walls that formerly surrounded the town are still to be seen. There are three churches, all ancient; and in the suburb of Monktown are some remains of a priory founded in 1098. There are also several dissenting places of worship, but none of the other buildings in the town require special notice. Pembroke derives its chief importance from its suburb of Pater, about 1 mile N.W. of the town, where is a government dockyard, and where a considerable trade is carried on. The borough is governed by a mayor, six aldermen, and eighteen councillors; and unites with Tenby, Milford, and Wiston in returning a member to Parliament. Market-day, Saturday. Pop. (1851) 10,107, of which Pater contains 6236.

PEMBROKESHIRE, a maritime county of Wales, occupying the extreme S.W. point of the principality. It is bounded on the N.E. by Cardiganshire, on the E. by Caermarthenshire and Caermarthen Bay, and on all other sides by the Irish Channel. The coast is very irregular in its form, and deeply indented with bays. The celebrated Milford Haven, which is in this county, penetrates with some of its minor ramifications to near its centre. The county is somewhat irregular in its general form, and is narrowest towards the northern extremity. Its greatest length from S. to N. is about 36 miles, and its greatest breadth from E. to W. is about 30 miles. It has an area of 628 square miles, or 401,691 acres, and is sixth in order of size of the Welsh counties. The Welsh name is *Sir-Benfro*, which means the promontory or headland of the country.

The northern part of the county rests upon the Cambrian group of rocks, but the southern portion lies chiefly on the old red sandstone formation, overlaid, however, in a considerable part of its extent by the carboniferous strata. The coal, which is chiefly anthracite, is but little worked. The upper beds are scooped away by shallow workings, and the produce—which is chiefly in the form of culm—is worked up with a sufficient quantity of clay to make it adhere together, and is then rolled into balls of about 4 inches in diameter. These are dried, and form the fuel of the inhabitants; so that a household fire generally seems to consist of from six to ten red-hot cannon-balls.

The mountains in this county are of no great height; but rising as they do almost from the sea-level, they present a grander appearance than they otherwise would. The principal range is that of the Precelly Mountains, in the north, of which the highest point, Precelly Top, is 1754 feet above the sea-level. The general configuration of the surface is undulating; but, with the exception of the mountains already named, the hills are nowhere high. The general want of trees, which, except in some sheltered situations, are prevented from growing above the size of mere shrubs by the south-west winds, gives a very naked and uninviting appearance to the greater part of this county; but its shores are diversified by fine headlands and well-sheltered bays, which lend a great charm to its coast scenery, and have made the neighbourhood of Tenby, one of its towns, well known as one of the most delightful of watering-places.

The rivers are of very little importance. The chief of these are the Eastern and Western Cleddau, which, rising in different parts of the county, pour their waters into two of the ramifications of Milford Haven. This celebrated haven is without doubt the most remarkable feature of the county. Its ramifications would be most aptly represented by one of the sprawling monsters so common on tea-cups. From its opening to the sea to the end of some of its branches is little short of 20 miles. In many places it is from 3 to 4 miles wide. It is completely sheltered and land-locked. The water is of great depth, and the anchorage good; and it is capable of holding the whole British navy within its recesses. It has been made famous in English history by the landing of Richard II. on his return from Ireland, where he lost his crown, and of Richmond before the defeat and death of Richard III.

The climate is moist and mild, but the south-west wind blows with the force of a tempest at times over the surface, and so affects the growth of trees that any of these which have succeeded in raising their heads above the shelter beside which they have been planted gradually assume the appearance of a pole with streamers attached, owing to the branches being projected at right angles to leeward. The soil in the southern part of the county is very fertile, and yields great crops of wheat, barley, and oats: potatoes and turnips are also largely grown. In the north the soil is poor, and the farming in a very miserable state. In the Castle Martin district, which is in the extreme south of the county, and is separated from the north by Milford Haven, there is some excellent farming; and an admirable breed of black cattle, known as "Castle Martins," is maintained. There is a considerable exportation of salted butter and pork; and the breed of horses is highly and justly prized. There is but little manufacturing industry practised.

Of late years this remote district has been thoroughly opened up by the South Wales line of railway, which, with the Great Western, affords a continuous line from London to the centre of the county; there is also a branch to Milford Haven; and attempts are now being made to connect Milford Haven with Manchester by a direct line to the north. If this project should be carried out, it is expected that Milford Haven, which at present is chiefly important as possessing one of the great government dockyards erected during the last continental war, will become one of the greatest mercantile entrepôts in the British Islands.

The principal towns are Pembroke, Haverfordwest, St David's, Tenby, Fishguard, Milford, and Narberth. The county returns one member to Parliament; Haverfordwest, with Fishguard, Narberth, and St David's, returns another; and Pembroke, with Tenby, Wiston, and Milford, returns a third. Much of the political influence was in the hands of the Owens of Orielton, but it has now passed into various hands.

A remarkable social feature in this county is the separation between the Welsh and "English," so-called, inhabitants, although these latter and their progenitors have been for many generations natives of the county. This separation has extended itself to language, customs, and even names of places; and while in the south everywhere English names, and the common English affix *ton*, are met with, in the northern parts the names of people and places are as purely Welsh as any in the principality. This peculiarity dates from a remote period, when a colony of Flemings were settled in the county.

Throughout the whole county Druidical remains are frequently met with; and in the north, near Newport, some of the most remarkable cromlechs anywhere to be met with still exist. The Coiton Arthur, one of these, on the northern slope of Precelly, is so lofty that a man on horseback may ride under the great stone or sacrificial slab, which is of such gigantic proportions as to excite feelings of wonder and curiosity as to the means which were employed to raise it to its place.

The population by the census of 1851 was 94,140, of which number 43,675 were males, and 50,465 females. This gives 149 persons to a square mile, or 4·3 acres to a person. The number of inhabited houses in 1851 was 19,136. There were 937 houses uninhabited, and 111 in course of building, giving 30 houses to a square mile, and 4·9 persons to

a house. The amount of real property assessed to the income-tax in 1851 was L.358,849, and of property assessed to the relief of the poor L.288,604. It is calculated that nearly 11 per cent. of the population live by agriculture; 9 per cent. by commerce, manufactures, &c. One-fourth of the whole are in the condition of labourers, servants, &c. Six hundred follow professions, and three thousand possess independent means.

In 1847 the total number of day-schools for the working-classes was 206, attended by 8053 scholars, of whom 49·5 per cent. were in Church of England schools. There were also 223 Sunday-schools, attended by 17,416 children, of whom only 3403 were in Church of England schools. The language is purely Welsh or purely English in the different districts of the county before referred to. (J. G—W—D.)

PENANG. See PRINCE OF WALES ISLAND.

PENARANDA-DE-BRACEMONTE, a town of Spain, in the province of Salamanca, 26 miles S.E. of the town of that name. It contains a parish church, an hospital, a Franciscan convent, court-house, prison, schools, &c. Manufactures are carried on of coarse woollen stuffs, hats, morocco leather, shoes, saddlebags, and other articles. In 1811 the Spaniards were defeated by the French at Peñaranda. Pop. 4140.

PENAS DE SAN PEDRO, a town of Spain, in the province of Albacete, 16 miles S.S.W. of the town of that name. It is surrounded with walls, and stands at the foot of a hill which is crowned by an almost impregnable fort. In the principal square stands the court-house and the prison, and in other parts of the town a parish church and schools. Chocolate, flour, soap, linen stuffs, &c., are made here; and some trade is carried on in wine, sheep, wool, &c. Pop. 7258.

PENATES, the household gods of the Romans, whether private, as relating to the family proper, or public, as relating to the family of citizens or the state. The word is derived by Freund (*Lexicon*, v. "Penates") from the root PEN, expressing the idea of entering, interior; and hence signifies properly deities of the *interior* (*penetralia*) of the house. The Lares were included among the penates with which they were not unfrequently confounded. (See LARES.) Of the former, however, a family had usually but one, whereas the penates are always spoken of in the plural, their number and names being indeed indefinite, as we learn from Varro. (Arnob. iii. 40, 123; Macrob. iii. 4.) These divinities included Jupiter, Juno, and Vesta, as the promoters of domestic union and happiness; but authorities do not always agree as to the exact divinities worshipped as penates. Their original seat is generally represented as Lavinium, whither they had been borne by Æneas from Troy. The private penates were worshipped at the hearth of every house, where a perpetual fire was kept burning in their honour, and on the table stood always the salt-cellar and the first fruits of the ground. Every meal was virtually a sacrifice to the penates. On going abroad, a prayer was offered to these divinities for a happy journey; and on returning to the hearth, the penates were saluted like the living inhabitants. A chapel to the penates of Rome stood near the centre of the city, in a place called Sub-Velia. (See Hartung, *Die Relig. der Rom.*; Smith's *Dict. of Gr. and Rom. Biog. and Myth.*; and Adam's *Roman Antiquities*.)

PENCILS. The name *pencil* is applied to a small hair brush used by artists, and also to a slender cylinder of black lead inclosed in a case, and used for drawing or writing. *Hair pencils* are made from the hair of the camel, the badger, the squirrel, the goat, and some other animals. A small bundle of hairs, with the points in one direction, is tied with strong thread at the root ends, and the points having been temporarily secured, the bundle is introduced at the wide end of a piece of quill tube, previously softened by moisture, when the thickness of the roots and of the binding thread prevents the bundle from passing quite through, while the contraction of the tube in drying holds the tuft securely. The broad end of the quill forms the socket for a holder of cedar wood. Some skill is required in tying and inserting the bundle of hair, for if pinched too tightly, the hairs spread out, instead of forming a fine point, and if not sufficiently pinched, they fall out. Hair pencils are made from the size of a crow or pigeon-quill to that of a swan. When larger pencils are required, tubes of tin-plate are used, with the stick firmly secured therein.

Lead pencils of the best kind are made of slender four-sided threads, which were formerly cut by means of a saw from solid pieces of plumbago. These threads were calcined in close vessels at a bright red heat, which imparts brilliancy and softness to the stroke of the pencil. The excellence of the mineral, as obtained from the mine of Borrowdale in Cumberland, has long given celebrity to English pencils; and the *crayons d'Angleterre* are in great esteem on the Continent. Mines of plumbago have been discovered in the United States of America, the most important of which is that at Sturbridge in Massachusetts. The mineral, however, is coarse in texture compared with that of Borrowdale. The method of preparing it is as follows:—It is pulverized, purified by sifting, and the powder is condensed into thin sheets by means of intense pressure; a welding property discovered by Mr Brockedon some years ago, and now brought into general use, owing to the threatened exhaustion of the Cumberland mine, and also for using up the waste material of the manufacture. The plan is to reduce the plumbago to a very fine powder, then to exhaust the intersticial air, and to subject the powder to the force of a hydrostatic press. In this way coherent masses are formed as dense and as useful as the original plumbago. Slices having been cut from a block thus formed: the edge of a slice is inserted in a channel in the cedar-holder, and being cut off, the process is repeated until the groove is filled; or the lead may be cut into square threads, which, after being rounded by passing through circular holes cut in pieces of ruby, are made into the proper lengths for ever-pointed pencils. The cedar for the handles is imported chiefly from South America.

The costliness of the best lead pencils has led to many attempts to economize the material by the introduction of other substances. The most successful attempt of this kind was made towards the end of the last century by a Frenchman named Conté. By mixing pure clay in various proportions with black lead in powder, and also with various coloured earths, he was able to produce pencils and crayons of various degrees of hardness and tint. The clay was carefully washed, and diffused in tubs of river-water, and after settling for two minutes, the milky liquor was drawn off by a syphon into a second tub, and the finest particles thus collected formed a soft and plastic mass fit for use after having been dried on linen filters. The powdered plumbago was calcined in a crucible to nearly a white heat, after which it was mixed with the clay in varying proportions; a fine hard pencil being produced by two parts of clay to one of plumbago, and a softer pencil by equal parts of each. The powders, when mixed, were triturated with water, and ground on a porphyry slab, and when of the proper consistence, the paste or dough was pressed into grooves in a board, previously greased, and another board was screwed down upon it; in this condition the air could act only on the ends of the pencils in the grooves, and these shrinking as they dried, the air gradually entered and dried the whole lengths. The drying was completed in an oven at a moderate heat, after which the threads were hardened by heating them in a crucible with sand or charcoal powder, the heat being regulated according to the degree of hardness required. If intended for very fine work,

such as architectural drawing, the threads were heated, and then immersed in melted wax or suet, nearly boiling hot. It was also found that different degrees of hardness could be obtained by plunging the pencils in various saline solutions, such as that of sulphate of soda, more or less concentrated. The lead thus prepared was then placed in the cedar cases in the usual way.

It has been asserted that the moderate admixture of clay with powdered plumbago takes away that unpleasant glistening property which we sometimes see in pencil-drawings, and does not diminish the blackness. By the addition of lamp-black to the clay and plumbago, pencils of every shade of black have been produced. The mixture must be calcined with exclusion of air, and afterwards made into a paste. The hardest pencils of the architect are made of lead melted with antimony and a small proportion of mercury.

The cheapest pencils are made with black lead in powder mixed with melted sulphur, and poured into holders of wood, of reeds, or of rushes. Common carpenters' pencils are made in this way. The graphitic modification of carbon deposited in the interior of coal-gas retorts is also used in the manufacture of lead-pencils. Gum-arabic, resin, sulphuret of antimony, fusible glass in powder, and other substances, are all used in making cheap pencils.

Slate pencils are made of slate for writing on slabs of the same material. Slate pencils have been made artificially by mixing slate powder with vulcanized india-rubber for writing on slabs of the same material, which are not liable to break; but the objection to the frequent handling of vulcanized india-rubber is the unpleasant smell occasioned by the sulphur. (C. T.)

PENDANT, an ornament hanging at the ear, and frequently composed of diamonds, pearls, or other jewels.

PENDANTS, in *Heraldry*, parts hanging down from the label to the number of three, four, five, or six at most, resembling the drops in the Doric frieze. When they are more than three, they must be specified in blazoning.

PENDANTS *of a Ship* are those streamers or long colours which are split and divided into two parts, ending in points, and suspended at the heads of masts, or at the yard-arm ends.

PENDLETON, a suburb of Manchester, on the slope of a hill to the N.W. of the town, consisting principally of a continuation of the main street of Salford. It contains churches belonging to various denominations, several schools, and a mechanics' institute. The inhabitants are chiefly employed in cotton-spinning, calico-printing, bleaching, and dyeing. Pop. 14,224.

PENDULUM.

THE application of the pendulum to clock-work was one of the great steps of human progress. The motion of time-keepers had previously been regulated by means of a balanced arm, which was made to vibrate backwards and forwards by the teeth of a wheel, called, from its peculiar shape, a *crown-wheel.* The time of vibration of this balance depended on the extent of its motion, and on the propelling force; and therefore clocks of this kind could hardly go with regularity; yet their performance was so satisfactory that they came into general use, and were made so small as to be portable.

Galileo, happening to observe that the oscillation of the chandelier in a cathedral was performed in the same time when the motion was dying away, as when it was extensive, was led to the idea of employing pendulums for the measurement of time. But the discovery of the true theory of isochronous vibration was made by Christian Huygens, who showed that the time of an oscillation is independent of its extent when the tendency of the body to return to its point of rest is exactly proportional to its distance from that point, and applied pendulums to regulate the motion of clocks. Now, in the case of a pendulum, the tendency to return is proportional to the sine of the arc, whereas the distance is proportional to the arc itself, and therefore the oscillations of a pendulum through large and through small arcs cannot be performed in times exactly equal to each other.

Let two bodies, A and B (fig. 1), of exactly equal weights,

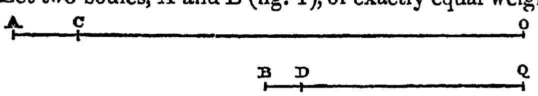

Fig. 1.

be drawn to their points of rest, O and Q, by tendencies exactly proportional to their distances from them; suppose that A is drawn twice as far from O as B is from Q, and that both are released at the same instant. The tendency of A to return is double of the tendency of B, and therefore, in some minute interval of time, when A has moved over the distance AC, B will have moved over BD, the half of AC, and will have acquired a velocity half of that of A; wherefore, at every succeeding interval of time, A must have moved twice as far as B, so that A must reach O at the very instant when B reaches Q. Proceeding on the other side of their respective points of rest, their velocities will be gradually diminished, that of A always being double that of B; and the two velocities will be extinguished simultaneously when the two bodies have reached distances equal, severally, to OA and QB. Thus it is clear that the two oscillations would go on together, and, as the same argument would hold for any other ratio of OA to QB, that the oscillations are performed in the same time, whatever may be their extents.

In order to obtain a faultless time-keeper, Huygens saw that some contrivance must be made for rendering the redressing tendency exactly proportional to the distance from the mean position. Now, the pressure required to bend a spring is proportional to the extent of flexure; and so, by attaching one end of a slender spring to the axis of the balance, the other end being fixed to the frame-work, Huygens at once brought the construction of watches to perfection as far as this part of their theory goes.

For the purpose of rendering the oscillations of a pendulum isochronous, he remarked that the tendency of a body to descend along a curve varies as the sine of the angle which the curve makes with the horizon; so that if a curve can be found such that the length of its arc, counted from the lowest point, is proportional to the sine of its obliquity, the oscillations of a heavy body describing that curve would be isochronous. Now, the cycloid, or curve described by a point in the circumference of a wheel which is rolled along a straight line, possesses this property; so that it only remained to contrive some mechanical arrangement which might produce a cycloidal motion. Huygens availed himself of the fact, that the evolute of a cycloid is another cycloid of equal dimensions. Let BOC (fig. 2) be the cycloid generated by rolling the circle of which DO is the diameter along the straight line BDC, and having produced OD to the equal distance DA, place BA and AC, two half cycloids, equal to OC and OB. Then, if a tangent be applied at any point T in the half cycloid AC, and be continued to meet OC in P, the length of the tangent TP is exactly equal to that of the cycloidal arc TC. Hence, if a plate of wood or metal be shaped into the form

ATC, and if a string fastened at A, and equal in length to AO, be partially wound upon the edge AT of the plate,

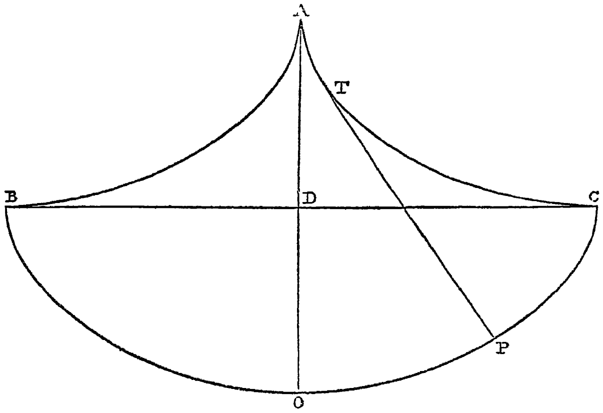

Fig. 2.

the other end P will describe the cycloidal arc OC, while another plate fitted to the curve BA will serve to produce the motion along BO.

The invention of the cycloidal pendulum has added much to the celebrity of Huygens, although it have failed to realize any practical advantages.

The difficulty of shaping the cycloidal cheeks, the loss of force caused by the bending of the flexible part of the pendulum, and, still more, the fact that the error of the ordinary pendulum is exceedingly small, have caused the cycloidal pendulum to fall into disuse; and it is now only to be found in the lecture-room as an admirable instrument for illustrating important principles.

The theory of the cycloidal pendulum has been received as complete; it is, however, defective thus far, that it can only apply to an imaginary pendulum consisting of a single heavy point, supported by a thread destitute of weight. Whenever we take into account the various motions of the parts of which any actual pendulum must be composed, the isochronism is found awanting.

Clock pendulums are now either suspended on knife-edges, or by means of thin flat springs.

The latter mode of suspension is by far the more common, because by far the better of the two. The elasticity of a steel spring is so nearly perfect that the loss of force attending its flexure and re-flexure is insignificant; nor is the oft-repeated bending found to alter its length even in many years, whereas the knife-edge is liable to a continual wear, which gradually deranges the going of the clock. Except as instruments for philosophical research, pendulums supported by knife-edges are hardly ever to be met with.

In an actual pendulum the various parts move with different velocities, whereas hitherto we have been supposing them all to move at one rate, or, which comes to the same thing, we have been assuming the whole mass of the pendulum to be accumulated at a single point, and the weight of the suspending thread to be zero. This imaginary arrangement is called the *simple pendulum*, and we must become acquainted with the manner in which such an ideal pendulum would move in order to be able to investigate the motions of a real or *compound* pendulum.

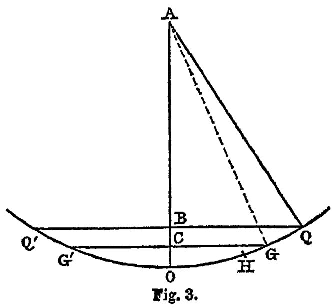

Fig. 3.

Let A (fig. 3) be the point of suspension, AG the suspending thread supposed to be devoid of weight, and G a minute heavy particle, constrained by the thread to move in the circular arc QOQ'. If the weight be brought aside to the point Q, and then let go, it will descend, gaining speed until it reach the lowest point O; then rising along the arc OQ' its velocity will gradually diminish until, at a distance OQ', equal to OQ, it become zero, when the body will begin immediately to descend again towards O. If there were no resistance from friction or from the air, this oscillation would continue for ever.

For the purpose of computing the time in which the pendulum performs its oscillation, we observe that, according to the well-known laws of mechanics, the velocity which the body acquires in descending from Q to G along the curve, is exactly equal to that which it would have acquired in falling from B to C. There is thus no difficulty in telling the velocity of the pendulum at each point of its arc; but it is by no means so easy to compute the time during which, with this ever-changing velocity, the pendulum will pass from Q to O.

If g represent the intensity of gravitation as measured by the velocity which a falling body acquires in one second of time, and if h denote the height through which the body has fallen, its velocity is given by the well known formula

$$v=\sqrt{(2gh)}\,; \quad . \quad . \quad . \quad . \quad . \quad (1.)$$

so that if h be taken for BC, the same expression gives the velocity which the pendulum has as it passes the point G.

If we put L for the length of the thread AG, A for the angle OAQ, α for OAG, we have $\mathrm{BC}=\mathrm{L}\,(\cos\alpha-\cos\mathrm{A})$, and therefore

$$v=\sqrt{(2g\mathrm{L})}\,\{\cos\alpha-\cos\mathrm{A}\}^{\frac{1}{2}}. \quad . \quad . \quad (2.)$$

Assume now some small arc GH, and the time which the heavy body would take to pass from G to H would be $\frac{\mathrm{GH}}{v}$, if its velocity did not change during that time. Actually the time must be somewhat less than this, because the velocity at H is somewhat greater than that at G; but the smaller this distance GH is taken, the less change there will be in the velocity, and therefore the more nearly will the fraction $\frac{\mathrm{GH}}{v}$ express the time occupied in passing from the one point to the other. In order to compute the whole time, we must suppose the arc QO to be divided into a great number of parts; compute the time for each, and add all these times together; and, that this computation may have any pretension to exactitude, the parts must be made very numerous. It is impossible to accomplish such a calculation without the aid of the infinitesimal method.

Let then $\delta\alpha$ represent the minute angle GAH, and δt the corresponding element of time; then, since $\mathrm{GH}=\mathrm{L}\delta\alpha$, we have

$$v=\frac{\mathrm{L}\delta\alpha}{\delta t}, \text{ and } \delta t=\sqrt{\left(\frac{\mathrm{L}}{2g}\right)}\,\{\cos\alpha-\cos\mathrm{A}\}^{-\frac{1}{2}}\,\delta\alpha, \quad (3.)$$

which gives the differential of the time, and which has to be summed or integrated in order to give the whole time.

Considerable artifice is required in order to effect the integration of this formula. Putting $\mathrm{A}=2\mathrm{B}$, $\alpha=2\beta$, whence $\cos\mathrm{A}=1-2\sin\mathrm{B}^2$, $\cos\alpha=1-2\sin\beta^2$, it becomes changed into

$$\delta t=\sqrt{\left(\frac{\mathrm{L}}{g}\right)}\,\{\sin\mathrm{B}^2-\sin\beta^2\}^{-\frac{1}{2}}\,\delta\beta \quad . \quad (4.)$$

Assume now an angle γ, such that

$$\sin\beta=\sin\mathrm{B}\,.\,\sin\gamma, \quad . \quad . \quad . \quad . \quad (5.)$$

and equation (4) becomes transformed into this one—

$$\delta t=\sqrt{\left(\frac{\mathrm{L}}{g}\right)}\,\{1-\sin\mathrm{B}^2\sin\gamma^2\}^{-\frac{1}{2}}\,\delta\gamma\,; \quad . \quad (6.)$$

or, developing by help of the binomial theorem,

$$\delta t=\sqrt{\left(\frac{L}{g}\right)}\left\{1+\tfrac{1}{2}\sin B^2 \sin \gamma^2+\tfrac{1}{2}\times\tfrac{3}{4}\sin B^4 \sin\gamma^4 + \tfrac{1}{2}\times\tfrac{3}{4}\times\tfrac{5}{6}\sin B^6 \sin\gamma^6 + \&c.\right\}\delta\gamma, \quad . \quad (7.)$$

each separate term of which can be integrated by help of the formula

$$\int \sin\gamma^n . \delta\gamma = \frac{n-1}{n}\int \sin\gamma^{n-2}\,\delta\gamma - \frac{1}{n}\sin\gamma^{n-1}\cos\gamma.$$

The result becomes, when arranged,

$$\begin{aligned} t=\sqrt{\frac{L}{g}}\Big\{ & \gamma\left[1+(\tfrac{1}{2})^2\sin B^2+(\tfrac{1}{2}.\tfrac{3}{4})^2\sin B^4+(\tfrac{1}{2}.\tfrac{3}{4}.\tfrac{5}{6})^2\sin B^6+\&c.\right] \\ & -\cos\gamma\sin\gamma\left[(\tfrac{1}{2})^2\sin B^2+(\tfrac{1}{2}.\tfrac{3}{4})^2\sin B^4+(\tfrac{1}{2}.\tfrac{3}{4}.\tfrac{5}{6})^2\sin B^6+\&c.\right] \\ & -\tfrac{2}{3}\cos\gamma\sin\gamma^3\left[(\tfrac{1}{2}.\tfrac{3}{4})^2\sin B^4+(\tfrac{1}{2}.\tfrac{3}{4}.\tfrac{5}{6})^2\sin B^6+\&c.\right] \\ & -\tfrac{2}{3}.\tfrac{4}{5}\cos\gamma\sin\gamma^5\left[(\tfrac{1}{2}.\tfrac{3}{4}.\tfrac{5}{6})^2\sin B^6+\&c.\right]+\&c.\Big\} \quad (8.) \end{aligned}$$

This complex formula gives us the interval of time during which the pendulum describes the arc OG, corresponding to the angle OAG$=2\beta$. In order to find the entire time of describing the arc OQ, we must put $\gamma=90°$, in which case β becomes equal to B; this gives cos $\gamma=$O, and

$$\tfrac{1}{2}T=\sqrt{\left(\frac{L}{g}\right)}\frac{\pi}{2}\left\{1+(\tfrac{1}{2})^2\sin B^2+(\tfrac{1}{2}.\tfrac{3}{4})^2\sin B^4+\&c.\right\};$$

or, denoting by T the whole time of a beat,

$$T=\pi\sqrt{\left(\frac{L}{g}\right)}\left\{1+(\tfrac{1}{2})^2\sin B^2+(\tfrac{1}{2}.\tfrac{3}{4})^2\sin B^4+\&c.\right\} \quad (9.)$$

for the time of passing from Q to Q′. From this the time of an oscillation can be very readily computed, since, in all practical cases, the angle B is very small.

If we imagine the extent of an oscillation to be exceedingly minute, the terms containing the powers of sin B may be neglected, and we have the usual formula

$$T=\pi\sqrt{\frac{L}{g}}, \text{ or } gT^2=\pi^2L, \quad . \quad (10.)$$

which gives the time of oscillation of an ideal pendulum, consisting of a single heavy point supported by a thread having no weight, and making oscillations imperceptible in extent.

From this equation it follows, that the lengths of simple pendulums are proportional to the squares of their times: for example, a pendulum swinging thirty times per minute must be four times as long as the common seconds pendulum, while a half-seconds pendulum must only have one-fourth part of the length.

According to observations made on moving bodies by means of Attwood's machine, the value of g comes out to be about 32 English feet, or 384 inches; wherefore the length of a simple pendulum vibrating in seconds should be

$$\frac{384}{(3{\cdot}1416)^2}=39 \text{ inches nearly.}$$

But neither observations made directly on falling bodies, nor those made by help of Attwood's machine, are susceptible of precision, while, as we shall see, measurements of the pendulum can be made with very great nicety; and thus, instead of deducing the length of the pendulum from the value of g, we derive an accurate knowledge of the intensity of gravitation from experiments made with the pendulum.

How minute soever the arc of vibration may be, the time of describing it must be longer than the result obtained from equation (10); and our first business, in attempting to deduce any accurate results from experiments made with the pendulum is, to determine the effect of the amplitude of the arc.

By help of equation (9), the following table has been computed, showing the time in which a pendulum will oscillate through arcs of 2°, 4°, 6°...up to 20°, that of making an infinitely small oscillation being taken as the unit:—

Half Arc.	Time of Oscillation.		
		1st Diff	2d Diff
0°	1·00000 00000	1 90389	3 80819
1	1·00001 90389	5 71208	3 80937
2	1 00007 61597	9 52145	3 81137
3	1·00017 13742	13 33282	3 81419
4	1 00030 47024	17 14701	3 81775
5	1·00047 61725	20 96476	3 82217
6	1 00068 58201	24 78693	3 82737
7	1 00093 36894	28 61430	3 83338
8	1·00121 98324	32 44768	3 84021
9	1·00154 43092	36 28789	3 84787
10	1·00190 71881	40 13576	3 85631
11	1·00230 85457	43 99207	3 86563
12	1 00274 84664	47 85770	3 87573
13	1·00322 70434	51 73343	3 88672
14	1·00374 43777	55 62015	3 89851
15	1·00430 05792	59 51866	3 91118
16	1 00489 57658	63 42984	3 92470
17	1·00553 00642	67 35454	3 93909
18	1·00620 36096	71 29363	3 95436
19	1·00691 65459	75 24799	
20	1·00766 90258		

Halt Arc.	Excess of Apparent Day.		
	Sec.	1st Dift.	2d Diff.
0°	0 00000	1·64496	3·29028
1	1·64496	4 93524	3·29129
2	6 58020	8·22653	3 29303
3	14·80673	11 51956	3·29545
4	26·32629	14 81501	3 29855
5	41·14130	18·11356	3 30234
6	59·25486	21·41590	3 30686
7	80·67076	24·72276	3 31203
8	105·39352	28·03479	3 31796
9	133·42831	31 35275	3 32454
10	164·78106	34·67729	3·33186
11	199 45835	38 00915	3 33990
12	237·46750	41·34905	3 34864
13	278 81655	44·69769	3·35811
14	323·51424	48·05580	3 36832
15	371·57004	51·42412	3 37926
16	422 99416	54·80338	3 39095
17	477 79754	58·19433	3 40336
18	535 99187	61 59769	3 41658
19	597 58956	65 01427	
20	662·60383		

The first column in each of these tables contains the half arc of vibration, or the extreme angular distance from the vertical line. The second column of the first table contains the time of an oscillation, with the first and second differences for the purpose of interpolating; and that of the second, the excess of the apparent day (or twenty-four hours as shown by the clock) over the true day (or that which would be shown by a clock of which the oscillations are imperceptible).

From these tables we see the importance of having a clock pendulum arranged to make small oscillations. If, to take an extreme example, we had a pendulum kept swinging to a distance of 20° on each side of the vertical line, and had it regulated to go to true time; and if, by the thickening of the oil, or some analogous change in the maintaining power, the oscillations were reduced to 19°, the clock would gain upon true time by 64ˢ·567, since the number of beats per day would be increased in the ratio of 1·00691 65459 : 1·00766 90258. But if, by augmenting the load on the pendulum, and, of course, properly modifying the escapement, the arc of vibration were reduced to only 1° on each side of the vertical line, and the clock again adjusted to go in true time; and thereafter, if a change in the maintaining power were to take place, so as to reduce the arc by one-twentieth part as before, the beats

of the clock would be increased in the ratio of 1·00001 72491 to 1·00001 90389, and there would be a daily gain of 0^s·154636. Thus a variation in the intensity of the maintaining power would occasion four hundred times as great an error on the pendulum with the long sweep as on that with the short one; the unsteadiness arising from this source being proportional nearly to the square of the amplitude.

"This may be confirmed by a very simple but beautiful experiment. Having suspended a leaden ball by means of a slender thread, let this simple pendulum be put in motion, so that the ball may describe a curve known to bear a considerable resemblance to the ellipse. If the times of vibration along the two axes of this curve were exactly equal to each other, the ball would repeatedly retrace the same orbit; but these times of vibration are different, and during the passage from end to end of the long axis the ball has more than returned to its position in reference to the short one, so that the axes of the orbit are gradually displaced in the direction of the movement of the ball." (*Edin. New Phil. Jour.*, vol. xv., p. 140.)

Having now investigated the law of the motion of an imaginary simple pendulum, we have to examine the case of a real one, consisting of parts, each moving with its own relative velocity. We shall first consider it as moving in a vacuum, and examine afterwards the effect of the air.

The weights of the various parts of the compound pendulum produce a tendency to turn it upon its axis, exactly equal to that which would be produced by the whole weight of the pendulum acting at its centre of gravity. But the quantity of motion existing in a moving body is greater than that which would have existed in it if all concentrated at its centre of gravity, by the motion of rotation which it would have had if turning simply with the same angular velocity on an axis passing through the centre of gravity; wherefore, in every possible case, the oscillations of a pendulum must be slower than those of a simple pendulum represented by the centre of gravity of the compound one.

If A (fig. 4) be the axis of motion supposed perpendicular to the plane of the paper, and G the centre of gravity of a compound pendulum, its motion may be represented thus: From G, with the distance GR equal to the mean distance of gyration of the mass, describe a circle; then if we suppose the whole weight of the pendulum to be distributed uniformly round the circumference of this circle, the motions of this imaginary ring will represent those of the compound pendulum.

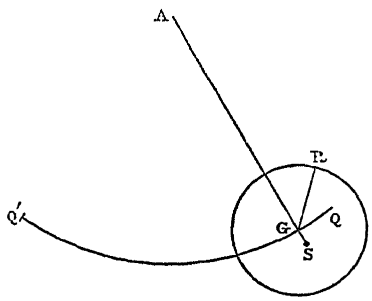

Fig 4.

When the point G is moving along the arc QGQ′, with the velocity v, the force of translation is v^2W, W being the whole weight of the pendulum; but the velocity of rotation of the ring R is $v\frac{\text{GR}}{\text{AG}}$, or, symbolically, $v\frac{\text{R}}{l}$, putting GR = R, AG = l; wherefore the rotatory motion is

$$v^2\frac{\text{R}^2}{l^2}\text{W};$$

and therefore the whole motion existing in the moving mass is

$$\text{W}v^2\frac{l^2+\text{R}^2}{l^2}=\text{F}. \quad . \quad . \quad . \quad (11.)$$

Now the total quantity of motion in any system, as measured by combining the weight of each part with the square of its velocity, is proportional to the quantity of *work* which has produced that motion, the work being estimated by combining each pressure with the distance through which it has acted, so that in any system whatever

$$2g\,.\,\text{work} = \text{motion}.$$

But the pressure in this case is W, and the distance through which it has acted is l (cos α − cos A); so that Wl (cos α − cos A) represents the quantity of work expended in producing the motion F. Wherefore

$$2g\ \text{W}l(\cos\alpha-\cos\text{A})=\text{W}v^2\frac{l^2+\text{R}^2}{l^2}; \quad (12.)$$

or, putting for v its equivalent $l\frac{\delta\alpha}{\delta t}$,

$$\delta t=\sqrt{\left(\frac{l+\frac{\text{R}^2}{l}}{2g}\right)}\{\cos\alpha-\cos\text{A}\}^{-\frac{1}{2}}\delta\alpha. \quad . \quad (12.)$$

If, then, we make GS a third proportional to AG and GR, and put AS = L, or

$$\text{L}=l+\frac{\text{R}^2}{l}, \quad . \quad . \quad . \quad . \quad . \quad (13.)$$

we shall have

$$\delta t=\sqrt{\left(\frac{\text{L}}{2g}\right)}\{\cos\alpha-\cos\text{A}\}^{-\frac{1}{2}}\delta\alpha,$$

which is an exact copy of equation (3); and therefore we conclude that the compound pendulum, of which GR is the mean distance of gyration, will oscillate in exactly the same time as a simple pendulum of which the length is AS.

From this equation (12) it appears that the oscillations of a compound are similar to those of a simple pendulum, and that therefore the tables which we have given apply to actual clocks.

But the investigation also shows clearly that the oscillations of a compound cycloidal pendulum cannot be isochronous; for when the pendulum is at the middle, the quantity of motion is augmented in the ratio of AO² + R² : AO², whereas, when the pendulum is in the direction TP, the augmentation is in the ratio of TP² + R² : TP², which is a higher ratio; so that this circumstance ought to be taken into account when we investigate the isochronism of a compound pendulum.

The point S is called the centre of oscillation, or that point at which, if the whole mass of the pendulum were supposed to be concentrated, the time of oscillation would not be changed; and we have this property, that *the rectangle under the distances of the point of suspension, and of the centre of oscillation from the centre of gravity, is equivalent to the square of the mean distance of gyration*, and is therefore constant for the same pendulum; that is AG . GS = GR².

From this law Huygens concluded that the point of suspension and the centre of oscillation are interchangeable; in other words, if the pendulum were suspended on an axis passing through the point S, its time of oscillation would be the same as when suspended from A.

Captain Kater proposed to utilize this property by employing it to determine the exact length of a simple pendulum vibrating in the same time with a compound one. For this purpose he placed two knife-edges exactly parallel to each other, one at A, the other at S, and carefully adjusted the weights of the parts by repeated trials, until he found that the two times of oscillation were alike; then, measuring the distance between the two knife-edges, he obtained the length of the corresponding simple pendulum; from which the intensity of gravitation can be computed.

This beautiful process is the only one available for determining with great nicety the length of the seconds pendulum, since it avoids the difficult and unsatisfactory operation of measuring with great precision the dimensions of the various parts; it is, however, subject to several sources of

minute error, which have either to be guarded against or allowed for.

The first of these sources of error is the wearing of the knife-edges, which gradually changes the points of suspension, and renders a new adjustment necessary; and it is a very important question, whether the distance between two blunted knife-edges on which the oscillations are performed in equal times be truly the length of the corresponding simple pendulum. M. Laplace demonstrated that the blunting of the edges does not impair the accuracy of the convertible pendulum.

For the purpose of examining thoroughly into this matter, let the pendulum be suspended on a cylinder, of which the axis is A (fig. 5), and the radius AM $=\rho$; this cylinder rolling upon a horizontal plane KL. In this arrangement the point G must describe a convoluted cycloid, while A moves in a horizontal line.

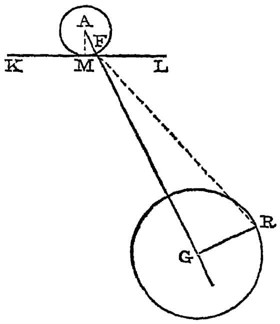

Fig. 5.

The linear motion of the point G is composed of two motions, one perpendicular and proportional to AG, represented by $l\,.\,\delta\alpha$, and the other horizontally, on account of the motion of the centre A, represented by $\rho\,.\,\delta\alpha$. The angle of these two motions being α, it follows that the square of the actual linear motion of G is $(l^2-2l\rho\cos\alpha+\rho^2)\,\delta\alpha^2$; wherefore the motion of translation is

$$W\{l^2-2l\rho\cos\alpha+\rho^2\}\left(\frac{\delta\alpha}{\delta t}\right)^2$$

and the entire quantity of motion in the system

$$W\{l^2-2l\rho\cos\alpha+\rho^2+R^2\}\left(\frac{\delta\alpha}{\delta t}\right)^2;$$

while the descent of the centre of gravity is as before, $l(\cos A-\cos\alpha)$, so that the equation of motion becomes, putting, as before, $A=2B$, $\alpha=2\beta$,

$$\delta t=\sqrt{\left(\frac{1}{gl}\right)}\left\{\frac{(l-\rho)^2+R^2+4l\rho\sin\beta^2}{\sin B^2-\sin\beta^2}\right\}^{\frac{1}{2}}\delta\beta;$$

or, making $\sin\beta=\sin B\,.\,\sin\gamma$, and putting, for shortness sake,

$$\frac{4l\rho}{(l-\rho)^2+R^2}=k$$

$$\delta t=\sqrt{\left(\frac{(l-\rho)^2+R^2}{gl}\right)}\left\{\frac{1+k\sin B^2\sin\gamma^2}{1-\sin B^2\sin\gamma^2}\right\}^{\frac{1}{2}}\delta\gamma. \quad (14.)$$

Expanding the variable part of this expression according to the powers of $\sin\gamma^2$, integrating each term, and taking the integral between the limits $\gamma=-\frac{\pi}{2}$, $\gamma=\frac{\pi}{2}$, we have for the time of an oscillation—

$$\begin{aligned}T=\pi\sqrt{\frac{(l-\rho)^2+R^2}{gl}}\Big\{&1+(\tfrac{1}{2})^2\sin B^2\,[1+\tfrac{2}{1}\cdot\tfrac{1}{2}k]\\&+(\tfrac{1}{2}\cdot\tfrac{3}{4})^2\sin B^4\,[1+\tfrac{4}{3}\times\tfrac{1}{2}k-\tfrac{2}{1}\cdot\tfrac{4}{3}\times\tfrac{1}{2}\cdot\tfrac{1}{4}k^2]\\&+(\tfrac{1}{2}\cdot\tfrac{3}{4}\cdot\tfrac{5}{6})^2\sin B^6\,[1+\tfrac{6}{5}\times\tfrac{1}{2}k-\tfrac{4}{3}\cdot\tfrac{6}{5}\times\tfrac{1}{2}\cdot\tfrac{1}{4}k^2+\tfrac{2}{1}\cdot\tfrac{4}{3}\cdot\tfrac{6}{5}\\&\qquad\times\tfrac{1}{2}\cdot\tfrac{1}{4}\cdot\tfrac{3}{6}k^3]\\&+(\tfrac{1}{2}\cdot\tfrac{3}{4}\cdot\tfrac{5}{6}\cdot\tfrac{7}{8})^2\sin B^8\,[1+\tfrac{8}{7}\times\tfrac{1}{2}k-\tfrac{6}{5}\cdot\tfrac{8}{7}\times\tfrac{1}{2}\cdot\tfrac{1}{4}k^2+\tfrac{4}{3}\cdot\tfrac{6}{5}\cdot\tfrac{8}{7}\\&\qquad+\tfrac{1}{2}\cdot\tfrac{1}{4}\cdot\tfrac{3}{6}k^3-\&c.]+\&c.\Big\}\quad . \; . \; . \quad (15.)\end{aligned}$$

the law of progression of which is obvious.

This formula gives the time of oscillation of a pendulum suspended on a cylinder, without any restriction as to the radius of curvature. From it we see that the correction for amplitude is not the same as for a pendulum hung by a perfect knife-edge, and that therefore the motions of no simple pendulum can strictly represent those of this one.

When the value of k is small,—that is to say, when AM is minute in comparison with AG, and when the angle B also is very small,—the expression becomes

$$T=\text{nearly }\pi\sqrt{\left\{\frac{l-2\rho+\frac{R^2}{l}}{g}\right\}}\{1+\tfrac{1}{4}\sin B^2(1+k)\}$$

and, if the oscillations be supposed to be infinitesimally minute,

$$(T)=\pi\sqrt{\left\{\frac{l-2\rho+\frac{R^2+\rho^2}{l}}{g}\right\}}\quad . \; . \quad (16.)$$

which agrees with those of a simple pendulum of which the length is

$$L=l+\frac{R^2+\rho^2}{l}-2\rho. \quad . \; . \; . \; . \quad (17.)$$

If, then, it were proposed to place the cylinder A at such a distance from the centre of gravity as that the time of a minute oscillation may be equal to that of a simple pendulum having the length L, we should have to solve the quadratic equation—

$$l^2-(L+2\rho)l+R^2+\rho^2=0.$$

Now, according to the properties of such equations, if l and λ be the two roots, their sum must be $L+2\rho$, and their product $R^2+\rho^2$, or

$$l+\lambda=L+2\rho\,;\ l\lambda=R^2+\rho^2. \quad . \; . \quad (18.)$$

Now $l+\lambda$ represents the distance between the centres of two cylinders placed on opposite sides of the centre of gravity; and thus, since

$$l+\lambda-2\rho=L,$$

the distance between the surfaces of the cylinders is equal to the length of the corresponding simple pendulum.

This investigation is free from all limitations as to the magnitude of the cylinders; so that if carefully-turned and polished cylinders were substituted for the knife-edges, and if the corrections for the amplitudes of the arcs of vibration were made according to the formula (15), the results would be rigorously exact.

When the curvatures of the two edges are not alike, an error is introduced, because the one distance is then the major root of the equation

$$l^2-(L+2\rho)\,l+R^2+\rho^2=0.$$

while the other is the minor root of another equation

$$l^2-(L+2\rho')\,l+R^2+\rho'^2=0.$$

The sum of these roots, when ρ and ρ' are minute, approaches sensibly to

$$l+\rho+\rho'\,;$$

so that in practical cases the fact of the edges being blunted does not vitiate the results.

The next source of error which we shall consider is the buoyancy of the air in which the experiments are made.

If the pendulum were composed entirely of one kind of material, its centre of gravity would coincide with the centre of buoyancy, and the co-efficient W in the first member of equation (12) would have to be replaced by W − A, A being the weight of the displaced air. But when the pendulum is made of various materials, the inquiry becomes a little more difficult. It will be enough to consider those cases in which the centre of buoyancy, the centre of gravity, and the points of suspension, lie all in one straight line. Let then B (fig. 6) be the centre of buoyancy, its distance from G being represented by e; then the motion which the system has acquired being due to the descent of the weight W through the distance l $(\cos\alpha-\cos A)$ less that of A through $(l-e)$ $(\cos\alpha-\cos A)$, we must have

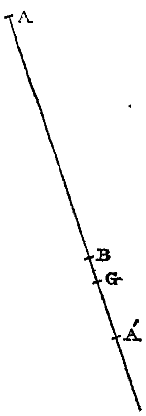

Fig. 6.

$$2g\{(W-A)\,l+Ae\}\,(\cos\alpha-\cos A)$$
$$=W(l^2+R^2)\left(\frac{\delta\alpha}{\delta t}\right)^2;$$

wherefore the length of a corresponding simple pendulum vibrating in vacuo is

$$L=\frac{W\,(l^2+R^2)}{(W-A)\,l+Ae}. \quad . \quad . \quad . \quad (19.)$$

If then we desire to place A so that the oscillations may agree with those of the simple pendulum L, we must solve the quadratic equation

$$l^2-\left(1-\frac{A}{W}\right)Ll+R^2-\frac{A}{W}Le=0. \quad . \quad (20.)$$

The two roots of this equation will not represent the one GA on the one side and the other GA′ on the other side of the centre of gravity, but two distances on one side, either of which will satisfy the condition of oscillation. When the pendulum is inverted to be suspended from the point A′, the equation becomes, putting λ for GA′,

$$\lambda^2-\left(1-\frac{A}{W}\right)L\lambda+R^2+\frac{A}{W}Le=0. \quad . \quad (21.)$$

The major root of the one and the minor root of the other being taken, we have the proper values of l and λ, viz.,—

$$l=\frac{W-A}{2W}L\pm\sqrt{\left\{\left(\frac{W-A}{2W}L\right)^2-R^2+\frac{A}{W}Le\right\}}$$
$$\lambda=\frac{W-A}{2W}L\mp\sqrt{\left\{\left(\frac{W-A}{2W}L\right)^2-R^2-\frac{A}{W}Le\right\}}$$

the sum of which is no longer independent of the specialities of construction of the pendulum.

If the centre of buoyancy coincide with the centre of gravity, e becomes zero, and

$$l+\lambda=\frac{W-A}{W}L; \quad . \quad . \quad . \quad . \quad (22.)$$

from which the length of the simple pendulum can be easily deduced; but *in no other case can the reversible pendulum vibrating in air give a result dependent only on the measurement of the distance between the knife-edges.*

While the air modifies the vibrations of a pendulum by its buoyancy, it also influences them by its resistance to motion. The law of this resistance, like all the laws connected with the motion of fluid bodies, is very imperfectly known; no method of analysis has been discovered which can at all approach the difficulties of the subject; nor has any glimpse yet been obtained of the internal arrangement of the parts of fluids, so that we have not even a foundation on which to build a train of reasoning.

The resistance which the air presents to a moving body is usually supposed to be proportional to the square of the velocity, and also, with similar solids, to the extent of surface; but there is some reason to believe that both proportions are only approximate. Even when assisted by this supposition, the powers of the higher calculus fail in discovering what effect this resistance has on the going of a clock. The equation of motion, when expressed in the notation of Leibnitz, takes the form

$$\frac{\delta^2\alpha}{\delta t^2}=P\sin\alpha-Q\left(\frac{\delta\alpha}{\delta t}\right)^2$$

which is not integrable by any known process.

Attempts have been made to overcome this difficulty by assuming that the resistance is exceedingly small in comparison with the tendency of the pendulum to descend along the arc; and it has been shown that, in this case, the extent, but not the time, of an oscillation is sensibly affected. Yet all such demonstrations want conclusiveness, since the result extracted may be only a disguised form of that assumption which has been arbitrarily made in order to bring the matter apparently within the power of the calculus.

Although we cannot ascertain the precise effects of the air's resistance, we may, by a general view of the subject, arrive at some useful conclusions.

On comparing the motion of a pendulum describing a large arc QQ′ (fig. 7), with that of another of the same dimensions oscillating through the smaller arc qq', we perceive that, generally speaking, the velocities of the two are proportional to the lengths of the arcs; wherefore the intensities of the air's resistance must be nearly proportional to the squares of those lengths. Now, the redressing tendencies are proportional to the sines of the arcs; wherefore it follows that the air's resistance bears a less proportion to the redressing tendency in the case of the small arc than in that of the large one, which forms another argument in favour of a small arc of vibration.

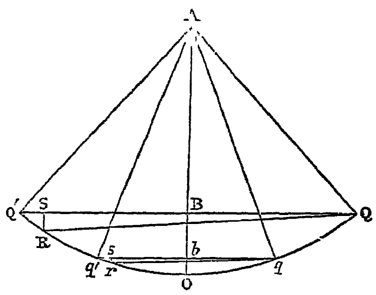

Fig. 7.

While the intensity of the resistance is proportional to the square of the length of the arc, the distance through which it acts is proportional to that length, wherefore the quantity of motion destroyed, or the loss of force, is proportional to the cube of the length. Now, if the pendulum, after having been dropped from Q, rise only on the other side to the distance OR, the loss of force is proportional to the distance SR, by which R is lower than Q; and therefore, we have, approximately

$$SR : sr :: QR^3 : qr^3.$$

Again, if we assume that the arcs Q′R, qr, are so small as to be undistinguishable from their tangents, the trigons Q′SR, $q'sr$ are similar to Q′BA, $q'ba$; so that if the arcs OQ, oq themselves be small,

$$Q'R : q'r :: OQ^2 : oq^2$$

approximately.

If, then, the oscillations of a pendulum be slowly arrested by the air's resistance alone, the successive amplitudes must form a progression in which the differences are proportional to the squares of the terms; that is, they must form a harmonic series, and the number of beats occurring between the amplitudes OQ = A and $oq=\alpha$, must be proportional to the difference of the inverse powers of α and A, or to $\frac{1}{\alpha}-\frac{1}{A}$. It has been erroneously asserted that the arcs should form a decreasing geometrical progression. In virtue merely of the air's resistance, then, the pendulum would never be brought absolutely to rest.

In addition to this resistance there is the friction on the knife-edge, which is nearly constant. When the pendulum is inclined at the angle α, its pressure upon the support is $W\,.\,\cos\alpha$, and therefore if f be the coefficient of friction for the particular knife-edge, the redressing tendency is $W(\sin\alpha-f\cos\alpha)$; and if we put $f=\tan\phi$, ϕ being then the angle of repose, or the minute angle through which the pendulum may be drawn aside from the vertical position without tending to return, the redressing tendency becomes

$$\frac{W}{\cos\phi}(\cos\phi\sin\alpha-\sin\phi\cos\alpha)=W\sec\phi\,.\,\sin(\alpha-\phi).$$

From this it is apparent that each oscillation will be performed on either side of a line inclined to the vertical line by the angle ϕ, so that the amplitude of the oscillations will form a decreasing arithmetical progression, of which the common difference is $2\,\phi$.

From the same expression it follows, that the time of an oscillation will be reduced in the ratio of $\sqrt{\cos\phi}$ to 1; or that, in order to make it vibrate in true time, the pendulum must be lengthened in the ratio of sec ϕ to unit.

In all practical cases, however, the angle ϕ is exceedingly minute, so that its cosine and secant cannot differ from the radius by any appreciable quantity; in other words, we may hold that the friction on the knife-edge has no perceptible influence on the time-keeping.

When both the air's resistance and the friction act together, the amplitudes must form a complex progression, approaching more and more nearly to an arithmetical one as the arcs become shorter.

A more serious cause of error in the determination of the length of the pendulum, is to be found in the yieldingness of the support. In our investigations, the point of suspension has been supposed to be absolutely immoveable; but there is no substance which does not yield to the pressure applied to it, and therefore, as the pendulum swings from side to side, the point of suspension oscillates also; and the whole framework becomes truly a part of the vibrating mass.

Hence the propriety of securing the suspending plate to a strong wall; and hence also the impropriety of the too common practice of making the house-clock rest on the bottom of its case.

When a pressure is applied to some point in an elastic structure, the form of the structure is deranged, and the point to which the pressure is applied is displaced; but the displacement is not necessarily in the direction of the pressure. Every elastic structure has, in reference to any given point in it, three directions at right angles to each other, in one of which the flexibility is a maximum, in a second a minimum, and in the third a maximum or minimum. And it is only when the pressure is applied in one of these three directions that the displacement is in the direction of the pressure. Hence, a general inquiry into the effect which the flexibility of the support may have upon the motion of the pendulum would be excessively complicated. In order to simplify it, we shall assume that the three directions alluded to are one vertical, one horizontal in the plane of the oscillation, and the third also horizontal, but perpendicular to the plane of oscillation; and this supposition is admissible, because of the symmetry of the parts.

The pressure, W cos α, which the knife-edge exerts against the suspending plate may be decomposed into two pressures, W cos α^2 in a vertical, and W cos α sin α in a horizontal direction; so that if μ and m be the coefficients of flexibility in those two directions, μW cos α^2 will be the depression, and mW cos α sin α the horizontal displacement of the point of suspension in virtue of this pressure.

But the point of suspension does not take up truly the position indicated by these quantities, because the matter of the framework has to be moved; and the motion imparted to it forms part of the sum total. Yet, as the quantity of motion is measured by combining the square of the velocity with the mass, and as the whole displacement is microscopical, the quantity of motion in the framework must be excessively minute, and we may assume that the above expressions represent truly the position of the support corresponding to the inclination α.

The differentials of these are

$$\mu W \sin 2\alpha \,.\, \delta\alpha, \text{ and } mW \cos 2\alpha \,.\, \delta\alpha;$$

wherefore the motion of the centre of gravity of the pendulum is composed of three motions,—$l\delta\alpha$ at an inclination of α to the horizon, μW sin 2α . $\delta\alpha$ upwards, and mW cos 2α . $\delta\alpha$ horizontally outwards; so that the square of its actual motion is, neglecting those terms which contain the squares of m and μ,

$$\{l^2 + 2lW\,(m \cos\alpha \,.\, \cos 2\alpha + \mu \sin\alpha \,.\, \sin 2\alpha)\}\,\delta\alpha^2;$$

and therefore the differential equation of motion is

$$\delta t = \left\{ \frac{R^2 + l^2 + 2lW\,(m\cos\alpha \,.\, \cos 2\alpha + \mu \sin\alpha \,.\, \sin 2\alpha}{2gl\,(\cos\alpha - \cos A)} \right\} \delta\alpha$$

and the integration of this expression would give the value of the time t.

When the arc of vibration is minute, the length of a simple pendulum vibrating in the same time becomes

$$L = \frac{R^2 + l^2 + 2lmW}{l};$$

and therefore, if we wish to determine that value of l which will produce a given time of oscillation, we must resolve the quadratic equation

$$l^2 - (L - 2mW)\, l + R^2 = 0.$$

Now, if l and λ be the two roots of this equation, we must have

$$l + \lambda = L - 2mW;$$

and thus the distance between the knife-edges of a reversible pendulum is less than the true length of the simple pendulum by $2m$W, m being a coefficient depending on the flexibility of the supports.

This equation suggests a method of discovering the amount of this inaccuracy; for if two pendulums of different weights be swung in succession from the same support, the values of L deduced from them will differ by the quantity $2m\,(W - W')$, and that difference will give the value of the coefficient m.

We have all along supposed the parts of the pendulum to be perfectly rigid, and have now to inquire whether the flexibility of the rod be not another source of error. This part of the subject has not received an adequate share of attention; and, indeed, the method employed by Borda for determining the length of the pendulum seems to have been contrived in neglect of the errors occasioned by the flexibility of the parts.

In order to put this matter in a clear light, let us construct a pendulum AXY (fig. 8), composed of a fine inflexible line carrying weights X, Y, &c., at various distances, AS being the length of the corresponding simple pendulum. Then, as this system oscillates, the changes in the motion of a particle placed at S are exactly those which gravitation would induce on that particle if suspended separately from the point A; the whole of its tendency to descend along the arc is expended in accelerating or retarding its motion. But it is different with a particle placed at X, above S: the actual motions of this particle are less rapid than they would have been if it were attached to A by a separate thread, in the ratio of AX to AS; and therefore only a part of the weight X, represented by $X \,.\, \frac{AX}{AS}$, is employed in accelerating or retarding its motion, the remainder $X \,.\, \frac{XS}{AS}$ being resisted by the stiffness of the pendulum-rod. That is to say, the body X tends to bend the pendulum-rod inwards by a pressure $X \,.\, \frac{XS}{AS} \sin\alpha$.

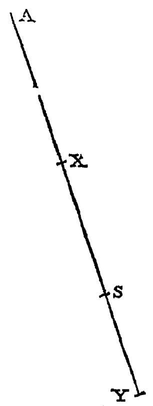

Fig. 8

In the same way, a body placed at Y, below S, has its motions made more rapid than they would have been if it were separately suspended, and therefore it presses outwards on the rod with an intensity of $Y \,.\, \frac{YS}{AS} \sin\alpha$.

It thus seems that the structure of the pendulum is subjected to variable internal strains, caused by the motions of

its own parts, and that, unless it be so strong as to resist these strains without any appreciable change of form, its oscillations cannot agree with those which have been deduced on the supposition of perfect rigidity.

Borda's method of determining the actual length of the seconds pendulum was to suspend a ball of platinum by a fine wire (fig. 9), to measure the entire length from the knife-edge to the lowest point of the ball, and thence to compute, by help of the measured dimensions of the apparatus, the mean distance of oscillation. In order to avoid the necessity of measuring the dimensions of the knife-edge and its framework, Borda first adjusted these parts separately to oscillate in the intended time, in order that they might exert no perceptible influence on the motion of the ball. By this ingenious device, the calculations were much simplified, as only the dimensions of the ball, the suspending cap, and the wire, had to be taken into account. But the whole arrangement is liable to the objection, that the centre of the ball, the point of attachment, and the knife-edge, do not remain in one straight line during the oscillation. A body suspended in this way has two kinds of motion, which may exist separately or conjoined. One of these is a short-period vibration, in which the centre of gravity remains nearly at rest; the other is a swinging motion, composed of two isochronous oscillations,—one of the wire on the knife-edge, the other of the ball on the point of attachment. The nature of this complex motion has not been investigated: it indeed presents difficulties of a very high order; and until these difficulties be overcome, a degree of uncertainty must attach to all observations made with this kind of pendulum.

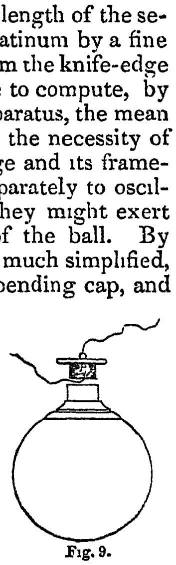

Fig. 9.

Besides being flexible, the pendulum-rod is distensible. Now, when suspended from the point A, the parts are subjected to one set of strains; when suspended from S, to another. Unless, then, the rod be of such strength as to resist these changes of strain without any appreciable change of length, the measurement of the distance between the knife-edges must give a result perceptibly erroneous.

These sources of error in the use of the convertible pendulum are inevitable; there are others to be found in the imperfections of the workmanship.

It is essential to have the plate on which the knife-edge rests perfectly flat and accurately horizontal. The sustaining plate is usually made of agate; yet there are few minerals capable of taking a high polish and so ill adapted for the purpose. The agate consists of layers of various degrees of hardness; and when it is ground with emery upon a brass surface, the hard parts are seen to project, somewhat like the layers of planed pine-wood. On this account, it is exceedingly difficult to obtain a surface on agate truly flat. This substance has another bad quality,—that its structure is porous, and that contact with it rapidly impairs a steel edge. A surface worked in rock-crystal or Cairngorm topaz would be much preferable. The want of flatness in the agate plate may account for the displacement of the knife-edge which has sometimes been noticed.

The two knife-edges must be placed exactly parallel to each other, and their plane must pass through the centre of gravity of the mass. In the accounts of experiments made with the convertible pendulum, there is no notice of any precautions which have been taken for the purpose of securing the fulfilment of these conditions; they seem to have been left entirely to the care of the workmen. It is not enough that, when one knife-edge is horizontal, and the pendulum at rest, the other knife-edge also be horizontal; it is of great importance that both be in the same vertical plane.

Every body has three principal axes passing through the centre of gravity at right angles to each other, on which its motion of rotation, with a given angular velocity, is maximum or minimum; and the amount of rotation on any other axis varies according to its position in reference to these three. On account of the symmetry of the parts in all actual cases, one of the principal axes may be assumed as lying along the length of the pendulum; one of the other two being in the plane of oscillation, the third at right angles to it.

The *bob*, or heavy part of the pendulum, is sometimes made flat or lenticular, the rod and other parts partaking of the same shape. In such case, the amount of rotation on the axis parallel to the knife-edge is greater than on that perpendicular to it, and any twist on the pendulum-rod causes the rate of the clock to vary: and, particularly when the rod is of wood, this form of *bob* causes great irregularity. In order to avoid this source of error, and to render innocuous any deviations of the knife-edges in azimuth, the mass of the pendulum should be distributed uniformly round its vertical axis, so as to render the amount of rotation constant for every horizontal axis passing through the centre of gravity.

The convertible pendulum is not kept in motion by machinery, like the pendulum of a clock, but having been set in motion, is allowed gradually to come to rest; and as it continues to oscillate for but a short while, the number of oscillations which it would make per day has to be ascertained by comparing its movements with those of a clock pendulum of which the rate is known.

In order to make this comparison, the convertible pendulum is erected in front of the clock, a telescope of low power being fixed at a little distance. A distinct white mark is made on the clock pendulum, of size sufficient to be just hid from view by a part of the convertible pendulum when both are at rest. If now the two pendulums were to oscillate in the same direction, keeping true time with each other, the white mark would be always concealed; but if, as is purposely arranged, the one pendulum oscillate a little more slowly than the other, they will gradually separate from each other, and the white mark will become visible. As the separation increases to become one beat, the pendulums pass each other in different directions, and the mark is covered for too short a time to prevent its being visible; but as the difference approaches to be two beats, the motions again agree, and the spot is hid. Thus, by noticing the successive instants of the complete disappearance of the mark, the observer can discover the difference between the rates of the two pendulums with great precision.

On account, however, of the diminution of the amplitude, the rate of the free pendulum slowly accelerates; and thus the intervals between the successive disappearances are unequal. Besides this, the vèlocities at the middles of the arcs become different, and the disappearance is not complete; the most favourable time for observation being when the apparent velocities of the parts, as seen from the telescope, are exactly equal to each other. It is thus a matter of very considerable difficulty to determine with precision the ratio of the beat of the free pendulum to that of the clock; and, in addition, there is the error to which the rate of the clock itself is subject.

Besides all these sources of minute error, which are special to the subject, there is that which attends all attempts at minute measurement, and which arises from thermal expansion. The comparison of the distance between the two knife-edges with the divisions on a standard scale, at a given temperature, requires an accurate knowledge of the rates of expansion of the two rods, and during the motion of the pendulum an account must be taken of the temperature. Now, the thermometer only can give the temperature

of the surrounding air, which only agrees with that of the pendulum when the changes are very slow; and therefore it is of the utmost importance, for the exactitude of the conclusions, that all experiments be carried on in a place not liable to fluctuations of temperature.

On reviewing all these sources of error, we need not be surprised to find disagreements among the results obtained by different observers, particularly when we consider that the expressions for the lengths of the pendulum have been carried to the ninth decimal place, that for the *thousand-millionth* part of a metre. It is matter of astonishment to find the results agree so well.

The determination of the length of the pendulum in different latitudes throws a great light upon certain departments of physical astronomy; and it is this circumstance which gives importance to the present subject. Among the experiments which have been recorded, there are many close coincidences, and not a few discrepancies, in the last-place figures. From these latter, attempts have been made to estimate irregularities in the structure of the earth; while from the former the amount of its oblateness is inferred. In this way, the pendulum becomes an important and valuable instrument for astronomical research.

For the purpose of discovering the variation of gravity at different parts of the earth's surface, it is sufficient to compare the number of oscillations which a pendulum makes per day at one place with the number which the same pendulum makes at another place: the intensities of gravitation at the two places are inversely as the square of these numbers.

Whichever of these two pendulums may be used, the trustworthiness of the result depends mainly upon the means which are taken to compare the oscillations with the length of the day. Though it be customary to use the mean solar day as the standard, the comparisons are really made with the sidereal day, that interval of time being, of all others, the most susceptible of exact and ready measurement. Now, with a four-foot portable transit instrument, the instant of the passage of a star over the meridian can hardly be determined to within one-tenth part of a second, the distance passed over by the image of an equatorial star in that time being little more than the three-thousandth of an inch upon the wires, and the position of the instrument being liable to errors of collimation, of levelling, and of azimuth. We cannot therefore venture to say that the clock's rate in a given day can be determined certainly to within one-tenth part of a second, although the comparisons have been made at an interval of twenty-four hours. Seeing, then, that the free pendulum is compared with the clock only over a small fraction of the day, it is a great deal to expect that its daily rate can be ascertained to within one second of time.

A change of one second per day in the rate of a clock corresponds to a change of $\frac{1}{43200}$th in the length of the pendulum, which is about $\frac{1}{1100}$th of an inch, or $\frac{1}{43}$d of a millimetre; and therefore we may regard this distance as indicating the probable limit of exactitude.

From careful measurements made at the instance of the British government, the length of the seconds pendulum at London, and at the level of the sea, is 39·1393 inches; while the length of the decimal pendulum, obtained at Paris with equal care, is ·7419076 metre. Now, by discussions on measurements made at various places, the length of the pendulum is found to be

$$1 - \cdot 00275 \cos 2 \text{ lat.},$$

according to some, and

$$1 - \cdot 00268 \cos 2 \text{ lat.},$$

according to other investigators; and therefore we may assume, with Vince, that

$$1 - \cdot 00270 \cos 2 \text{ lat.}$$

represents the length of the pendulum at any latitude, when the pendulum at latitude 45° is taken as the unit.

According to this formula, the pendulums at Paris and London should be in the ratio of 1·000360 to 1·000605. Multiplying the length of the decimal pendulum by the square of the fraction $\frac{1000}{864}$, we obtain ·9938534 for the length of the common seconds pendulum at Paris, and augmenting this in the above ratio, ·9940967 metre for the length of the pendulum at London; wherefore the ratio of the metre to the inch, as determined by help of the pendulum, is 39·1393 to ·9940967, from which the length of the metre comes out 39·37172 inches. Direct comparison has given 39·37079, and there is a discrepancy of very nearly one-thousandth part of an inch.

Adopting the authorized value 39·1393 for the length of the pendulum at London, and using Vince's formula for reduction, the length of the pendulum at 45° is 39·1156 inches, and at any other latitude,

$$39 \cdot 1156\ (1 - \cdot 0027 \cos 2 \text{ lat.})$$

From this, by help of equation 10, we obtain the intensity of gravitation—

$$386 \cdot 05\ (1 - \cdot 0027 \cos 2 \text{ lat.}),$$

as measured in English inches; that is to say, a heavy body falls during the first second of time through 193 inches, or 16 feet 1 inch, in latitude 45°, and in a vacuum.

The determination of the oblateness of the earth from observations on the length of the pendulum belongs to physical astronomy. It is enough to remark here, that the irregularities of two, three, or even five seconds per day which occur among the observations, can scarcely support a speculation on the irregularity of the earth's structure, seeing that in the immediate vicinity of powerful stationary transit instruments, and with every appliance and convenience for insuring precision, there has been a disagreement of a whole second.

ATTACHED PENDULUMS.

The great utility of the pendulum lies in its application to time-keeping. This part of the subject has already been adverted to under the head CLOCK-WORK; in the present place, we shall consider a little more in detail the abstract principles which are involved.

As has been stated, clock pendulums are never suspended on knife-edges; they are hung by means of thin flat springs. The elasticity of these, and the form which they take on being bent, cause a deviation from the circular motion, the effect of which has not been rigorously investigated, but which evidently tends toward the condition of cycloidal motion; so that the errors caused by changes in the amplitudes must be less than in the case of the knife-edge suspension.

The wheel-work of the clock performs the double function of recording the number of oscillations and of maintaining the motion; and the perfection of its action requires that it never miss count, and that it preserve a constant amplitude. Now, nothing short of perfect workmanship can secure the attainment of the latter condition; and therefore the primary object in contriving the parts of the movement is to arrange them so that a variation in the maintaining power may produce no perceptible change in the daily rate, for which purpose the natural motion of the pendulum must be interfered with as little as possible.

The progress of the wheels cannot be continuous, for then the extent of the oscillation would depend on the dimensions of the parts: the wheel-work must then move by steps; and therefore its action must consist of three distinct parts,—viz., the *detention*, the *release*, and the *impulse*. The apparatus for accomplishing these three actions constitute what is called an *escapement*.

In some escapements the detention is effected by allowing a tooth to rest upon some part of the pendulum; in such cases the detaining surface must be exactly or nearly concentric with the motion of the pendulum; if it be truly concentric, the wheels remain perfectly stationary during the detention, and the escapement is called *dead-beat;* but if, as in the earlier clocks, the detaining surface be inclined, the wheels move backwards and forwards during the detention, and the escapement is called *recoil.* The recoil escapement is so obviously faulty that one is puzzled to account for its having remained so long in use, particularly when we reflect that a very slight change in the form of the parts converts it into a dead-beat.

In these escapements the *release* is effected by allowing the tooth to slip off one end of the detaining surface. In the case of the simple dead-beat the end of the detent is sloped a little from the radial direction, in order that the tooth in descending along it may give the impulse; or the tooth itself is so shaped that it may produce the same effect. When the impulse has been given, another detaining surface has come into such a position as to oppose the motion of another tooth, and the blow produced by this contact *beats* the second. For counting, this kind of escapement is decidedly the best.

In the duplex escapement, when the long tooth slips off the detent, the wheel turns rapidly through a distance which the clockmaker arranges to be as small as possible, until the impulse-tooth fall upon, or rather overtake, the pallet; this produces a slight sound. When the impulse has been given, the impulse-tooth is relieved from the pallet, and the escape-wheel turns rapidly, but again only through a small distance, until the alternate detent stop the next long tooth. This last action is accompanied by a more distinct beat, indicating the second; but the astronomer, unless placed at such a distance as not to hear the preceding slight sound, finds it more difficult to estimate the fractions of a second with this than with the former escapement.

For the purpose of avoiding entirely the rubbing during the detention, a separate detent is provided, on which the tooth may fall. This detent and the wheel-work remain stationary until the release be effected by some part of the pendulum coming in contact with and lifting the detent, so as to permit the impulse to be given: escapements of this class are called *detached.* The now very common *detached lever* and the *chronometer* escapements are characteristic though dissimilar examples of this class. Because of the number of abrupt actions, each accompanied by a slight sound, neither of them is well adapted for minute observations, unless the ear be so far removed as not to catch the lesser sounds.

In discussing the comparative merits of different kinds of escapements, it would be tedious to enter into the peculiarities of their construction; it will be enough to examine their actions under the general heads of *detention, release,* and *impulse.*

In the common dead-beat, and also in the duplex escapement, the friction of the detained tooth upon the circular arc is nearly constant; but the influence of a constant friction upon the motion of a pendulum has not been strictly investigated; so that we have nothing better than approximation to guide us. It can easily be shown that a constant friction acting upon the balance of a watch, in which the redressing tendency is proportional to the distance from the point of rest, produces no change in the time of the oscillation, and only displaces, first to one side and then to the other, the middle of the arc; and we have shown above that a friction varying as the cosine of the obliquity produces both a displacement of the arc and an imperceptible acceleration on the pendulum; wherefore we may conclude that, with a small arc of oscillation, the effect of friction on the clock's rate must be very trifling. The most serious effect is, the diminution of the amplitude, which necessitates a more powerful impulse. In respect of this, the duplex is decidedly preferable to the simple dead-beat; but the detached escapements have the advantage over both, since they occasion no friction at all.

The release in the dead-beat and duplex escapements is merely the end of the detention; the tooth slips off the detaining arc. But in detached escapements the release is a distinct action; the detent has to be removed from before the tooth. In the chronometer escapement the detent is kept in its place by a spring, which must be bent backwards when the detent is raised, thus causing a retardation through a small part of the arc. The comparative value of the two classes of escapements must depend to some extent on whether this resistance of the detent or the friction on the pallet be most injurious to the time-keeping. The watchmaker gives a motion as extensive as possible to the balance, while the clockmaker's aim is to render the arc as small as he can; and thus the advantages of the detached escapement are greater in watch than in clock work.

When the release has been accomplished, the wheels are impelled forward, but not instantaneously. They acquire velocity gradually, until arrested by the stroke of the impulse-tooth upon the pallet.

In a common dead-beat escapement, let A (fig. 10) be the axis of the crutch, C that of the escape-wheel, and T the tooth, which, having been detained upon the surface EF, is just released by the motion of the pendulum towards the right. The pallet continues its motion, and the tooth begins to descend according to the ordinary law, its distances being proportional to the squares of the elapsed times. In consequence of these two motions, T would trace upon a surface attached to the crutch a paraboloid curve FG, tangent to the arc EF at F; and if the end of the pallet were exactly shaped to this curve, the tooth would merely graze it, without communicating any impulse.

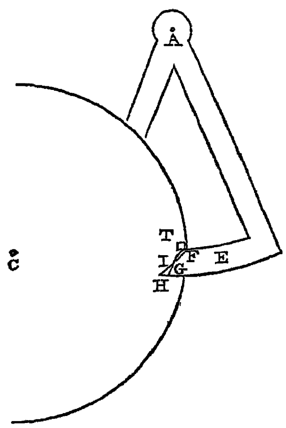

Fig. 10.

When the end of the pallet is bevelled, as FH, making a sharp corner at F, the tooth falls behind at first, gains speed, and overtakes the pallet at I; so that the impulse is only given from I to H. Although the interval FI be so small as to escape observation, it is not the less real, and as its tendency is to cause a slight uncertainty in the action, it ought always to be obviated by rounding a little the corners of the ruby. It is completely removed in those escapements which have the tooth T part of a cylinder.

But this interval exists unavoidably in the duplex and in the detached escapement. Its extent in all cases is augmented by an increase in the weight of the escape-wheel, for which reason that wheel ought to be made as light as is consistent with accuracy and permanency of form.

The great derangement of the time-keeping is from the impulse. Friction, imperfect elasticity, and the air's resistance, are injurious chiefly because they render an impulse necessary; and the important matter in contriving an escapement is to place the arc of impulse so as not to influence the time of the oscillation.

The effect of the impulse can be strictly investigated when the redressing tendency is proportional to the derangement; and it can be shown (*Edin. New Phil. Jour.* for July 1835) that the proper time for the impulse is nearly at the middle of the oscillation; but when, as in the

case of the pendulum, the redressing tendency is proportional to the sine of the inclination, the inquiry transcends the power of the calculus. We may, however, satisfy ourselves that the impulse ought to be given when the pendulum is near its lowest point by considerations which do not require any elaborate formulæ.

The impulse is to restore the motion that has been lost by friction and the air's resistance; and therefore the product of the impelling pressure, by the distance through which it acts, must be equal to that of the resistance by its distance. Its effect upon the pendulum is to augment the square of the velocity by a certain quantity, and to shorten the time in which the arc of impulse is passed over. If V be the velocity which the pendulum would have had at the end of the arc of impulse if let alone, and V′ the velocity which it has after having received the impulse, we have $V'^2 - V^2 = I$, or $(V' + V)(V' - V) = Pi$. When the impulse is given near the middle of the arc, $V' + V$ is large, and therefore $V' - V$ small; but when it is given near the limit of the motion, $V' + V$ is small, and therefore $V' - V$ proportionally great. Now i being the extent of the arc of impact, $\frac{i}{V}$ is the time during which it would have been described with the velocity V, and $\frac{i}{V'}$ that with the velocity V′; hence $\frac{i}{V} - \frac{i}{V'}$ is proportional, approximately, to the direct influence of the impulse upon the time of an oscillation. This may be put under the form $i\,\frac{V' - V}{VV'}$; and it is to be observed of this fraction that its numerator is inversely proportional to $V' + V$, whence $\frac{i}{VV'(V+V')}$ represents the error in time-keeping caused by the impact.

From this we conclude, that when the change $V' - V$ is not great, the error caused by the impulse is inversely as the cube of the velocity of the pendulum at the time of receiving it; and also that the shorter the arc, the pressure being proportionally augmented, the less the derangement is.

Now, neither the detached escapement nor the duplex can be used with a very small arc of impulse, as the risk of missing would be great; while the simple dead-beat can have that arc reduced by an alteration on the forms of the tooth and pallet; so that, considering its smooth, quiet action, and the facility which it gives for reducing the direct error of the impulse, we need not wonder that it is regarded as, practically, the best escapement.

REMONTOIRES.

As the maintaining power is communicated to the pallets through a long train of wheels, it is liable to periodical variations from malformation of the teeth, and to more permanent changes from dust, and from the thickening of the oil. Also in spring time-keepers the form of the fusee does not compensate perfectly for the varying tension of the mainspring. Hence the utility of what are called *remontoires*, or re-winders.

This name is given to various arrangements by which a small weight or slender spring, as the case may be, is wound to a determinate height at short intervals of time, this weight or spring becoming virtually the maintaining power. If the remontoire be made to act every minute, the seconds hand proceeds as usual, but the minute and hour hands spring forward by one minute at a time. The periodical inequalities are in this case repeated every minute, and cannot accumulate to become perceptible; while, as all the parts above the remontoire can be highly finished or jewelled, the variations of friction are little felt.

When the re-winding occurs every second, the arrangement becomes what is known under the name of the *gravity escapement*. In the greater number of gravity escapements the impulse weight is held by the clock-work at a fixed height until the pendulum relieve it and carry it to the extremity of the oscillation. During this part of the action the weight retards the motion; but when the pendulum begins to descend, the weight descends also, and as it is not arrested till it has reached a point lower than that from which it started, it accelerates more than it retards the pendulum. When the impulse-weight has reached its lowest point, the detent is unlocked, and the wheel-work raises the weight to its first place, there to await the pendulum.

In electric clocks, galvanic contact is made or broken at the proper instant, and the impulse-weight is lifted by the electro-magnet.

These escapements are essentially recoil escapements, and have all the defects which are inseparable from the class. An extraneous influence cannot be brought to bear on the pendulum at a worse place than at the extremity of the motion, where the velocity is zero. And seeing that, for good time-keeping, the arc of impulse must be very short, it cannot but be detrimental to lengthen it out over a half oscillation. These escapements, in fact, are in direct opposition to the principles which have just been explained.

METRONOME PENDULUMS.

We have seen that the length of simple pendulums vibrating in different times are proportional to the squares of those times, and that these lengths are fixed by the intensity of gravitation; thus a simple pendulum vibrating once a second must be about 39 inches long. But it does not follow that a compound pendulum must have this length.

For the purpose of marking time, musicians employ an instrument called a *metronome* (fig. 11), of which the principal part is a small pendulum capable of being regulated to suit the character of the opera, B being the principal weight of this pendulum, and A the axis of motion, the rod BA is prolonged above the fulcrum, and on the prolongation AD an adjusting weight C is made to slide; divisions also are engraved and numbered on AD, to indicate the number of beats which the pendulum makes per minute.

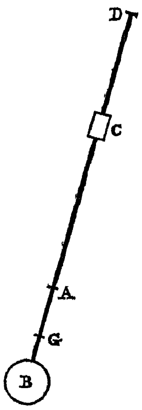

Fig. 11.

If m_1, m_2, m_3, &c., represent the masses of which a pendulum is made up, r_1, r_2, r_3, &c., their distances from the axis of motion, and if AG be the distance of the centre of gravity from that axis,—

$$\frac{m_1r_1^2 + m_2r_2^2 + m_3r_3^2 + \&c.}{AG\,(m_1 + m_2 + m_3 + \&c.)}$$

expresses the length of the simple pendulum vibrating in the same time.

Now, by raising the weight C, we augment the numerator of this fraction, and at the same time lessen the denominator, since the centre of gravity is also raised, so that we lengthen the time of the oscillation. If C were raised so high as to bring the centre of gravity up to A, the mean distance of oscillation would become infinite; so that there is no degree of slowness that cannot be attained by this arrangement.

If M be the weight of the permanent part of the metronome pendulum, including the axis and pallets, R its mean distance of gyration round the axis, and l the distance of its centre of gravity, then

$$L_0 = \frac{MR^2}{Ml}$$

is the mean distance of oscillation of the unloaded metronome. And if m be the weight of the sliding-piece, ρ its mean distance of gyration round an axis passing through its own centre of gravity parallel to the axis of the pendulum, and λ the distance of its centre of gravity above that axis,

$$L=\frac{MR^2+m\rho^2+m\lambda^2}{Ml-m\lambda}$$

is the mean distance of oscillation of the loaded metronome. The weights M and m can be determined directly, and the length L_0 can be obtained by observing the oscillations of the pendulum when unloaded, using the equation

$$l=t^2\times 39.1393;$$

by this means we can eliminate MR^2, and the equation

$$\frac{Ml}{m}L-\left(\frac{Ml}{m}L_0+\rho^2\right)=\lambda^2-L\lambda$$

expresses the relation between L and λ. In this there remain still the quantities l and ρ to be determined by experiment. By placing the weight C at three different positions on the stem, and observing the times of oscillation, these quantities l and ρ can be found, and thence the graduation of the instrument.

However, as the matter does not call for extreme precision, the ordinary method of finding by trial three or four points on the scale, and then graduating between, is sufficient for the purpose.

COMPENSATION PENDULUMS.

The expansions and contractions of the pendulum-rod, consequent on changes of temperature, are sources of great irregularity in the going of clocks. Thus, iron wire expands, according to M. Biot, $\frac{1}{812}$th from freezing to boiling water, and therefore this change of temperature would cause an alteration of 53 seconds in the daily rate; that is, very nearly 3 seconds for every 10 degrees of Fahrenheit's thermometer. A piece of white deal expands only about the third part as much as iron; and hence the irregularity of a pendulum with a deal rod is only about 1 second per day for a change of 10 degrees Fahrenheit. A well-made clock, with a deal-rod pendulum, is sufficiently accurate for the ordinary purposes of life; but where great nicety is required, means are taken to correct the effects of expansion.

As this part of the subject has already been adverted to under the head CLOCK-WORK, it is enough, here, to indicate the general features of the investigation.

A very simple and inexpensive compensation pendulum may be made of a cylindric deal rod carrying a long leaden cylinder; and if the rod be composed of several slips, well glued together, and thoroughly varnished, to prevent the effects of the moisture, there is perhaps no pendulum yet contrived which will keep better time.

Fig. 12.

The strict investigation into the effects of a change of temperature upon a clock furnished with such a pendulum would take into account—1*st*, The weight, form, and expansion of the crutch and its appendages, since these form an essential part of the oscillating mass; 2*d*, The expansion and change of stiffness of the slender steel spring AB (fig. 12); 3*d*, The expansion, lateral as well as longitudinal, of the deal rod BC; and, *lastly*, The expansion of the perforated leaden bob CD, and the thermal compensation, will be effected when the various dimensions are arranged; so that the numerator and denominator of the fraction

$$\frac{\Sigma\,.\,mr^2}{AG\,.\,\Sigma m}$$

receive proportional augmentations on an increase of temperature. Now it is evident that the square of the temperature will be found in the new numerator, while only its first power can enter into the denominator; and thus we see that no compensation can be *perfect* for every change of temperature. However, as the expansions are all minute, the second powers of the fractions which represent them may be neglected without causing any appreciable error.

There is a great uncertainty as to the rates of expansion of different bodies, arising partly from the difficulty of making the measurements, and partly from irregularities among different specimens of the same substances. On this account, it would be a waste of labour to compute the conditions of compensation strictly—the more so, that the fine adjustment must be made by trial; we shall content ourselves with an analysis on the supposition that the parts are merely linear, and that the pendulum is swung from a knife-edge.

If m_1 and m_2 be the weight of the deal rod AC, and of the leaden bob CD, the mean distance of oscillation is

$$l=\frac{2}{3}\frac{m_1\,.\,AC^2+m_2\,(AC^2+AC\,.\,AD+AD^2)}{m_1\,.\,AC+m_2\,(AC+AD)}$$

for the temperature at which the measurements are made; and if e_1, e_2 be the rates of expansion for one degree, while AC and CD are denoted by H and h, the condition of compensation is expressed by the equation

$$\frac{m_1H^2+m_2\,(3H^2-3Hh+h^2)}{m_1H+m_2(2H-h)}$$
$$=\frac{m_1\,(2H^2e_1)+m_2\,(6H^2e_1-3Hh\,(e_1+e_2)+2h^2e_2)}{m_1\,(He_1)+m_2\,(2He_1-he_2)}.$$

Again, if we suppose that the weight m_1 of the rod is insignificant in comparison with m_2, the equation becomes much simpler, and reduces itself to the form

$$e_2h^3-(4e_2+e_1)Hh^2+(3e_2+6e_1)H^2h-6e_1H^3=0;$$

so that, even in this most simple case, the determination of the ratio of h to H requires the resolution of a cubic equation.

Supposing that for deal $e_1=\frac{1}{2400}$, and that for lead $e_2=\frac{1}{350}$, we have $e_1:e_2::7:48$, and the equation becomes

$$48h^3-199h^2H+186hH^2-42H^3=0;$$

whence very nearly $H=3h$; that is, the column of lead must be one-third part as long as the deal-rod; and for a seconds pendulum the whole length must be about 46·35 inches; the leaden bob being 15·45 long.

ATMOSPHERIC INFLUENCE.

The effect of the buoyancy of the air upon the going of a clock is considerable: thus lead is about 9000 times heavier than air of the same volume, and therefore a change of one inch in the barometer will alter the apparent weight of the leaden bob by one part in 270,000, which corresponds to an alteration in the daily rate of the clock of $\frac{16}{100}$ths of a second, or rather more than one second per week; and as the whole of the pendulum is not made of such weighty materials, the actual derangement must be somewhat more than this. It is thus impossible, in a climate so variable as ours, to construct a clock that shall keep true astronomical time, unless it be cased and protected entirely from changes in the buoyancy of the air, or unless some means be fallen upon to compensate for atmospheric changes.

In the delicate operation of determining the apparent right ascension of a star or planet, the time of transit over the wires of the telescope is sought to within a small fraction, as the twentieth or fiftieth part of a second. We must be able, therefore, to depend on the going of the clock from one observation of a standard star till another within this degree of precision, otherwise the care bestowed on the collimation of the instrument is thrown away. Now a rise of half an inch in the barometer will, in twelve hours, produce a retardation of $\frac{1}{24}$th of a second; so that, if an

astronomer aim at precision in his observations, he must be able to make allowance for the effect of the air's buoyancy on the going of his clock.

By carefully collating the observed variations in the clock with the indications of the thermometer and barometer, an empirical formula may be constructed, by means of which the error may be computed up to any given time.

When steel or iron rods enter into the composition of the pendulum, an error of another kind is induced. The rod, particularly in latitudes where the needle dips much, becomes magnetic, and is then influenced by the earth's magnetism. The amount of this influence increases until the maximum magnetism is induced; and thus newly-made clocks which have steel and mercury compensation pendulums are liable to show an acceleration of rate for a considerable time after they are set up; they are also liable to changes of rate depending on variations in the intensity of the earth's magnetism.

CONICAL PENDULUM.

When a pendulum, instead of being hung on an axis which restricts its motion to one plane, is hung on a point merely, its movements are much more complex. Laplace has partially investigated the case of a single material point suspended by means of an imponderable thread; but the general subject has hardly yet been inquired into.

If the motion of a simple pendulum be restricted to a very minute distance from the point of rest, it describes almost exactly an ellipse; but whenever the amplitudes become perceptible, the major axis of the curve turns in space so as to imitate in some respects the motion of the line of apsides of a planet. When, however, the pendulum is compound, a much more intricate movement takes place.

To illustrate the nature of this complex motion, let us suppose that a pendulum of irregular shape is swung from a Hooke's universal joint, the two axes of which are parallel to the horizontal axes of greatest and least rotation. Then if the pendulum be drawn aside in the direction of one axis, and let go, it will continue to oscillate on the other axis; but the times of the oscillation on these axes will not be the same: let us represent them by T and t. If now the pendulum be drawn aside in a direction not parallel to either axis, both oscillations will go on conjointly. The determination of the complex motion thus induced is too difficult for the calculus in its present state; if, however, we restrict the amplitudes to be exceedingly minute, the form of the curve may be obtained by the following process:—

Assume O (fig. 13) as the central position, A O a, B O b as the extents of the oscillations parallel to the two axes, then the rectangle C D c d circumscribes the curve. On cD and DC describe two semicircles, and divide each of them into equal parts, the numbers being proportional to the times T and t (the ratio assumed in the adjoining fig. is 5 : 3), and through the points of section draw lines parallel to the sides of the rectangle. Then, beginning

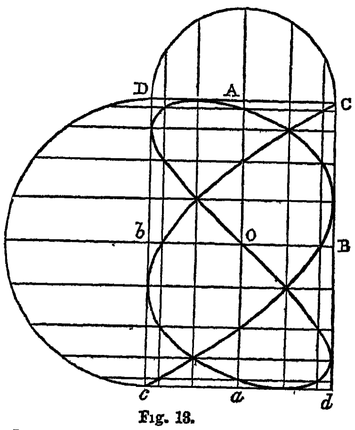

Fig. 13.

at any of the crossings, let a curve be traced diagonally through the adjoining meshes; this line represents the path of the pendulum. It is of the same nature with the curves described by the free extremity of a straight wire held firmly by the other end.

If the periodic times of the oscillations be nearly alike, the curve assumes the appearance of an ellipse, of which the major axis oscillates between the diagonals Cc and Dd, and which collapses into a straight line in each of them.

When, however, the amplitudes are considerable, this method fails to give a correct representation of the movement.

If the suspension could be by means of a thread offering no resistance to torsion, the motions of an irregular mass would be still more complex; and when the cord resists torsion, an oscillatory-rotatory motion is superadded, and the complexity becomes enormous.

One species of conical pendulum deserves attention as being used for regulating the speed of steam-engines and water-wheels. In it the pendulum is hinged on a horizontal axis, which is caused to revolve round a vertical one, and the effect of the motion is to throw the pendulum aside from the vertical position. If there were no friction on the hinge, the rotatory motion would be combined with an oscillatory motion on the horizontal axis; but in the actual apparatus, the friction and other resistances destroy the oscillation, while the rotation is kept up by the machinery; and, on this account, the only object of interest is to determine the degree of inclination which belongs to a given speed.

Let AB (fig 14) be the vertical axis of a governor, C and C′ the hinges, G and G′ the centre of gravity of the two pendulums; then having drawn GD perpendicular to AB, GD is the radius of the circle described by G, and therefore, if T be the time of a rotation, $m\frac{4\pi^2}{g}\frac{\mathrm{DG}}{\mathrm{T}^2}$ is the centrifugal tendency in the direction DG; and the resultant obtained by combining this with m in a vertical direction must lie along CG; wherefore, having produced GC to meet AB in E—

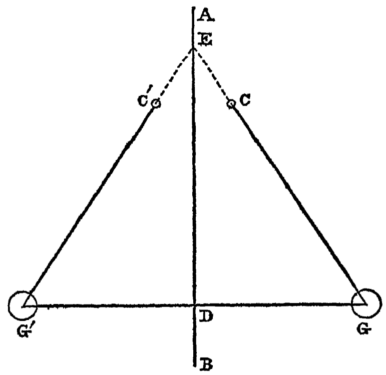

Fig. 14.

$$\tan \mathrm{DAC} = \frac{4\pi^2}{g}\frac{\mathrm{DG}}{\mathrm{T}^2} = \frac{\mathrm{DG}}{\mathrm{ED}};$$

$$\text{whence } \mathrm{ED} = \frac{g}{4\pi^2}\mathrm{T}^2.$$

If we notice that in reckoning the oscillations of a pendulum we counted from one side to another, whereas a complete oscillation requires a return to the same place, we shall see that the height DE of the conical pendulum is equal to the length of a simple pendulum oscillating along with it.

FOUCAULT'S EXPERIMENT.

When a round body, suspended by means of a flexible thread, is once set to oscillate in a plane, it continues to move in that plane. M. Foucault has taken advantage of this property in order to demonstrate the diurnal rotation of the earth. If the earth were at rest, the direction of the vibrations would remain, and would appear to remain, fixed; but as the earth turns while the plane of oscillation preserves its parallelism, that plane appears, in reference to surrounding objects, to turn in the direction of the apparent motion of the stars.

In repeating this beautiful experiment, care must be taken that the weight be symmetric in shape, and that no bias be given at the outset, lest some of the complex movements above mentioned be induced. (E. S.)

PENEDO, a town and district of Brazil, in the province of Alagoas, on the left bank of the São Francisco, 60 miles S.W. of Alagoas. The town is large and well built, partly on the bank of the river, and partly on the slope of a hill. It contains several churches and schools, a town-hall, and a Franciscan convent. The adjacent country produces in abundance cotton, rice, pulse, millet, and mandioc. Pop. of the district, 14,000.

PENELOPE, the wife of Ulysses, and mother of Telemachus, was famous for her conjugal constancy. During the long absence of her husband, numerous suitors sought in vain to win her hand. She constantly put them off by declaring that she must finish the shroud which she was then weaving before she could listen to their proposals. At the same time, she continued to undo during the night that part of the woof which she had done during the day. This stratagem kept them at bay until the arrival of Ulysses.

PENIG, a town of Saxony, circle of Leipsic, on the right bank of the Mulda, 35 miles S.S.E. of Leipsic. It contains a Gothic church built chiefly of porphyry, two ducal castles, a court of law, bleachworks, and cotton, silk, and paper manufactories. Pop. 4817.

PENINSULA (*pene*, almost, *insula*, an island) is a portion of land almost surrounded by water.

PENITENCE, or PENANCE, is one of the seven sacraments of the Church of Rome. Penitence is sometimes used for a state of repentance, and sometimes for the act of repenting. It gives title, besides, to several religious orders, consisting either of converted debauchees and reformed prostitutes, or of persons who devote themselves to the office of reclaiming them. Of this latter kind is the *Order of Penitence of St Magdalen*, established about the year 1272 by one Bernard, a citizen of Marseilles, who devoted himself to the work of converting the courtezans of that city. Bernard was seconded by several others, who, having formed a kind of society, were at length erected into a religious order by Pope Nicholas III. under the rule of St Augustin. F. Gesnay says they also constituted a religious order of the penitents, or women they converted, giving them the same rules and observances which they themselves followed. The "Congregation of Penitents" at Paris was founded with a similar view.

PENKRIDGE, a market-town of England, in the county of Stafford, on the Penk, an affluent of the Trent, here crossed by a stone bridge, 5½ miles S. of Stafford, and 131 N.W. of London. It consists of two principal streets, uniting near the bridge; and contains a parish church with a square tower, places of worship belonging to Methodists and Independents, and a national school. The lower part of the town is subject to inundations of the river. There are 3 annual fairs; and yearly races are held in September. Pop. (1851) 2663.

PENN, WILLIAM, founder of the state of Pennsylvania, and the most accomplished Englishman that ever joined the Society of Friends or Quakers, was a native of London, born October 13, 1644. He was the eldest son of a brave naval officer, one of the sea-captains of the Commonwealth, who, after the Restoration, rose to the rank of admiral, was knighted by Charles II., and appointed a commissioner of the navy. In the flag-ship of the Duke of York, Admiral Penn held the post of "Great Captain Commander," and was with his royal highness in the decisive victory over the Dutch off Harwich in 1665. An intimacy was thus formed between the prince and the admiral which had an important influence on the fortunes and character of the admiral's son, the Quaker preacher and legislator. In his fifteenth year William Penn was entered a gentleman commoner of Christ Church, Oxford. Polemical controversy and religious fervour, under various forms, then agitated the country; the university partook of the excitement, and Penn joined the serious or puritanical class of students who waged war against the surplice and high church ceremonial patronized by the court. He attended the preaching of a Quaker named Thomas Loe, neglected the college rules and discipline, and was fined: he became still more contumacious, and was expelled. Admiral Penn, a worldly, ambitious man, who looked forward to a peerage, was inexpressibly chagrined and mortified by this strange conduct on the part of his son and heir. He adopted, however, a mild and judicious mode of treatment; he sent the young Nonconformist abroad in company with some friends, to make the tour of France and Italy. The experiment was completely successful. Withdrawn from the Oxford influences, William Penn became the fine gentleman and man of the world. He remained abroad two years, and on his return to England, was introduced to the court, where his polished manners and handsome appearance soon rendered him a favourite. In order to fit him for public life, his father entered him as a student of Lincoln's Inn, and employed him also on his own private affairs. In June 1665 the plague broke out in London. That awful visitation, which carried terror to every heart and struck down thousands in the capital, revived all William Penn's serious and self-abasing impressions. He abandoned the licentious court, left off visiting the gay circles that swarmed around "the merry monarch, scandalous and poor," and, shutting himself up, took to the study of controversial and practical divinity. His father saw that it was again time to interfere. He had property in Ireland, a valuable barony in the county of Cork, which had been granted by the king in exchange for an estate bestowed on the admiral by Cromwell. The new grant was disputed by local claimants, lawsuits were instituted, and negotiations were necessary to settle the matter. William Penn had already shown his aptitude for business, and his father despatched him to Ireland, recommending him in an especial manner, by introductory letters, to the care of the Duke of Ormond, then viceroy of Ireland. At the court at Dublin Penn was a welcome visitor; and an insurrection breaking out at this time among the military at Carrickfergus, he served for a short period as a volunteer. In his capacity of soldier Penn displayed so much coolness and bravery that he was offered the command of a company. For a moment visions of military glory seem to have dazzled the future apostle of peace; but his father, not dreaming of another relapse to the Quaker rule, and sensible of the value of the services rendered to his family by his son's management of the Irish estate, opposed himself to this intended military destination. A crisis was at hand. William Penn happened to visit Cork; Thomas Loe was there on a Quaker mission; and curiosity led Penn one day to attend the preaching of his former Oxford acquaintance. The circumstance was decisive. All his former enthusiasm came back upon him with augmented force; he joined the hated and despised sect; and shortly afterwards was, with the rest of the congregation, sent to prison on the usual charge of riot and tumultuous assembling. His friends at the viceregal court procured his release, and the admiral sent for him home. The meeting must have been a painful one on both sides. To the rage and expostulations of his father the neophyte opposed calm answers and subtle arguments. He got a short time to deliberate—retired, prayed, and was immoveable in his resolution to adhere to the new doctrines. His father turned him out of doors! The die was now cast; Penn was elevated to a sort of martyrdom, and he seems to have exulted in his emancipation from all worldly compromise and restraint. He set himself vigorously to prosecute what he conceived to be his Divine mission. His father, after a few months' absence, permitted him to return home, but would not see him; and we may conceive

the astonishment and disgust with which the courtly admiral read the title-page of his son's first exposition or defence of Quakerism—a work thus set forth as a flag of defiance to all gainsayers:—

"TRUTH EXALTED, in a short but sure Testimony against all those Faiths and Worships that have been formed and followed in the darkness of Apostacy; and for that Glorious Light which is now risen and shines forth in the life and doctrine of the despised Quakers, as the alone good old way of Life and Salvation. Presented to Princes, Priests, and People, that they may repent, believe, and obey. By WILLIAM PENN, whom Divine Love constrains in an holy contempt to trample on Ægypt's glory—not fearing the King's wrath, having beheld the Majesty of Him who is Invisible."

This work appeared in 1668, in William Penn's twenty-fourth year. It is a crude, fanatical, acrimonious production, directed against all sects except that of the Quakers, and against all those "idolatrous, superstitious, carnal, proud, wanton, unclean, mocking, and persecuting princes, priests, and people" who should "go on to rebel against the reproofs and instructions of this holy light." Another work published by Penn the same year, entitled *The Sandy Foundation Shaken*, is less wildly vehement and more argumentative. It attracted a good deal of attention, and replies to it, he says, were thundered forth in books and from the pulpit. This notoriety led to a consummation very common in those persecuting times—a false charge of sedition was trumped up against Penn, and he was committed to the Tower. He was confined for eight months, the patient victim of intolerance; and he occupied himself by writing a more elaborate exposition of his doctrines and belief, which he entitled *No Cross no Crown*. This is the best of his theological treatises, and was the most popular. He enforces with great earnestness and ability (quoting largely from Scripture) the leading Quaker tenet, that to do well with constancy and bear ill with fortitude is the only way to attain lasting happiness; and he adds a series of "testimonies" drawn from the lives and writings of eminent men, ancient and modern. These selections evince considerable reading and research, and in subsequent editions he enlarged the number. It is worthy of remark, that though he praises the wit and morality of Cowley, he nowhere alludes to his great contemporary Milton, who was not only conspicuous for his advocacy of religious freedom, but was even suspected of a leaning towards Quakerism. Some doctrines or opinions of the Quakers Milton undoubtedly held; but his bold speculations and majestic genius were both above the range of the ordinary sectaries of his day. If known at all to men like Penn, he must have been regarded rather with fear and wonder than with confidence or admiration. The blind poet and patriot held aloof from all sects and "dwelt apart;" but in one instance at least tidings of Penn must have reached Milton in his small house in the Artillery Walk, and drawn from him, and from his friends Andrew Marvell and Cyriack Skinner expressions of warm sympathy and hearty approbation. The Conventicle Act prohibiting dissenters' meetings was renewed in the spring of 1670. William Penn was one day found addressing a crowd in the street, and, along with another Quaker named Mead, was taken up and committed to Newgate. They were tried at the next Old Bailey sessions before the mayor, recorder, aldermen, and sheriffs, and the trial was marked by all the coarse and brutal insolence which unrestrained power generates in vulgar minds. Penn, however, vindicated the principles of English freedom and the rights of conscience with admirable intrepidity and talent; the indictment was proved to be wrong both in its statements of law and of fact; and the whole proceedings were so glaringly and monstrously unjust, that the jury refused to return any severer verdict than that of "Guilty of speaking in Gracechurch Street." Again and again were they turned back and browbeat by the bench; they were kept two days and two nights without food, fire, or water, but the stout English spirit was strong within them, and it was found impossible to extort a verdict agreeable to the court. Their last decision was "Not guilty," and for this they were fined forty marks each, with imprisonment in Newgate until the fine should be paid. Penn and Mead were also fined for contempt of court. All of them went to Newgate. The jurors appealed to the Court of Common Pleas against the mayor and recorder; the appeal was sustained; and Penn had thus the triumph of overcoming his oppressors, and establishing the principle, that it is the right and the special function of juries to judge of the value of evidence, independent of any direction or attempted coercion of the court. Penn followed up his victory by the publication of a full report of the case, *The People's Ancient and Just Liberties asserted*, &c., accompanying the report with some forcible and pungent remarks. Altogether this trial and publication—the firmness of the twelve London citizens, and the impartial award of the Court of Common Pleas, for all which we stand indebted to Penn—form a great landmark in the progress of our popular and constitutional liberties.

Admiral Penn was now dying. The courage and ability of his son gratified the parental pride and affection, and a complete reconciliation took place. "Son William," said the admiral, "if you and your friends keep to your plain way of preaching, and also keep to your plain way of living, you will make an end of priests!" To accomplish any approach to such a sweeping result, persecution, however, would have been necessary. When the Quakers were permitted to meet unmolested, and to speak, preach, and dress after their own peculiar fashion, their importance was gone, and their exclusive self-denying doctrines were not likely ever to become general.

During the next ten years, from 1670 to 1680, Penn continued to write, preach, and hold public disputations in defence of Quakerism. He was six months in Newgate (in 1671), convicted of frequenting an "unlawful assembly;" and in those six months he wrote and published four treatises, one of which, *The Great Case of Liberty of Conscience*, is a good comprehensive statement of a great principle then little understood. He travelled in Holland and Germany, interceded with foreign states in favour of the victims of persecution, and in 1676 became one of the proprietors of West Jersey in America, and was instrumental in colonizing that province by the English. At home he was associated with Algernon Sidney in endeavouring to obtain some mitigation of the severity against dissenters; and before the infamous Popish plot of Titus Oates had driven the nation into a paroxysm of insane fury and intolerance, he was permitted to address the House of Commons in behalf of those persons who were suffering penalties for conscience sake. There was, however, little prospect of emancipation in England, and Penn applied himself to found a religious democracy in the New World. The government stood indebted to the family of Sir William Penn in a sum of about L.15,000; the claim was just and undisputed; but the exchequer of Charles II. was rarely in a condition to meet such a demand. In lieu of a money settlement, Penn solicited, and after some delay obtained, by letters patent from the Crown, a grant of land on the River Delaware, a vast province that had belonged to the Dutch, 360 miles in length by 160 in width. It had been called New Netherlands, but as the territory was mountainous, he proposed to name it New Wales. A Welsh secretary of state, Blathwayte, objected to this appropriation; and Penn substituted Sylvania, in reference to the great forests which covered the land. King Charles, in honour of his late friend the admiral, suggested the prefix of *Penn;* and thus the new province bore, in the royal charter, the liquid and euphonious name of Pennsylvania.

"God hath given it me in the face of the world," said Penn in the fulness of his heart; "He will bless and make it the seed of a nation;" a prophecy which even one century, a fragment in the history of a people, saw fulfilled.

In framing a constitution for his new colony, Penn was assisted by Algernon Sidney. That fearless politician, whose tendencies were all towards republicanism, brought ample knowledge of ancient and modern governments to the task. Penn, less enlightened, but perhaps more practical, knew and felt deeply the value of religious liberty. That sheet-anchor he never would forego, and there were no traditional associations to bind the lawgivers. Two still greater men of that age, Milton and Locke, drew up forms of government. Locke's scheme was tried at Carolina, and proved a failure. Milton's ideal republic was an intellectual aristocracy that never could have been realized with Englishmen. But Penn and Sidney made their scheme of Christian democracy essentially popular in its character, with a council and assembly elected by universal suffrage, and with ample scope for the future development and improvement of the colony. (The progress of Pennsylvania, under this enlightened system of local government, will be found described under PENNSYLVANIA.) Trading companies were soon organized; and emigration proceeded from London, Bristol, and Liverpool. Penn himself sailed for his new domain in the autumn of 1682. His voyage in the ship Welcome, his enthusiastic reception, his laying out the city of Philadelphia—that city in which, as springing from the seed sown by Penn, the great declaration of American independence was discussed and adopted,—and his solemn conference with the Indian chiefs and warriors, are proud and interesting materials of history. Who can ever forget the memorable signing of the Great Treaty, the only treaty upon record, according to Voltaire, that was never sworn to and never broken? Who does not picture in imagination that scene on the banks of the Delaware, under the magnificent old elm-tree, at which the Indian king, attended by his *sachems* and younger warriors, and the English governor, accompanied by his pilgrim-followers, interchanged pledges of amity and brotherhood,—invoking the Great Spirit, the common Father of all, to bless and ratify that scroll which was to unite for ever the Christian and the red man, the wild children of the Six Nations with the intrepid adventurers from the Old World; who were to carry civilization and commerce, equity, mercy, and peace, into the far wildernesses of the West? The annals of conquest and diplomacy, in the moment of supreme triumph, or in halls of state, furnish no parallel in picturesque or moral beauty to this simple conference on the American plain under the open canopy of heaven.

Penn landed in England on the 12th of June 1684. On the 6th of February following, Charles II. died; and Penn lost no time in waiting on the new king, and representing to him the sufferings of his Quaker brethren, imprisoned for refusing to take the oaths and attend the established church. James found that he could at once relieve the Quakers and those of his own church, the Roman Catholics; and orders were issued by which about thirteen hundred Quakers, and a still greater number of Catholics, some of whom had been confined for years, were set at liberty. Penn removed to Kensington to be near the court; he was almost daily at Whitehall closeted with the king; and such was the extent of his supposed influence, that if he had been disposed, he says, to "make a market of the fears and jealousies of the people," when James came to the throne, he could have put L.20,000 into his purse, and L.100,000 into his province of Pennsylvania. He declined every offer of reward or gratuity from those he was able to serve; the sordid vice of avarice was never charged against him. He experienced, however, the usual fate of courtiers, in being alternately envied and hated, applauded and traduced. His contemporaries said he was a Papist, holding a correspondence with the Jesuits at Rome. That amiable and tolerant divine Tillotson for a moment gave credence to the popular clamour, but was disabused of the impression by the solemn and explicit denial of Penn, who declared that he did not know one Jesuit or priest of the Romish communion. To another friend, William Popple, secretary to the Plantation Board, Penn made a fuller communication on the subject. He visited Whitehall, he said, because he had continual business there in making solicitations for his friends. His own affairs also were unsettled; and he required royal authority to restrain encroachments on his distant property. "To this," he continues, "let me add the relation my father had to this king's service, his particular favour in getting me released out of the Tower of London in 1669, my father's humble request to him on his deathbed to protect me from the inconveniences and troubles my persuasion might expose me to, and his friendly promise to do it, and exact performance of it, from the moment I addressed myself to him: I say, when all this is considered, anybody that has the least pretence to good-nature, gratitude, or generosity, must needs know how to interpret my access to the king." That access, however, was so familiar and uninterrupted during the whole of the king's unpopular reign, that we need not wonder at its exposing Penn to obloquy and suspicion. As in the classic fable, all the footsteps pointed to the royal cave; but there were few traces of mercy or favour issuing from it. Penn had witnessed the horrors of the Bloody Assizes for which Jeffreys was rewarded by his sovereign; he was present at the burning of Elizabeth Gaunt and the execution of Henry Cornish; and he saw daily the oppressions and confiscations exercised towards the Puritans and Nonconformists, with the insane efforts of James to advance and re-establish Popery. He was in several instances employed as arbiter and negotiator. All these things, it might be imagined, would have disgusted Penn with the court, and driven him, as they did Locke and Burnet, to Holland and the Prince of Orange. But he continued a courtier and friend of King James to the last. His conduct no doubt proceeded, like most actions in life, from mixed feelings or motives. His vanity was gratified by the royal attentions he received, and by the crowd of suitors that thronged his doors at Kensington. Such distinction was a pleasing novelty to one who had felt persecution, and been thrust into Newgate and the Tower: it was a public recognition of his services as a pacificator and patriot. There was also attachment to the king as his guardian and benefactor; and, above all, there was his conscientious desire and study to "allay heats and moderate animosities." If he struck off from the court, all hope of promoting religious toleration or benefiting his oppressed brethren was at an end; he was a breakwater between the royal vengeance and the noncomplying Protestants.

The latest and most brilliant of English historians, Lord Macaulay, has looked with disfavour amounting to aversion on these courtly compliances of the Quaker negotiator. He has even charged him with direct complicity in some of the most questionable transactions of the period, and with having thereby compromised his character as a man of honour and humanity, and as a consistent supporter of religious liberty. It is evident that Penn did not know James as well as Lord Macaulay, or Lord Macaulay's readers. But the worst of the historian's accusations seem to rest on imperfect evidence. They are derived from meagre reports of personal conferences, doubtful letters, and obscure despatches, which, if full information could be obtained, might be susceptible of a totally different interpretation.

The most prominent of Lord Macaulay's charges is, that Penn was a pardon-broker or extortion-agent, a character by no means uncommon in that age, when the sale of par-

dons was a regular trade. After the suppression of the Monmouth rebellion, some young girls of Taunton who had worked colours, and presented them to the unfortunate duke, were excepted from the general amnesty, and thrown into prison, in order that their relatives might purchase for them separate pardons. The money to be thus extorted was granted to the queen's maids of honour; and William Penn, according to the historian, was appointed an agent to the maids of honour, and submitted to receive instructions to make the most advantageous composition he could in their behalf. Had his name appeared on the other side as intercessor for the poor girls (who had only acted under the orders of their schoolmistress), the incident would have been in keeping with his general character; but the discredit of undertaking such a commission to gratify the rapacity of the court is foreign to all we know previously of the life of William Penn. The member for Bridgewater, Sir Francis Warre, was at first requested to exact the ransom. He excused himself, and then the Earl of Sunderland, secretary of state, wrote a letter which begins:—"Mr Penne, Her Majesty's maids of honour having acquainted me that they design you and Mr Walden in making a composition with the relations of the maids of Taunton," &c. The question arises, was the party so addressed William Penn? The slight difference in the spelling of the name Penne or Penn is a point of no consequence, for at that time, as Lord Macaulay has remarked, a proper name was thought to be well spelt if the sound were preserved. But it is of importance to ascertain whether there was not some other individual of the name to whose character, position, and circumstances, the language of Sunderland would apply. Now, it is proved that there existed at this time a certain George Penne, engaged, as the registers of the Privy Council show, as a pardon-broker at Taunton. He had been paid a sum of L.65 for the ransom of Azariah Pinney, one of the persons compromised with Monmouth. The character of this man, the spelling of his name, and the circumstance of his trafficking in pardons at Taunton, all point him out as a fit agent for the maids of honour, and warrant the conclusion that he was the person addressed by Sunderland. The minister apparently had no doubt of the willingness of his intended agent to accept the scandalous commission. The maids of honour, he says, "*design you* and Mr Walden." Is it probable that the offer, rejected by Sir Francis Warre, would have been made in such terms to William Penn, a man high at court, and the personal friend of Sunderland and the king? But if even the insulting offer were made to William Penn, there is literally no proof that he accepted it. According to Oldmixon (a bad authority, it is true, but his word may be taken on an indifferent matter when there is nothing to controvert his statement), the composition with the Taunton maids was ultimately arranged by another pardon-broker, a lawyer named Brent, who was assisted by a local agent at Bridgewater. The name of William Penn, therefore, may, we think, be considered as standing free from this degrading association. The charge rests on what we believe to be a wrong inference from a single letter in the State-Paper Office, and it is one which only the clearest and most indubitable evidence could render credible.[1]

In another case cited by Lord Macaulay, Penn, we admit, appears in a humiliating position. When the churchmen at last abandoned the doctrine of passive obedience, and refused to acquiesce in the arbitrary edicts of James, the weak and bigoted monarch endeavoured to gain over some of the more conspicuous of the dissenters. Amongst these was William Kiffin, a wealthy London merchant, and a leader among the Baptists. Kiffin had lost two grandsons, popular young men, who had joined Monmouth's rebellion, and suffered death under circumstances that excited the public compassion, and evinced the hard and unrelenting character of the king. In consequence of this severity, it was doubtful whether Kiffin would accept the offer of a city magistracy held out to him by the court. "I used all the means I could," says the old man, "to be excused, both by some lords near the king, and also by Sir Nicholas Butler and Mr Penn, but it was all in vain. I was told that they knew I had an interest that might serve the king, and although they knew my sufferings were great in cutting off my two grandchildren and losing their estates, yet it should be made up to me, both in their estates and also in what honour or advantage I could reasonably desire for myself. But I thank the Lord these proffers were no snares to me." (*Kiffin's Memoirs.*) It is painful to find William Penn engaged in such a mission, and connected, as Lord Macaulay remarks, with "the heartless and venal sycophants of Whitehall." But we know not how far he was implicated in the work of seduction. The language of Kiffin is general and obscure, and the proffers to which he refers are likely to have proceeded from the "lords near the king." Penn individually may have been passive in the transaction, though led by his attachment to the king, or urged by the royal entreaties, to confer with Kiffin. The matter is to be regretted; but it is one that implies a want of feeling, not a want of principle.

There is still another case of Penn's mediation which has exposed him to censure. This is the case of Dr Hough, president of Magdalen College, Oxford, afterwards Bishop Hough, "loved and esteemed by all the nation," as Pope has written. Hough, supported by the fellows of his college, would not retire from his presidency at the dictation of the king, to make way for the infamous Parker, Bishop of Oxford. Such compliance would be a violation of their statutes and their oaths. But anxious to conciliate James, the fellows engaged the services of Penn as intercessor on their behalf. "He exhorted the fellows," says Lord Macaulay, "not to rely on the goodness of their cause, but to submit, or at least to temporize." The authority for this statement is a note addressed during the heat of the controversy to Bailey, one of the fellows of Magdalen. The note was without signature, and was not in Penn's handwriting, but Bailey believed it to proceed from him, and he replied to it in a letter addressed to Penn. Both letter and answer were printed, and afterwards, during Penn's life, were frequently reprinted, without calling forth any public contradiction from him. Hence Lord Macaulay concludes that the anonymous epistle containing such discreditable counsel was really the production of Penn. To this it is replied that Penn *did* deny the letter. A contemporary account of the transaction is extant among the papers of Magdalen College, and on the margin of the anonymous letter is written by Hunt, one of the fellows engaged in the conference, the distinct declaration,—"This letter Mr Penn disowned." How he disowned it, whether verbally or by letter, does not appear; but the indorsement made by Hunt seems an authentic contradiction. Having satisfied the parties most nearly interested, Penn might be unwilling for various reasons to resort to a public disavowal. He had completely failed as a mediator, and the king, in his contest with the college, had rendered himself at once odious and contemptible. Silence, therefore, was the euthanasia to be desired.

The conference with the fellows was afterwards resumed at Windsor. On this occasion Penn is charged by

[1] Sir James Mackintosh first inferred that Sunderland's letter was addressed to William Penn. He was ignorant of the existence of George Penne. (For the full discussion of this and other charges against the Quaker legislator, see the *Life of William Penn*, by Mr Hepworth Dixon, new edit., 1856; and Lord Macaulay's *History of England*, edition of 1858.)

Penn Lord Macaulay with having "used a bishopric as a bait to tempt a divine to perjury." The divine was Dr Hough, who, in a letter to a friend, gave the only account we possess of the interview. "I thank God," says Hough, "that he (Penn) did not offer any proposal by way of accommodation; only once, upon the mention of the Bishop of Oxford's indisposition, he said, smiling, 'If the Bishop of Oxford die, Dr Hough may be made bishop. What think you of that, gentlemen?'" And Hough adds, "When I heard him talk at this rate, I concluded he was either off his guard, or had a mind to droll upon us." The drollery was certainly ill-timed and open to misconstruction; but we cannot think that it affords any good basis for a serious accusation. Penn we believe to have been sick of the conference. He knew how utterly fruitless the whole would be; his own views were directed towards a larger measure of toleration; and, tired of the contest, he was glad to escape for a moment from unavailing argument to the shelter of even a poor jest. He had better been absent from both conferences; but the sum of his errors does not amount to criminality. He was credulous and deluded as to the king's intentions; he lived in bad times; and, considering political questions as vastly subordinate to his religious views, he was willing, in order, as he conceived, to promote the latter, and preserve peace, to concede points which his friends Sidney and Locke would have strenuously resisted or unhesitatingly condemned.

In the midst of these difficulties and contentions, Penn issued another theological treatise—*Good advice to the Church of England, the Roman Catholic, and Protestant Dissenters.* The work was an earnest pleading for toleration to all sects, and for the repeal of the Test Act; but it was little regarded. The nation had then entered on that great contest which resulted in the abdication and flight of the king. Penn saw the inevitable tendency of James's measures, and counselled him against the headlong defiant course which lost him his throne, but his efforts had only the effect of increasing the popular suspicion against himself. The infatuated monarch had scarcely crossed the Channel ere Penn was summoned before the lords of council, and obliged to give security, in a sum of L.6000, for his appearance on the first day of next term. When that day arrived there was no charge and no accuser. But in May 1690 Penn was arrested on the grave accusation of holding a treasonable correspondence with the deposed king. James had written to Penn soliciting his assistance and renewing his professions of regard, and the letter, along with others, had been intercepted. Penn's defence was simple and direct. He could not prevent the royal exile from writing to him: he felt towards James a sincere friendship, but he had never thought of restoring him to the throne; and he had not been able to agree with him on state affairs. The new sovereign, William III., would at once have set him at liberty without imposing any conditions, but in deference to some members of council, Penn was required to give bail. Next year a similar charge was preferred against him by an infamous informer named Fuller (afterwards branded by the House of Commons as a cheat, a rogue, and false accuser), and Penn withdrew from public notice. His enemies were numerous and strong: they darkened the very air against him, he said. He retired to his seat in the country (whither he does not seem to have been pursued), and continued there for more than two years. He solaced his forced retirement by literary labour, and produced a series of *Reflections and Maxims,* embodying the experiences of his busy life, and an *Essay towards the Present and Future Peace of Europe,* in which he argued for a great European congress to settle international differences without an appeal to arms. At length, towards the close of 1692, Penn, on an urgent application to the Crown, obtained a public hearing in council, and was fully acquitted of all the charges and suspicions that had so long hung over him. A brighter day seemed at length to be at hand.

A new series of troubles, however, sprung up regarding his American colony—that "Holy Experiment" which lay so near his heart. The success of the French in the war then raging rendered it necessary to strengthen the frontiers, and form one imperial government out of the northern colonies. The separate charter of Pennsylvania would require to be abolished in order to secure military co-operation, and in such a step, however liberally the government might be disposed to act in acquiring the province, the governor saw the destruction of all his long-cherished hopes and plans. The calamity was averted by Penn relinquishing in part his pacific Quaker principles, and agreeing to furnish a contingent of eighty men, with the necessary equipments, during the continuance of the war. The peace of Ryswick afterwards removed this difficulty, and no military organization was attempted. Discontent, however, began to spread in Pennsylvania, and Penn was resolved to proceed once more to his colony. In September 1699 he embarked for America, and arriving in safety at Pennsylvania, continued to reside there for a period of three years. His presence had the effect of appeasing the animosities of rival factions. He renewed and extended his friendly treaties with the natives, and, in conjunction with his council and assembly, arranged another governmental code or charter for the province. In all these transactions—difficult and delicate as many of them, with a mixed body of settlers, must have proved—the justice, benevolence, and generosity of Penn are strikingly apparent. His exertions in the New World were, however, threatened with total destruction at home. A strong effort was made to convert the private into Crown colonies. A Bill of Annexation had been drawn up and brought into the House of Lords; and Penn hastened back to England to vindicate his rights. He was again successful; but other calamities awaited the governor of Pennsylvania. His son, whom he had sent out as his representative to the colony, disgraced his birth, and alienated the affections of the people by flagrant misconduct; and the executors of a crafty steward, whom he had long trusted, preferred against him a claim amounting to L.14,000, at the same time threatening to seize and sell the province if the sum were not immediately paid. The accounts were complicated; a Chancery suit followed; and Penn, acting under legal advice, sought shelter from successful knavery in the Fleet Prison. In this extremity of his fortunes he contemplated the sale of Pennsylvania to the Crown. For the soil and government of the province he asked a sum of L.20,000, with a guarantee that it should remain a separate and distinct colony, and enjoy the free institutions established by its founder. A considerable portion of the settlers had grown lukewarm or hostile to their old benefactor, animated by that grasping and selfish spirit too often the concomitant of young colonies struggling for wealth and power. But Penn remembered the principles on which he had founded his Christian democracy, and still desired to legislate for future generations. The imperial government declined his offer, restricted by the conditions to which he adhered; and Penn was able by the help of friends, to effect a settlement with his rapacious creditors. He was again at liberty, and he retired to a country seat which he had taken in Berkshire. His long confinement in the close atmosphere of the Old Bailey, his griefs, disappointments, and losses, and the pressure of more than threescore years, had seriously impaired his health and vigour. He still corresponded on the affairs of his colony, his latest efforts being directed towards the relief of the poor Negroes. But in 1712 he sustained several shocks of paralysis, and ere the year closed the once active and fertile mind of William Penn was laid in ruins. He lingered

on for nearly six more years, lost to the world, but free from suffering—a child in intellect, and delighting in his children, his fields, and flowers, till death came to his release, July 29, 1718. "The traveller," says a local historian, "in passing from Beaconsfield to the neighbouring village of Chalfont St Giles in Bucks, passes a small inclosure on the right-hand side of the road, known as the Friends' or Jourdan's burial-ground. But though no monumental stone attracts attention, and the sunken graves hidden in the tall grass escape the passing glance of a stranger, it well deserves to be recorded as the resting-place of William Penn, the founder of Pennsylvania." Two of Milton's friends—Thomas Ellwood, who read to the poet in his blindness, and Isaac Pennington—were buried in the same sequestered graveyard. Near it is the cottage in which Milton resided during the prevalence of the plague in London, and where he is supposed, at the suggestion of Ellwood, to have written his *Paradise Regained;* and a few miles off, separated from Chalfont by green lanes and groves of beech and elm, are the last residences and the graves of Waller and Burke. Amidst scenes thus consecrated by genius and patriotism, and rich in natural beauty, the ashes of William Penn—an English worthy of the old simple heroic stamp—have found a fitting place of repose. (R. C—S.)

PENNANT, THOMAS, an eminent naturalist, was born of an old Welsh family at Downing in Flintshire on the 14th June 1726. He acquired the rudiments of his education at Wrexham, and subsequently studied at the university of Oxford. His taste for natural history was first excited by the perusal of Willughby's *Ornithology;* and he had no sooner left Oxford than he set out on an excursion into Cornwall in pursuit of his favourite science. He became a contributor to the *Philosophical Transactions* as early as 1750; and in 1756 was chosen a member of the Royal Society of Upsal on the recommendation of Linnæus. His reputation as a naturalist was established by his *British Zoology*, in one volume folio, in 1761, and subsequently extended to 2, 3, and 4 octavos. He visited the Continent while this work was in the press, and made the acquaintance of Buffon, Pallas, and Haller. He set out for Scotland on a scientific excursion in 1771, and published an amusing account of his tour in three volumes 4to, which passed through several editions. During the same year he published his *Synopsis of Quadrupeds*, afterwards enlarged into a *History of Quadrupeds.* His Welsh tour was published in 1778, and his journey from Chester to London in 1782, in one volume 4to. About the year 1784 appeared his *Arctic Zoology*, a work which, although chiefly a compilation, was very much esteemed. He also published a natural history of the parishes of Holywell and Downing, within the latter of which he had resided during more than fifty years. Not long before his death appeared his *View of Hindustan*, in two volumes 4to, two more volumes being brought out by his son after his death, entitled *Outlines of the Globe.* Pennant died at his seat at Downing in 1798, in the seventy-second year of his age.

PENNISTON, a market-town of England, in the West Riding of Yorkshire, stands on the right bank of the Don, 17 miles S.S.W. of Wakefield, and 175 N.N.W. of London. It is well and regularly built; and contains a parish church, places of worship belonging to Independents, Methodists, and Quakers, a grammar school, and a free school for girls. There are here quarries of paving-stones, coal-pits, and woollen and cotton manufactories. A weekly market and five annual fairs are held at Penniston. Pop. of parish, 6302.

PENNSYLVANIA is central in its position with respect to the original Thirteen States and their territories; New England at the N.E., and the southern states at the S., being equally distant. Later accessions of territory have thrown it eastward and northward of the geographical centre, though it still remains nearly central to the business and population generally. The limits of the state form a nearly perfect rectangular figure, lying between a line at 39. 43. N. Lat. at the S., and one at 42. 15. at the N. The eastern boundary is irregular, following the course of the Delaware River, and at the extreme points reaching to 74. 42. W. Long. The western boundary is a right line at 80. 46. W. Long. The adjacent states are,—New York on the N., New Jersey on the E., Delaware, Maryland, and Virginia on the S., with a part of Virginia and Ohio on the W. At the north-western corner some territory is added, giving a shore-line of 45 miles on Lake Erie; and at the S.E. the state of Delaware extends northward, along a crescent line of 25 miles, into the rectangle. The extreme length of the state is 310 miles, and its width 160 miles, to which last 15 miles are added at the point of contact with Lake Erie. The whole area is 44,400 square miles, or 28,416,000 acres.

The south-eastern part of the state is very little elevated above the sea; but proceeding northward and westward, it soon becomes rough, and finally mountainous, the central part of the state being particularly so. The elevated mass which this mountainous interior presents is cut through by several branches of the Susquehanna and Delaware rivers; yet the most accessible pass for the railroad to Erie is at 1900 feet above the sea, and that of the central railroad to Pittsburg is at 2360 feet. A tunnel here reduces the actual track of the railroad to 2161 feet. Westward of this mountainous centre the surface declines toward the Ohio River and Lake Erie, remaining generally at about 1150 feet elevation, though deeply cut by the Ohio and its tributaries. The bed of the Ohio is at 650 feet above the sea at the point where it leaves the state, and the plain bordering Lake Erie is at nearly the same altitude. Notwithstanding the number of mountain ridges, and the general altitude of the interior and western portions, the surface aspect is usually smooth and well wooded, without the proportion of rocky and precipitous declivities usually found in such uplifted tracks.

The mountains of the state are a section of the great Appalachian chain, and consist of a large number of parallel ridges, which come into the state at the S., on a line from S.W. to N.E., but curve more eastward toward the N., forming crescent lines, and passing into New Jersey and southern New York. This mountainous belt is nearly 200 miles in width, and the ridges on the eastern side are generally more narrow and precipitous than those on the W. These last are the Alleghanies proper, and they are more massive, often with broad summits, and with large areas of arable surface. The ridges at the E. have a share of igneous and altered rocks, but those of the interior and the W. are all made up of rocks of the coal measures, or of rocks just below them. None of the mountains are granitic or volcanic, except some small portion of the South Mountain, the first ridge met from the east. This ridge is about 1000 feet above the sea; and the next inland, called the Blue Mountain or Blue Ridge, is about 1500 feet high,—the first named being interrupted in the interior, and the last named passing entirely through the state from New Jersey into Maryland at the south. West of this, in the coal region, is Broad Mountain; and a constant succession of less distinguished or less continuous ridges occupies the space westward, until, at the most elevated portion, the Bald Eagle, Alleghany, Chesnut, and Laurel ridges of mountains are met. These last named are often near 3000 feet above the sea, and their average is about 2500 feet. There are no single peaks of any note in the state, and the remarkable continuity of the ridges is everywhere characteristic.

The valleys are the complement of the peculiar ridge formation belonging to this chain of mountains, though not so decisively marked as those of Virginia in this respect. The whole arable portion of the interior of the state lies in

the succession of valleys corresponding with the ridges, and in the river valleys cutting through these ridges. The Susquehanna and Delaware cut through the entire belt of ridges; but their tributaries usually drain the valleys in a line at right angles to the two greater rivers. The Cumberland or Appalachian Valley is the principal one in the state, extending entirely through it eastward and southward of the Blue Ridge. The Wyoming Valley is the most important on the north branch of the Susquehanna; and on the west branch the Juniata and Sinnemahoning valleys are examples. West of the mountains the beds of the Alleghany and Monongahela rivers constitute deep and continuous valleys, into which tributaries from the lateral valleys of the Alleghany ridges fall; the most important of which are in Fayette, Somerset, and Indiana counties.

Delaware River forms the eastern boundary of the state, and it is much like the Hudson in its breadth and depth of water for a considerable distance inland. Tide water extends 132 miles from the sea to Trenton, New Jersey; and the river is remarkable for its depth at and below Philadelphia, admitting ships of the largest class. For much of the wharf-line of that city it measures 45 feet in depth. The Delaware rises in New York among the Shawangunk Mountains, and it is navigable for boats for the whole distance after touching Pennsylvania, though partial interruption exists at the Delaware Water Gap, where it breaks through the Blue Ridge, and again where it passes over a ledge of primary rocks at Trenton, New Jersey. Its length is 300 miles. The Susquehanna drains the central portion of the state southward into Chesapeake Bay. This is a rapid river with a rocky bed, and navigable only for floats and lumber within the state, which are sent down it in great quantities at the spring floods. The main stream is 150 miles long below Northumberland. The north branch rises in New York, and has a tortuous course of 250 miles to the point of junction. The west branch rises beyond the Alleghany Mountains, and cuts through them in a very irregular course of 200 miles to Northumberland, the point of junction. The Ohio River drains all the western part of the state, except a small slope to Lake Erie; yet 50 miles only of the river so named lie within it. The Alleghany is its chief branch, rising in the northern county of Potter, and making a curve within the limits of New York, to return southward 150 miles to Pittsburg. It is navigable for steamboats throughout this distance for a part of the year. The Monongahela is the other great branch, rising in Virginia, and running northward, and navigable for steamboats 60 miles. Below their junction the Ohio is usually navigable for large boats, though sometimes failing in summer. The Lehigh and Schuylkill are branches of the Delaware from the west, and of note in the business and history of the state. Both have canals and lockage navigation, and send vast quantities of coal and iron to market. The Lehigh is 90 miles in length, and the Schuylkill 120 miles, passing through Philadelphia just below its entrance into the Delaware. The Juniata is a large branch of the Susquehanna from the west, running through a rich coal and iron region for 150 miles.

Lake Erie is the only lake bordering on or within the state. At this point, which is one-third its length from Buffalo, the lake is clear from ice early, and here is the very superior harbour of Presque Isle, or Erie.

The geological features of the state may be described as being made up of an area of primary rocks of the stratified class, with small veins of granite and intrusions of trap at intervals, covering the south-eastern counties below a line from Easton to Harrisburg and Gettysburg. All these lie at an angle of 30° to 60°, dipping S.E. Next is a belt of gneiss, mica-slate, and the older sandstones, in the like positions. Other altered rocks, with their unaltered associates, in various positions of folding and even of overturned plication and contortion, succeed, in proceeding inland; and following in the ascending series, are the white sandstone, the iron-bearing shales, the valley limestone, and then the slates, limestones, sandstones, and shales of the New York formations. Above these are the conglomerates, and upon these last the coal measures, which, like all below them, present the most extraordinary phenomena of folding, overlapping, and every form of wave-like disturbance. To this disturbance and its attendant alterations the production of the anthracite coal is due. Many faults and dislocations of shale exist here, and the entire body of the coal is deprived of its bitumen. Toward the interior a portion of the coal becomes semi-bituminous, and beyond the Alleghanies it is wholly bituminous. The coal measures cover the whole western portion of the state, sinking all the older geological formations far beneath the surface, the deepest point of the basin being near Pittsburg. The vast bituminous coal basin is little disturbed by geological uplifts, dipping inward and southward; the strata cropping out, however, at the northern line of the state. Toward Lake Erie the descent is rapid over the outcropping strata of the New York shales, the only rocks in this part of the state below the coal, 2000 feet of these being cut through in a descent of 1000 feet to the bed of the lake. The distortion and alteration of the eastern part of the great coal formation of Pennsylvania is the most remarkable geological feature of the state.

The minerals of the state are indicated by its geological character. Coal is first, and iron next, as its natural associate. There are no mines of the precious metals; but copper, zinc, and lead are found in small quantities in the east. Plumbago is also mined. Iron is more extensively made than in any other part of the Union, because of the proximity of rich fossil and hematite ores to the anthracite coal. The entire belt of hilly lands lying next the first high ridges is remarkably rich in all forms of the sedimentary oxides of iron, both the open surface and the lower strata of the primal shales yielding great quantities of these ores; and they are also abundant in the interior and western part of the state. Very valuable iron sandstones are also worked at Danville and in other parts of the interior. The production of iron for three years is here given, the anthracite iron being made in the anthracite coal region, and the charcoal and coke-iron mainly near Pittsburg:—

	Anthracite. Tons.	Charcoal and Coke. Tons.	Total. Tons.
Iron made in 1854	208,703	152,703	361,406
„ 1855	255,326	138,201	393,527
„ 1856	306,966	140,752	447,718

The production of coal is very great. The mines of the anthracite region are remarkable for the great size of the beds, their peculiar and often vertical position, and for the very great facilities they offer for cheap mining on the hillsides, the constant succession of folded strata often bringing thick beds of coal to the very tops of the hills. A picturesque feature of the anthracite region is the machinery for running coal down the hills to the level of rivers and railroads. In the bituminous coal region equal facility of access to the coal beds exists, and much of it is mined from horizontal strata, easily exposed, and opening directly into the river valleys. The quantity of coal mined for recent years is as follows:—

	Anthracite Coal. Tons.	Bituminous Coal. Tons.
1855	6,626,288	1,503,000
1856	7,258,891	1,842,600
1857	6,764,587	(estimated at) 2,000,000

In 1857, 34,000,000 bushels of bituminous coal were shipped to markets on the Ohio River below Pittsburg, or 1,360,000 tons. Valuable beds of cannel coal are worked near Pittsburg for the manufacture of oil, as well as for fuel. Large quantities of marble are produced in various parts of the state; and the recent limestone of the coal

Pennsylvania.

measures, with the blue limestone of the Appalachian valleys, are generally abundant, and largely used as fertilizers after burning. The marble used so much at Philadelphia is from the limestone basin of Montgomery county.

Salt springs are worked on the Monongahela and Beaver rivers. In 1850, 919,100 bushels of salt were made there. Nitrate of potash (saltpetre) has been found in large deposits. Mineral and medicinal springs exist in many parts, generally chalybeate, or but slightly sulphurous, of which the Bedford springs are the most celebrated as a resort. Valuable white sulphur springs exist in a few localities.

The climate of Pennsylvania is marked by the extremes of heat and humidity peculiar to all parts of the United States in that latitude. The yearly mean temperature is 45° on the northern border, and 52° on the southern; the isothermal line of 50° traversing the state somewhat south of its centre. The summer mean is 70° for the central portion, varying from 66° at the highest part of the northern border to 73° at the south. In winter the western part is relatively coldest, the mean for the three months being 30° at Pittsburg, and 33° at Philadelphia. At Philadelphia the most extreme cold observed is 10° below zero, and the greatest heat in the shade 100°. The average of minimum observations for January is 8°, and of maximum temperature in July 93½°. At Pittsburg the coldest point observed is 18° below zero, and the greatest heat 100°. The elevated portions of the interior are colder than the cities named by about 1° for 400 feet of altitude. The quantity of rain falling has an average for the year of 42 to 45 inches for the eastern part of the state, and of 36 inches for the part west of the mountains. In the three months of summer 12 inches fall east of the mountains, and 10 inches west of them. In winter the eastern part has 10 inches, and the western 7, more than half of which falls as snow. In the central and northern parts the snow remains on the ground throughout the winter; but at Philadelphia it rarely lies long. In extreme winters the Delaware is covered with ice. Navigation was closed for weeks in 1856 and 1857; but such instances occur only at remote intervals. The Ohio River is more frequently frozen, and navigation is usually suspended on it for the three winter months. Periods of severe drought are incident to the climate; and periods of excessive humidity also occur, the quantity of rain falling in one summer month sometimes reaching to 12 inches. The winds are generally from the west; but south-east and north-east winds produce great storms, particularly in the eastern part of the state. The climate is, on the whole, a favourable one to energy and health, being less severe than that of the northern states, and free from the unhealthy heats of the states at the south and along the Gulf of Mexico.

The soil is very uniformly fertile, except on the declivities of the mountain ridges. No considerable portion is sandy to excess, as is the case with soils nearer the Atlantic; and most of the arable surface overlies limestone, or is within easy reach of it. Lime is largely used as a fertilizer; and with it clover and wheat have been established and maintained as staple crops. The red clay of the Atlantic border occurs in small quantities in the south-eastern counties; but the soil is generally better, and made up of more diversified elements, than that of the states southward. In the north there are elevated tracts of a somewhat tenacious soil of clay and loam, best fitted for grazing purposes; a belt made up of the northern line of counties being generally of this character. The richest lands are on the many river alluvions, and on the bituminous coal measures in the western part of the state; the last being remarkably productive both in grain and forage crops, and consisting of a deep loam, into the composition of which lime largely enters, by abrasion of rocks at or near the surface. Guano is largely used as a fertilizer near Philadelphia, but not in the western part of the state. Narrow belts of barren magnesian soil exist on the serpentine rocks of the south-eastern counties.

The agriculture of the state is mainly devoted to grain-growing and grazing. Corn and tobacco are largely cultivated,—the second, however, is not cultivated as a leading field crop; while cotton is unknown, and hemp very little cultivated. By the census of 1850 there were 127,577 farms, embracing 8,628,619 acres of land, which quantities would be in 1858 probably 140,000 farms and 9,000,000 acres under cultivation, in consequence of the opening up of new lands. In 1850 the crop of wheat was 15,367,691 bushels; of rye, 4,805,160; of Indian corn, 19,835,214; of oats, 21,538,156; of peas and beans, 55,231; of Irish potatoes, 5,980,732; of buckwheat, 2,192,693; of barley, 165,584; of clover and grass seeds, 178,983; of flax-seed, 41,728 bushels, &c. The grazing products were 39,878,418 lb. of butter; 2,505,034 lb. of cheese; 4,481,570 lb. of wool; 1,872,970 tons of hay. Value of live stock, L.8,645,844; and of slaughtered animals, L.1,712,468. The production of tobacco was 912,651 lb.; of maple-sugar, 2,326,425 lb. The value of orchard fruits was given as L.150,706, and of market products L.143,842. For the year 1858 the increase upon these last sums is very great, raising the last named at least to twice the sum here given.

The manufactures of the state are extensive, particularly in iron and the textile fabrics of wool and cotton. The most recent official statistics are those of the census of 1850, and these are probably nearly correct for the interior of the state, though known to have been imperfectly taken in the great cities, and to be very much below the actual extent of all the manufactures of the state at that time. This census gives the following division of items:—

	No. of Establishments.	Capital.	Hands employed.	Production.
Cotton manufactures.....	208	L.943,525	7663	L 1,108,805
Woollen manufactures ..	380	626,055	5726	1,108,722
Manufactures of pig-iron	180	5,783,005	9294	1,264,898
Manufac. of iron castings	320	713,084	4783	1,115,600
Manufac. of wrought-iron	162	1,631,024	6598	1,921,720

The total for the state of all classes embraced under the head of manufactures, mining, and the mechanic arts, is 21,605 establishments, L.19,682,000 of capital, 127,768 persons employed, and an annual product of L.32,301,000. By researches carefully made at Philadelphia at the close of 1857, it was ascertained that the manufacture of iron in all its forms for that city and its vicinity reached an aggregate value of L.3,000,000 for the year ending July 1, 1857; employing 12,000 workmen. The same investigation showed a production of L.5,000,000 in cotton, woollen, and silk textile fabrics for the same district, employing 20,000 male and female work-people. At Pittsburg alone there was produced in 1857 glass to the value of L.548,330. The leading manufactures other than these are paper, drugs and chemicals, gold-leaf and watches, silver ware and plate, boots and shoes, clothing and hats, plain and morocco leather, glass-ware, brass and brazier's and bolt copper, cabinet and house furnishing wares, soap and candles, carriages, and a large number of classes of useful and fancy goods. These manufactured goods are mainly sold at the south and west, including the West Indies, though many are sent to the northern states and Canada.

The commerce of the state is large and increasing, though several causes have recently concurred to cause foreign importations to come through the port of New York. It is estimated that about L.2,500,000 worth of package dry goods are so imported at New York and Boston for merchants in Philadelphia, and for distribution to the interior from this point. The tonnage for the port

of Philadelphia for the year ending June 30, 1857, was,—tons registered, 59,404; tons enrolled and licensed, 151,976; total, 211,380 tons. The tonnage of the river-port of Pittsburg was 51,061 tons; and of the lake-port of Erie, 10,378 tons. The coasting and coal trades employ much of the tonnage now entered at Philadelphia. A line of Liverpool packets of the first class exists; and an ocean steam line to Liverpool was in operation from 1852 to 1856. The total value of imports at Philadelphia, where all the foreign commerce of the state is carried on, for the year ending July 1, 1857, was,—of free goods, L.428,000; of goods paying duty, L.3,290,850; total, L.3,718,850. The principal articles were,—

Sugar	58,137,504 lb.	L.651,350
Coffee	18,823,714 „	371,410
Molasses	3,137,011 gallons	164,630
Salt	1,101,567 bushels	32,537
Sulphur, soda, and chloride of lime	......	99,830
Copper, lead, brass, and tin	.....	54,685
China and porcelain	....	101,047
Manufactures of wool, and wool and cotton	......	481,255
Manufactures of cotton	....	585,378
Manufactures of silk	....	79,938
Manufactures of linen	......	234,602
Iron, steel, and manufactures of do.	.....	302,314
Raw hides and skins	.....	110,532

The total value of exports to foreign countries for the year ending July 1, 1857, was, for goods the produce of the United States, L.1,451,050; and for goods of foreign origin, L.35,400. The chief articles of export were—

Flour and wheat	L.622,259	Manufactures of iron	L.92,473
Indian corn and meal	184,505	Manufactures of wood	43,741
Pork, lard, and bacon	151,558	Candles and soaps	30,463
Butter and cheese	17,168	Clover-seed	26,754
Beef and tallow	35,800		

The principal trade of the state is not represented in its imports or exports, being with other states of the Union west and south. Dry goods (foreign and domestic), manufactures of iron and other metals, glass, manufactures of leather, chemicals and drugs, and the full supply of all goods, indeed, is taken to the south-western states, mainly from Philadelphia and Pittsburg. Large quantities are also sent northward and coastwise to all parts of the United States. Great quantities of lumber, coal, glass, and iron are carried down the Ohio River from Pittsburg. The lumber trade of the Alleghany River alone for 1857 reached the amount of L.300,166 for lumber sold at Pittsburg, and L.373,080 for that sent by way of the Ohio River to other states. The amount of lumber sent down the Susquehanna River for 1856 and 1857 was about 70,000,000 superficial feet, and its value L.163,000 for each year.

Railroads were constructed as early as 1828 in the coal-mining districts; and they have maintained their prominence among transportation agencies, this state now having a greater aggregate number of miles than any other. At the close of 1857 there were 59 railroads in the state not less than 10 miles in length, and making up an aggregate length of 2500 miles. Their total cost was L.27,000,000. The principal were,—Pennsylvania Central, Philadelphia to Pittsburg, 329 miles; Philadelphia and Reading, 98; Delaware, Sackawanna, and Western, 113; North Pennsylvania, Philadelphia to Bethlehem, 67½; Williamsport and Elmina, 78; Sunbury and Erie, 270 miles—now finished, 40; Lehigh Valley, 46; Catawissa, Williamsport, and Erie, 63½; Alleghany Valley, 176 miles—finished, 44; Northern Central, 138 miles—within the state, 96; Lebanon Valley, 53½. Of the great southern road to Baltimore 19 miles are within the state. The Philadelphia and Newton road, 28 miles, is a part of the great northern line. From Pittsburg there are several great roads leading westward, each about 40 miles in length within the state, as the Pittsburg, Fort Wayne, and Chicago; Pittsburg and Steubenville; and Pittsburg and Connellsville. Within the year ending with June 1858 the sale and transfer of all the state property in lines of internal transportation by canal and railroad has been effected. The Pennsylvania Central Railroad Company purchased the main line of public works, consisting, 1*st*, of two canals, one 181 miles in length, from Columbia to Hollidaysburg, and the other, 101 miles in length, from Johnstown to Pittsburg; 2*d*, of a double-track railroad, 81 miles in length, from Philadelphia to Harrisburg, and 37 miles of railway between Johnstown and Hollidaysburg. For these roads and canals the Central Railroad Company pays L.1,500,000, which sum is added to the cost of that road as given above. The second sale by the state was to the Sunbury and Erie Railroad Company, conveying to them the canals of the north and west branches of the Susquehanna River, four in number, and forming a connected line from the Juniata River to the New York State line along the north branch, and to Farrandsville on the west branch,—a total distance of 167 miles; and also the Delaware division of the state canals, from Bristol to Easton, 60 miles. These canals were sold for L.700,000, both sales by act of the legislature. The remaining canals within the state are the property of private companies. The total length of canals in the state is 1293 miles, of which 921 miles are east of the mountains, and 372 miles west of the mountains. The canals belonging to private companies are as follows:—Schuylkill Navigation, Philadelphia to Port Carbon, 108 miles; Lehigh Navigation, Easton to Stoddartsville, 84; Union Canal, Reading to Middletown and Pinegrove, 99; Susquehanna and Tidewater, Columbia to Havre de Grace, 45; Delaware and Hudson Canal, Howsdale to Hudson River, 25 in the state; Erie Canal, Beaver to Erie, 136; Pennsylvania and Ohio,—portion within the state, 10; Monongahela Navigation, along Monongahela River, 84; Bald Eagle Navigation, at Bellefonte, 25; and Conestoga and Youghiogheny Navigation, 36. The business of these railroads and canals in the coal region is immense. For 1856 the Schuylkill Canal transported 1,275,988 tons of coal, and the Reading Railroad 1,709,692 tons. The Lehigh Canal transported, in 1856, 1,186,230 tons of coal.

The government of Pennsylvania has the simple republican form common to all the States. The legislature consists of a House of Representatives of 100 members, elected annually, and a Senate of 33 members, elected for a term of three years. Both classes are now elected by districts having sometimes two or three representatives each, but after 1864 the constitution requires their election by single districts. The powers of the legislature are liberally construed; it may enact any laws not prohibited by the constitution. In 1776 the colony made many changes in its charter, giving it much of the form of a state constitution; but the first complete state constitution was prepared and adopted by a general convention called for that purpose in 1790. In 1838 the constitution was amended by general convention, and the amendments were adopted by popular vote. In 1850 it was again amended to make the judiciary elective; and in 1857 it was still further amended by restricting the power of the legislature to contract debts beyond the sum of L.150,000, to confer power to repeal corporate enactments, and to require elections to the legislature by single districts. The governor is elected for three years, and has the usual powers and restrictions. He has now no power to appoint judges or magistrates of any grade, except to fill vacancies until the time of the stated election. The judiciary consists of five judges of the Supreme Court, elected for fifteen years; of one president and two associate judges for each Court of Common Pleas, elected for terms of five years each; and of local and municipal magistrates. The Supreme Court and Court of Common Pleas possess many

of the powers of courts of Chancery, and the judges of Common Pleas also hold quarter sessions of the peace, and an orphans' and probate court.

The revenues of the state are derived from various forms of taxation. The townships levy taxes for the support of schools, and for the construction of roads. The counties levy, collect, and disburse the taxes necessary to support the administration of justice in matters confined to themselves. The state levies a direct tax of three mills on a dollar upon all property at the value fixed by assessments; but a still larger sum of its revenues is obtained from special taxes. The following sums were raised in 1857:—

General tax	L.323,890
Canal and railroad tolls	272,825
Tax on bank dividends and corporations	115,517
Tax on tonnage and passengers	42,617
Tax on licenses	80,983
Various special taxes	141,365
Total revenues	L.977,197

The expenditures of the state in 1857 were L.1,126,516. The public debt at the close of 1857 was L.8,308,695; from which sum the sale of the public works in effect takes L.2,200,000, leaving the actual debt L.6,108,695. By the triennial assessments the valuation of all property in the state, real and personal, was as follows:—

Valuation of 1851	L.102,687,506
„ 1854	110,777,315
„ 1857	118,493,800

The religion of the population is chiefly Protestant, though many Catholic churches exist. With the exception of a preponderance of Friends, or Quakers, in Philadelphia and the eastern part of the state, there is nothing to distinguish the religious character of the population as a whole. The principal sects are Methodists, Presbyterians, Lutherans, and Baptists.

The educational system of the state was re-organized and greatly invigorated by the legislature in 1838, which gave the counties power to establish free schools; and again in 1854, when all were required to support free schools. An energetic and well-directed system of teaching and supervision for these free schools is now fully established, with an efficient county and state superintendence. A sum of L.40,000 annually is distributed by the state for the support of these schools, and a larger sum is raised by local tax. The tax levied for school purposes in the year ending June 1, 1857, was L.323,037; and for buildings, L.68,680. Of this there was—

Collected and expended within the year	L.319,733
Received from the state	34,317
Cost of instruction	L.236,949
Cost of fuel, &c.	35,952
Cost of school-houses, &c.	92,559
Total cost, 1856–7	L.365,460

The number of children taught for the same year was 541,247, and the number of teachers 12,475. In all this statement the county of Philadelphia is not included. A system of academies was established previous to the adoption of the free school system, one in each county receiving an appropriation of money from the state; but the appropriations are not continued, and that class of institutions is not well sustained. There are ten flourishing colleges, seven theological schools, four medical colleges, and one law school in the state,—all incorporated, and generally flourishing, though sustained by their own revenues and endowments alone. The university of Pennsylvania at Philadelphia has 12 professors, 129 students, and 1269 alumni. Jefferson college has 10 professors, 222 students, and 1492 alumni. The ten colleges have together 10 colleges, 73 professors, 886 students, 5191 alumni; 7 theological schools, 19 professors, 184 students; 4 medical colleges, 31 professors, 1182 students.

The district bordering on the Delaware River and Bay, which subsequently became the province of Pennsylvania, and its appendage of the three Lower Counties, received its first colony from Sweden. An extensive scheme of colonization for the New World was set on foot in Sweden and Finland nearly at the date of the earliest colonization of New England; and in 1627 a body of Swedes and Finns settled on the Delaware, going as far northwards as the locality of Philadelphia. They made little progress, though a deserving people, and not particularly unfortunate, until visited in a hostile manner by the Dutch from New York in 1655; and submitting without a contest, they passed, with all other possessions of the Dutch, under British rule in 1664. In 1681 the whole district west of the Delaware was granted to William Penn; and in 1682 Penn founded Philadelphia, and planted his colony near it. Under this charter from Charles II. the three Lower Counties were retained under the same governor and proprietor until 1699, when the Lower Counties were granted a separate legislature, though retained under the same governor until the revolution in 1776. The colony planted by Penn was remarkably fortunate in its relations with the Indians. His justice and firmness, with the high character of the body of the colonists, who were all Friends, or Quakers, preserved a peace with them unbroken during the whole colonial period previous to the French war of 1755. Subsequently the original colonists, or Friends, were regarded with uniform kindness by the Indians; though Braddock's defeat and the Wyoming massacre attested the identity of the savage tribes of this colony with others of their race. In the contest of the colonies with the mother country, Pennsylvania bore an active but not an embittered part. The most prosperous of the colonies, and in a central position, it became the seat of the congresses held by the colonies both before and after the decision of the struggle. Franklin, Rush, and Robert Morris represent the moderate yet firm views of Pennsylvania at that time. Independence was proclaimed here; and the seat of the general government of the United States remained here until 1800. A large emigration from Germany settled in the counties near Philadelphia before and subsequent to the revolution, and these have retained their language and national characteristics much longer than like colonies of Germans elsewhere. The defeat of Braddock, and the revolutionary battles of Brandywine and Germantown, with the memorable hardships of Washington's winter encampment at Valley Forge, are prominent historical incidents.

The population is derived from several sources. Traces of the original Swedish colony remain, but the Friends constituted nine-tenths of the population for more than half a century. The large German and Irish emigrations peopled the middle and western parts next, and at the revolution began that indiscriminate interchange of populations which now characterizes all the States. The following statistics are from the enumerations at the several dates of the national census:—Population of Pennsylvania in 1790, 434,373; 1800, 602,545; 1810, 810,091; 1820, 1,049,313; 1830, 1,347,672; 1840, 1,724,033; 1850, 2,311,786.

The classification of the population in 1850 was, 1,142,734 white males, 1,115,426 white females; 25,369 coloured males, and 28,257 coloured females. Thirteen per cent. were of foreign birth: 151,723 in Ireland; 44,260 in England, Scotland, and Wales; 78,592 in Germany; and 4083 in France. Of paupers there were 11,551; 1145 deaf and dumb, 1914 insane, and 1467 idiotic. There were 408,497 families, inhabiting 386,216 dwellings. In 1857 there were returned 603,407 taxables, which number would, at the ratio of former years, place the total population of the state in 1857 at about 3,400,000. (L. B.)

PENNY. See COINAGE.

PENNYWEIGHT. See COINAGE; also WEIGHTS AND MEASURES.

PENOBSCOT, a river in the United States. (See MAINE.)

PENON DE VELEZ, a fortified town of Morocco, belonging to Spain, stands on a lofty rock on the S. side of the Straits of Gibraltar, 80 miles S.E. of Ceuta. It is built in the form of an amphitheatre, with two principal streets; and contains several churches, a bomb-proof magazine, storehouses, and a state prison. It was founded in 1508 by Pedro of Navarre; captured by the Moors in 1522; but recovered in 1664 by the Spaniards, who have since retained it.

PENRITH, a market-town of England, county of Cumberland, in a fertile valley watered by the Eamont and Lowther, which unite about a mile below the town, 17 miles S.S.E. of Carlisle, and 282 N.N.W. of London. It stands at the foot of a hill, on the verge of the county, and of the district called Inglewood Forest. The principal street extends along the road from Kendal to Carlisle; and many of the houses are handsome, most of them being built of red freestone. On a knoll to the W. of the town stand the ruins of the castle, which give to Penrith a very picturesque appearance. It was built by the Nevilles during the wars of the Roses, and dismantled in the civil war by the parliamentary party. The parish church of Penrith is a large and handsome though plain edifice in the Grecian style. It was almost entirely rebuilt in 1722. In the churchyard is a singular ancient monument, called the Giant's Grave, consisting of two pyramidal stones 11½ feet high, and 15 feet distant from each other, which are said to have been set up in memory of a giant named Owen Cœsarius. A new Episcopal church, in the style of the thirteenth century, was built at Penrith in 1850, and forms one of the principal ornaments of the town. There are also places of worship belonging to Independents, Wesleyan Methodists, United Presbyterians, Quakers, and Roman Catholics. The town has several schools, a mechanics' institute, a reading-room, and a savings-bank. To the N. of Penrith is a race-course, on which races take place annually in October; and about a mile from the town, in the same direction, stands a square tower called the Beacon, commanding a beautiful and extensive view. The people of Penrith are chiefly employed in agriculture and weaving; some retail trade is also carried on. Since the opening of the Lancaster and Carlisle Railway, on which Penrith is a station, the place has risen very much in importance; and many handsome new houses and shops have been built. The town is a place of considerable antiquity, and it formerly played a conspicuous part in the border warfare. It was taken by the Scots several times in the fourteenth century, and in 1715 and 1745 was occupied by the insurgents. In the vicinity there are many relics of antiquity; and among the best, King Arthur's Round Table, an inclosed circular area, probably intended for martial exercises, which is called by Sir Walter Scott,

> "Red Penrith's table round
> For feats of chivalry renowned."

Pop. (1851) 6668.

PENRYN, a municipal and parliamentary borough and market-town of England, county of Cornwall, stands on the slope of a hill, in a sheltered, rich, and fertile valley, at the head of a branch of Falmouth harbour, 30 miles S.S.W. of Bodmin, and 266 W.S.W. of London. It consists of one broad main street crossed by other smaller ones; and the principal buildings are the town-hall, market-house, Episcopal church, Wesleyan and Baptist churches, national and grammar schools. Manufactures of paper, woollen stuffs, arsenic, and gunpowder are carried on; and there is a quay between the two branches of Falmouth harbour. Some trade is carried on with the mining district of Redruth; and granite is exported in considerable quantities. Five cattle fairs are held annually at Penryn. The borough unites with Falmouth in sending two members to Parliament. Pop. (1851) 3959.

PENS, PEINS, or PENCZ, GREGOR, a German painter and engraver, was born at Nuremberg about 1500. His knowledge of art was obtained under very favourable circumstances. He first became the pupil of his fellow-townsman Albert Durer. Then having removed to Rome, he softened and refined his style of painting by studying the works of Raphael, and acquired the art of engraving by attending the instructions and aiding the labours of Marcantonio Raimondi. How much advantage he received from these great masters is shown by his numerous prints, which are so well known in England, and by his historical pictures, which are preserved in the galleries of Vienna, Munich, Nuremberg, and Berlin. The death of Pens took place about 1550.

PENS. The word *pen*, in Holy Scripture, refers either to an iron *style* or to a *reed;* the latter being the earliest form of pen used for writing on papyrus with a fluid ink. Reed pens are still in use in the East, and are said to be better adapted to the Arabic character than quill pens. Quills came into use about the fifth century, and continue to maintain their ground, notwithstanding the general employment of metallic pens. The goose furnishes the chief supply, vast flocks being maintained in Russia and Poland for the sake of their quills, of which as many as 27,000,000 have been received in this country in one year from St Petersburg alone. The swan, the crow, the ostrich, the turkey, and other birds occasionally contribute. As there is still a considerable demand for quill pens, a few words on the method of preparing them will not be out of place. The quills, as imported, are tough and soft in texture, and covered with a membrane, so that they will not make a clean slit; the vascular membrane which adheres to the internal surface of the barrel also renders them opaque. These defects are got rid of by the operations of *quill-dressing* or *quill-dutching.* The quills are first sorted into *primes, seconds,* and *pinions.* They are next plunged into hot sand, which causes the interior lining membrane to shrivel up and detach itself from the barrel, and so far loosens the outer membrane that it can be removed readily by scraping with a sharp instrument. The heat also dries up the oily matter of the quill, and renders the barrel transparent, like fine thin horn. By dipping the barrels in dilute nitric acid they become hardened, and acquire a fine yellow tint. In some cases the quills are exposed to the action of steam, and scraped under the edge of a fine instrument, which flattens and apparently spoils them; but they are restored to shape by exposure to a moderate heat.

The first attempt at metallic pens was to arm the points of quill pens with metallic nibs. Pens have also been constructed of horn, tortoise-shell, and glass. Small pieces of precious stones, such as the diamond and the ruby, have been embedded in the points of horn and tortoise-shell pens by pressure. Thin pieces of gold or other metal have also been attached to tortoise-shell. Nibs of ruby set in fine gold have also been employed; and to prevent injury to the points, the ink-stand was lined with india-rubber. Dr Wollaston constructed pens with two flat slips of gold placed at an angle, and tipped with rhodium. Messrs Wiley of Birmingham have pens of gold, palladium, gold and silver, and silver, pointed with the native alloys of iridium and osmium. Such pens have the advantage of presenting the writing always of the same character and of not being corroded by the ink; they are, however, too costly for common use.

Steel pens were introduced about the year 1803; but many of the improvements which led to their present ex-

tensive use were introduced by Mr Gillott of Birmingham and by Mr Perry of London. Birmingham is the chief seat of the manufacture; the steel is rolled for the purpose at Sheffield into thin sheets, and these are cut into strips about three feet long and four inches broad. After annealing, the scales are removed by pickling in dilute sulphuric acid, when the strips are again rolled to the required thickness. From these strips *blanks* or *flats* are cut out by means of a stamping-press, the fibres of the steel being made to take the direction of the length of the pen. After this the hole which terminates the slit is pierced, and the superfluous metal is removed. The blanks are now annealed in a muffle, and the maker's name is stamped on each blank by means of a small punch. The next operation is to make the flaps concave for nib-pens, and to form the barrel for barrel-pens: this is done at a stamping-press with an appropriate bed and punch. The pens are next inclosed in an iron box raised to a red heat, and quenched in oil, which hardens them. The adhering oil is got rid of by agitating the pens in a tin-plate barrel. They are tempered at a moderate heat, and are placed in a revolving cylinder with sand, which restores the natural colour of the steel. The nib is next ground upon a small emery wheel, after which the slit is made by means of a chisel with a flat side fixed to the bed of a press, the descending screw of which has a cutter which accurately corresponds with the chisel. The pens are coloured brown or blue by placing them in a revolving cylinder over a charcoal fire, and removing them as soon as the film of oxide of the desired colour is formed. A gloss is given to them by immersing them in a solution of lac in naphtha, after which they are dried by heat, counted, and made up in boxes. Steel pens are liable to be corroded by the ink, a defect which does not apply to the pens of thin laminated zinc recently introduced. Pens have also been formed of the new metal aluminum, and pen-holders have been made of the same light material, which, however, is too costly for such common applications.

Pens have been made of vulcanized india-rubber, the ingredients for which are first rolled out in a thin sheet of the thickness of a strong quill, then cut into strips of the width suitable for pens, next heated between two surfaces of glass, one convex and the other concave, and raised in the course of six hours from the temperature of 230° to 305°. This effects the combination of the ingredients, and gives a permanent form to the semi-cylinders, which are made into lengths, and formed into pens by appropriate cutting instruments.

Numerous patents are taken out every year for pens, pen-holders, lead-holders, and pencil-cases; so numerous, indeed, that a list of them for the last few years would occupy considerable space. Purchasers are fond of novelty; and novelty, however slight, is sure to claim the protection of a patent. It is not creditable to our inventive skill that in so copious a patent list so very small a number of inventions should retain a permanent hold on the public. (C. T.)

PENSACOLA, the capital of Escambia county, in the state of Florida, North America, stands on the W. shore of Pensacola Bay, about 10 miles from the Gulf of Mexico, and 64 E. from Mobile. The harbour is safe, but admits only vessels of light draught. The town is regularly built; and contains several churches, a market-house, court-house, and custom-house. About 6 miles below the town, and 5 from the entrance of the harbour, is a U.S. navy station, covering nearly 80 acres of ground, and surrounded by a high brick wall. Pop. of town (1850) 2164.

PENSACOLA BAY, an inlet of the Gulf of Mexico, at the mouth of the Escambia River, is about 27 miles in length by 12 in extreme breadth.

PENSIONARY, or PENSIONER, a person who has an appointment or yearly sum, payable during life, by way of acknowledgment, and charged on the estate of a prince, company, or particular person. At the universities of Cambridge and Dublin the term *pensioner* is applied to those students who live at their own expense, and who are at Oxford called *commoners*.

The term *Grand Pensionary*, was formerly applied to the first minister of the states of Holland, and the first minister of the regency of each city in that kingdom was called a *Pensionary*.

PENSHURST, a village of England, county of Kent, on the Eden, near its confluence with the Medway, 6 miles W.S.W. of Tunbridge. It has a fine old church with many interesting monuments, a Baptist chapel, and two national schools. In the vicinity is an ancient mansion called Penshurst Place, the birthplace of Sir Philip Sidney and Algernon Sidney. Manufactures of paper are carried on; and there are stone quarries in the neighbourhood. Pop. 1628.

PENTACHORD, a musical scale consisting of five conjunct diatonic degrees. Also an instrument of five strings, according to Martianus Cappella and other writers. Julius Pollux ascribes its invention to the Scythians.

PENTAGON. See GEOMETRY.

PENTAMETER (πέντε, *five*, μέτρον, *a measure*), a peculiar kind of verse, consisting, as the name implies, of five feet or metres. The first and second feet may be either dactyls or spondees; the third is always a spondee; and the two last anapests. A pentameter line subjoined to an hexameter constitutes what is called *elegiac* verse. Numerous specimens of this verse are to be found among the Greek and Latin classics. Callinus, Tyrtæus, Mimnermus, Theognis, and Solon, in Greece; and Catullus, Propertius, Tibullus, and Ovid, in Rome, were the most celebrated of the ancient elegiac writers. Goethe and Schiller have attempted the introduction of this species of versification into German poetry; and the characterization of the hexameter and pentameter distich by the latter poet is well known through Coleridge's version :—

> "In the hexameter rises the fountain's silvery column,
> In the pentameter aye falling in melody back."

PENTATEUCH (Πεντάτευχος, from πέντε, *five*, and τεῦχος, *a volume*) is the title given to the five books of Moses,—viz., GENESIS, EXODUS, LEVITICUS, NUMBERS, and DEUTERONOMY. The division of the *Book of the Law* (ספר התּוֹרָה), as the Jews called the Pentateuch, into five books is alluded to in the works of Josephus and Philo. It seems that this division was first made by the Alexandrian critics. In Jewish writers are found statements indicating that the Pentateuch was formerly divided into seven portions (comp. Jarchi, *ad Proverb.* ix. 1; *ibique* Breithaupt). In the Jewish canon the Pentateuch is kept somewhat distinct from the other sacred books of the Old Testament, because, considered with reference to its contents, it is the book of books of the ancient covenant. It is the basis of the religion of the Old Testament, and of the whole theocratical life. The term *law* characterizes the principal substance of the Pentateuch, but its real kernel and central point is the foundation of the Jewish theocracy, the historical demonstration of that peculiar communion into which the God of heaven and earth entered with one chosen people, through the instrumentality of Moses; the preparation for, and the development of, that communion; the covenant relation of Jehovah and Israel, from its first rise down to its complete termination.

In considering the Pentateuch, the first question which arises is—Who was its *author?* It is of great importance to hear, first, what the book itself says on this subject. The Pentateuch does not present itself as an anonymous production. On the contrary, it speaks most clearly on this subject. According to Exod. xvii. 14, Moses was commanded by God to write the victory over the Ama-

Pentateuch lekites *in the book* (בספר). This passage shows that the account to be inserted was intended to form a portion of a more extensive work, with which the reader is supposed to be acquainted. It also proves that Moses, at an early period of his public career, was filled with the idea of leaving to his people a written memorial of the Divine guidance, and that he fully understood the close and necessary connection of an authoritative law with a written code. It is therefore by no means surprising that the observation repeatedly occurs, that Moses wrote down the account of certain events (Exod. xxiv. 4, 7; xxxiv. 27, 28; Num. xxxiii. 2). Especially important are the statements in Deut. i. 5; xxviii. 58. In Deut. xxxi. 9, 24, 30, the whole work is expressly ascribed to Moses as the author, including the poem in Deut. xxxii. It may be made a question whether the hand of a later writer, who finished the Pentateuch, is perceptible from ch. xxxi. 24 (comp. xxxiii. 1, and xxxiv.), or whether the words in xxxi. 24–30 are still the words of Moses. In the former case we have two witnesses, viz., Moses himself, and the continuator of the Pentateuch; in the latter case, which seems to us the more likely, we have the testimony of Moses alone. Modern criticism has raised many objections against these statements of the Pentateuch relative to its own origin. Many critics suppose that they can discover in the Pentateuch indications that the author intended to make himself known as a person different from Moses. The most important objection is the following,—that the Pentateuch, speaking of Moses, always uses the third person, bestows praise upon him, and uses concerning him expressions of respect. The Pentateuch even exhibits Moses quite objectively in the blessing recorded in Deut. xxxiii. 4, 5. To this objection we reply, that the use of the third person proves nothing. The later Hebrew writers also speak of themselves in the third person. We might adduce similar instances from the classical authors, as Cæsar, Xenophon, and others. The use of the third person, instead of the first, prevails also among oriental authors. In addition to this we should observe, that the nature of the book itself demands the use of the third person, in reference to Moses, throughout the Pentateuch. This usage entirely corresponds with the character both of the history and of the law contained in the Pentateuch. By the use of the word I, the objective character of this history would have been destroyed, and the law of Jehovah would have been brought down to the sphere of human subjectivity. If we consider that the Pentateuch was destined to be a book of Divine revelation, in which God exhibited to his people the exemplification of his providential guidance, we cannot expect that Moses, by whom the Lord had communicated his latest revelations, should be spoken of otherwise than in the third person. In the poetry contained in Deut. xxxiii. 4, Moses speaks in the name of the people, which he personifies and introduces as speaking. The expressions in Exod. xi. 3, and Num. xii. 3 and 7, belong entirely to the context of history, and to its faithful and complete relation; consequently it is by no means vain boasting that is there expressed, but admiration of the Divine mercy glorified in the people of God. In considering these passages, we must also bear in mind the far greater number of other passages which speak of the feebleness and the sins of Moses.

It is certain that the author of the Pentateuch asserts himself to be Moses. The question then arises, Whether it is *possible* to consider this assertion to be true—whether Moses *can* be admitted to be the author? In this question is contained another, viz., Whether the Pentateuch forms such a continuous whole that it is possible to ascribe it to one author? This question has been principally discussed in modern criticism. In various manners it has been tried to destroy the unity of the Pentateuch, and to resolve its constituent parts into a number of documents and fragments. Eichhorn and his followers assert that GENESIS only is composed of several ancient documents. This assertion is still reconcileable with the Mosaical origin of the Pentateuch. But Vater and others allege that the whole Pentateuch is composed of fragments; from which it necessarily follows that Moses was not the author of the whole. Modern critics are, however, by no means unanimous in their opinions. Ewald, in his history of the people of Israel (*Geschichte des Volkes Israel*, vol. i., Göttingen 1843), asserts that there were seven different authors concerned in the Pentateuch. On the other hand, the internal unity of the Pentateuch has been demonstrated in many able essays. The attempts at division are especially supported by an appeal to the prevailing use of the different names of God in various portions of the work; but the arguments derived from this circumstance have been found insufficient to prove that the Pentateuch was written by different authors. The inquiry concerning the unity of the Pentateuch is intimately connected with its *historical character*. If there are in the Pentateuch decided contradictions, or different contradictory statements of one and the same fact, not only its unity, but also its historical truth, would be negatived. On the other hand, if the work is to be considered as written by Moses, the whole style and internal veracity of the Pentateuch must correspond with the character of Moses. Considerate critics, who are not under the sway of dogmatic prejudices, find that the passages adduced to prove that the Pentateuch was written after the time of Moses by no means support such a conclusion; and that a more accurate examination of the contents of the separate portions goes to demonstrate that the work originated in the age of Moses.

The general arguments for and against the authenticity of the Pentateuch which remain to be considered are the following:—

1. The history of the art of writing among the Hebrews has often been appealed to in order to disprove the authenticity of the Pentateuch. It is true that in our days no critic of good repute for learning ventures any longer to assert that the art of writing was invented subsequent to the Mosaical age (Ewald's *Geschichte des Volkes Israel*, p. 64, sq.); but it is questioned whether the Hebrews were acquainted with that art. It is said that a work of such extent as the Pentateuch was beyond the means of the primitive modes of writing then existing. But various testimonies, not merely in the Pentateuch itself, but also derived from other sources, from the period immediately subsequent to that of Moses, prove that a knowledge of the art of writing was widely diffused among the Hebrews (comp. Judges viii. 14). And if there was any knowledge of this art, its application would entirely depend upon the particular circumstances of a given period. Some writers seem to entertain the opinion that the materials for writing were yet, in the days of Moses, too clumsy for the execution of larger works. This opinion is refuted by the fact, that the Hebrews became acquainted, just in the Mosaical period, with the use of very good materials for writing, such as papyrus, byssus, parchment, &c. (comp. Herodotus, v. 58.) There are, indeed, mentioned in the Pentateuch some more solid materials for writing, such as tables of stone (Exod. xxiv. 12; xxxi. 18; xxxiv. 1, &c.); but this does not prove that in those days nothing was written except upon stone. Stone was employed, on account of its durability, for specific purposes.

2. The language of the Pentateuch has also been the subject of many discussions. It has frequently been urged that it differs less from that of the later books of the Old Testament than might have been expected if this work proceeded from Moses. In this objection the characteristic stability of the oriental languages has been overlooked. The oriental languages are not, in the same degree as the

occidental, in a state of development and constant change. It is also overlooked that the Pentateuch itself, by its high authority, exerted a constant influence upon the whole subsequent religious literature of the Hebrews. And we do not know any other literature of the ancient Hebrews except the religious. In addition to this, we must observe that, nevertheless, the style of the Pentateuch has its distinctive features of antiquity. It contains, for example, a number of characteristic *grammatical formations;* it contains also *words* which do not occur in the other parts of the Old Testament; as well as certain characteristic *phrases* peculiar to the style of that time. Others have vainly endeavoured to find in the Pentateuch, and especially in Deuteronomy, vestiges of a later style. The instances produced by the opponents of the Mosaical origin of the Pentateuch do not stand examination, and are therefore unable to counterbalance the weight of argument deducible from the antique expressions in the Mosaical writings.

3. The historical contents of the Pentateuch are of very great importance in our present inquiry, because they constantly bear testimony in favour of its age and authenticity, and lead to the following important results:—We find, in later times, no period which we could deem capable of producing the Pentateuch as a whole: for this reason, the opponents of its authenticity are obliged to ascribe the different portions of the work to widely different periods. If we allow that the apostles were such persons as they assert themselves to be, we must admit also that the very frequent apostolical allusions to the Pentateuch are a high sanction to the work; and we cannot overlook the fact, that every opinion which, with greater or less decision, finds in the Pentateuch a work of fraud, enters into an unavoidable conflict with the New Testament itself.

In the remote times of Jewish and Christian antiquity, we find no vestiges of doubt as to the genuineness of the Mosaical books. The Gnostics, indeed, opposed the Pentateuch, but attacked it merely on account of their dogmatical opinions concerning the Law, and Judaism in general; consequently they did not impugn the authenticity, but merely the Divine authority of the Law. Heathen authors alone, as Celsus and Julian, represented the contents of the Pentateuch as being mythological, and paralleled them with pagan mythology. In the middle ages, but not earlier, we find some very concealed critical doubts in the works of some Jews—as Isaac Ben Jasos, who lived in the eleventh century, and Aben Ezra. After the Reformation, it was sometimes attempted to demonstrate the later origin of the Pentateuch. Such attempts were made by Spinoza, Richard Simon, Le Clerc, and Van Dale; but these critics were not unanimous in their results. Against them wrote Heidegger (*Exercitationes Biblicæ,* i. 246, sq.); Witsius (*Miscellanea Sacra,* i. 103, sq.); and Carpzov (*Introductio,* i. 38, sq.) In the period of English, French, and German deism, the Pentateuch was attacked rather by jests than by arguments. Attacks of a more scientific nature were made about the end of the eighteenth century. But these were met by such critics as John David Michaelis and Eichhorn, who energetically and effectually defended the genuineness of the Pentateuch. These critics, however, on account of their own false position, did as much harm as good to the cause.

A new epoch of criticism commences about the year 1805. This was produced by Vater's *Commentary* and De Wette's *Beiträge zur Einleitung in das Alte Testament.* Vater embodied all the arguments which had been adduced against the authenticity of the Petateuch, and applied to the criticism of the sacred books the principles which Wolf had employed with reference to the Homeric poems. He divided the Pentateuch into fragments, to each of which he assigned its own period, but referred the whole generally to the age of the Assyrian or Babylonian exile. Since the days of Vater, a series of the most different hypotheses has been produced by German critics about the age of the Pentateuch, and that of its constituent sections. No one critic seems fully to agree with any other; and frequently it is quite evident that the opinions advanced are destitute of any sure foundation—that they are quite arbitrary, and produced by merely subjective motives. We will illustrate this by a few examples relative to the Pentateuch as a whole.

Schumann makes Ezra the author of the law. According to A. T. Hartmann, the separate portions of the law sprang up gradually, some of them as late as the exile; but he does not show by what circumstances they were combined into a whole. According to Dr Ammon, the Pentateuch was planned by Moses; was gradually continued down to the times of Solomon; was entirely forgotten during the period of idolatry; was re-discovered under the reign of Josiah; and was then re-touched, and edited under the name of Moses. Von Bohlen urges the fact mentioned in the Second Book of Kings (ch. xxii.) as if it were explanatory of the origin of Deuteronomy; but he considers some portions to be of a much later origin. He asserts that the Pentateuch was partly written after the exile, that it was gradually developed, and was brought to a conclusion in the age of Christ. According to the latest statements of De Wette, in his *Einleitung in das Alte Testament,* § 157, sq., the ELOHIM portions were written in the age of Samuel and Saul, the JEHOVAH portions nearly about the same period, but Deuteronomy much later, under Josiah. Ewald assigns seven authors to the Pentateuch, who, however, wrote in very different periods. The first, he supposes, wrote in the days of Samson; the second in the reign of Solomon; the third in the reign of Elijah, &c.

The critical doubts respecting the authenticity of the Pentateuch have produced in modern times several works in defence of its genuineness; such as Kanne's *Biblischer Untersuchungen,* 2 vols., 1820; the observations by Jahn, Rosenmüller, and Bleek; Ranke's *Untersuchungen über den Pentateuch,* 2 vols.; Hengstenberg's *Beiträge zur Einleitung,* vols. 2 and 3; Hävernick's *Einleitung in das Alte Testament,* vol. 1; Drechsler, *Ueber die Einheit und Authentie der Genesis;* König's *Alt-testamentliche Studien,* 2d number; Sack's *Apologetik,* &c.

The most important commentaries and exegetical aids for the explanation of the whole Pentateuch, and its constituent parts, are the following:—Calvini Bonfrerii *Pentateuchus Commentario Illustratus,* 1625; Marckii *Commentarius in præcipuas quasdam Pentateuchi partes,* 1721; Clerici *Commentarius,* 1710; Gerhardi *Commentarius in Genesin,* 1693; Merceri *Commentarius in Genesin,* 1593; Vater, *Commentar über den Pentateuch,* 1802, sq., 3 vols.; Rosenmulleri *Scholia,* 3d ed., 1821, sq.; Schumann, *Pentateuchus Hebraice et Græce,* tom. 1, 1829; Von Bohlen, *Die Genesis übersetzt und erklärt,* Königsberg, 1825; Tiele, *Das erste Buch Mosis,* &c., 1st vol., 1836; Tuch, *Commentar über die Genesis,* 1838, &c. The following are the principal English works on the Pentateuch:—Ainsworth, *Annotations on the Five Books of Moses,* 1699; Kidder, *Commentary on the Five Books of Moses,* 1713; Parker, *Bibliotheca Biblica,* 1720, 1735; Jamieson, *Critical and Practical Exposition of the Pentateuch,* 1748; Robertson, *Clavis Pentateuchi,* 1770; Graves, *Lectures on the Pentateuch,* 1815; *The Pentateuch and its Assailants,* by Dr W. T. Hamilton, 1852; *Commentary on the Pentateuch,* by G. Townsend, 2 vols., 1849. There are English translations of the following German works on the Pentateuch. *On the Genuineness of the Pentateuch,* by E. W. Hengstenberg, 2 vols., 1847; an *Historico-Critical Introduction to the Pentateuch,* by H. A. Ch. Hävernick, 1850; and an *Historical Introduction to the Old Testament,* by H. A. Ch. Hävernick, 1852.

PENTATHLON (πέντε, *five*, and ἆθλον, *the prize of contest*), signifies properly the contest of the five exercises, and was a general designation given to the five Grecian games of leaping, running, throwing the discus, throwing the spear, and wrestling. This is the order in which, according to Böckh, these games followed each other in the pentathlon. This was considered, after the *pancratium*, the most beautiful of all athletic performances. It was called by the Romans *quinquertium*.

PENTECOST (Πεντηκοστή, *fiftieth*) is the name given in the New Testament to the "Feast of Weeks," or of "Ingathering," which was celebrated by the Jews on the *fiftieth* day from the festival of the Passover; or seven weeks from the 16th day of Nisan. It was a feast of thanksgiving for the harvest, and commenced immediately after the Passover. It was one of the three great yearly festivals in which all the males were required to appear before God at the place of his sanctuary. Josephus states that in his time great numbers of Jews resorted from every quarter to Jerusalem to keep this festival. (*Antiq.* xiv. 13, 4; xvii. 10, 2; *De Bell. Jud.* ii. 3, 1.) This testimony affords corroboration of Acts ii. 1, 9–11; xx. 16; 1 Cor. xvi. 8, in which the same fact appears. The commencement of the Christian church on the day of Pentecost attached a peculiar interest to this season, and it was established as one of the great festivals in the fourth century. This day became one of the three baptismal seasons (Tertull. *De Baptis.* c. 19; Hieron. *in Zach.* xiv. 8); and it derives its name of Whitsunday, or white-Sunday, from so many being clad in *white* on this the day of their baptism.

PENTLAND FIRTH, a channel separating the Orkney Islands from the coast of Caithness, and joining the North Sea and the Atlantic. It is about 17 miles long from E. to W., and 6 or 8 broad. At the eastern extremity, 4 miles N.E. of Duncansby Head, are the Pentland Skerries, two islands, the largest of which has a lighthouse, with two fixed lights. The depth of the strait varies from 10 to 40 fathoms; and the current runs strongly to the E., with a velocity from 4 to 9 miles an hour.

PENTLAND HILLS, a range of hills in Scotland, in the counties of Edinburgh, Peebles, and Lanark, extending from the distance of 4½ miles S. by W. of Edinburgh for about 16 miles in a S.W. direction. They consist of porphyry, with boulders of granite and gneiss; are partially cultivated, and afford good pasture for sheep. The highest summit is East Carnethy Hill, near the middle of the range, 1878 feet above the sea.

PENUMBRA (*pene*, almost, *umbra*, a shade) is a partial shade observed between the perfect shadow and the full light in an eclipse. As long as any part of the sun is visible during a solar eclipse, the observer is in the *penumbra*, and not in the *umbra* or shadow.

PENZA, a government of European Russia, lying between N. Lat. 53. and 54., E. Long. 42. 20. and 45. 20. It is bounded on the N. by the government of Nijni-Novgorod, E. by that of Simbirsk, S. by that of Saratov, and W. by that of Tambov. Length from E. to W., 170 miles; greatest breadth, 145; area, 14,670 square miles. The surface is generally flat, or slightly undulating; and is crossed by low ranges of hills, which in the S. form the watershed between the Volga and the Don. Numerous rivers water the country; but of these none are of any size or importance, except the Sura and the Moksha, both affluents of the Volga,—the latter rising in this government, and the former in that of Saratov. There are also several small lakes. The soil is fertile, producing corn, hemp, flax, potatoes, and fruit. The extent of arable land in the government in 1849 was 3,962,008 acres; of meadow land, 1,251,249 acres; of wood, 3,645,551 acres; and of waste land, 389,029 acres. There were produced in the same year 39,182,368 bushels of corn, and 1,569,186 bushels of potatoes. The climate is healthy, and the summers are mild and temperate; but severe cold is frequently experienced during the winter. Great attention is paid by the inhabitants to the raising of cattle, sheep, and especially horses; and large quantities of bees are kept. Penza contained in 1849, 291,994 horses, 205,500 horned cattle, 494,314 sheep, and 190,348 swine. The principal mineral production of the government is iron, of which there are mines in the vicinity of Troitzk. Mill-stones are also quarried; and sulphur and vitriol are obtained. There are few large manufacturing establishments; but the peasants in their cottages spin flax and hemp, weave large quantities of coarse linen and woollen cloth, and prepare articles of other kinds for their own use. There are, besides, blast-furnaces and iron-works, soap-works, glass-works, tanneries, and distilleries, all of which, especially the last, are both numerous and large. The trade is chiefly carried on by land, especially with Nijni-Novgorod. Annual fairs and markets are held at various places in the government. The principal exports are corn, flour, honey, wax, brandy, soap, timber, wool, leather, blankets, carpets, and potash. In respect of education, Penza is under the university of Kasan; but the schools are neither numerous nor good. The only printing-press in the government is entirely under the control of the Crown. There are about 600 churches, 11 of which are cathedrals, several convents, and about 70 Tartar mosques. The government is divided into 10 circles, and contains 1,058,444 inhabitants:—

	Pop.		Pop.
Penza	93,371	Nijni-Lomov	112,282
Insara	136,157	Kerensk	83,246
Saransk	112,620	Mokshansk	86,072
Narovchat.	87,558	Gorodischtche	116,151
Chembar	113,136	Krasnosslobodsk	117,851
Total			1,058,444

The most of the people belong to the Greek Church; but there are also 41,210 Mohammedans, and a few Jews and Roman Catholics.

PENZA, the capital of the above government, stands at the confluence of the River Penza with the Sura, 210 miles S.S.E. of Nijni-Novgorod, and 465 S.E. of Moscow. It occupies a beautiful situation on a hill, and is in a great part built of wood, having numerous gardens within its precincts. Among its many churches there is a large stone cathedral. It has several schools and benevolent institutions, the residences of the civil governor and of the Bishop of Penza and Ssaranssk, &c. Tanning, soap-making, weaving, and silk-making are carried on here; and there are large magazines for corn and salt. An active trade is carried on in corn; and an annual market is held (from June 25 to July 4), at which about L.9000 worth of goods is sold. In front of the town is a fine park, with an orchard and a school of agriculture. Pop. (1851) 22,723.

PENZANCE, a municipal borough and market-town of England, in the county of Cornwall, stands on the N.W. shore of Mounts Bay, 24 miles S.W. of Truro, and 281 W.S.W. of London. It is the most westerly town in Great Britain, and is beautifully placed along the curving shore, encircled by rocky eminences. The principal streets, four in number, meet in the market-place; they are for the most part but ill paved, and lined with mean houses. The town-hall is a handsome building of granite in the Grecian style, surmounted by a cupola. There are two Episcopal churches, one of which, recently built, is a fine granite edifice, in the early English style, containing a pulpit made of a single block of granite. The town also contains places of worship belonging to Methodists, Independents, Baptists, Roman Catholics, and Jews. The Royal Geological Society of Cornwall has its head-quarters here, where there is a museum with a valuable collection of minerals. There

is also here a natural history and antiquarian society, an agricultural society, a literary institution, and a public library. The town has a custom-house, and a pier 600 feet long, with a lighthouse at the end. The harbour, however, is only suitable for small vessels. The trade of the place is considerable: tin, copper, china clay, and fish, being exported; while iron, timber, hemp, hides, and tallow are the chief articles of import. Fishery is actively carried on in Penzance, pilchards being the fish chiefly obtained; and there are here tanneries and smelting-houses for tin. The climate of Penzance is extremely mild, and much less variable than that of London. The mean temperature of summer is 60°·5., and of winter 44°·66. Markets are held twice a week, and there are three annual fairs. The number of vessels registered at the port in 1857 was 81, aggregate tonnage 7299. In the same year there entered the port 733 sailing-vessels, tonnage 45,338; and 72 steamers, tonnage 23,042: and there cleared 221 sailing-vessels, tonnage 14,092; and 1 steamer, tonnage 32. The environs of the town are very beautiful; and many interesting remains are to be seen in the neighbourhood. A curious custom is observed in Penzance on the 23d and 28th of June, which is supposed to be a remnant of the ancient sun-worship practised at the summer solstice. After burning a number of tar barrels in conspicuous places, they dance about with blazing torches, and on the following day festivities of a more quiet character are celebrated. Penzance was destroyed by the Spaniards in 1695, and was afterwards sacked by the parliamentary party under Fairfax in 1646. Sir Humphry Davy was born here in 1778. Pop. (1851) 9214.

PENZING, a town of Lower Austria, on the Wien, 3 miles W. of Vienna. It contains many fine villas, a parish church, barracks, and a bathing establishment. Cotton and silk stuffs are manufactured. Pop. 4135.

PEPIN D'HERISTAL, surnamed *Le Gros*, the ancestor of the Carlovingian line of French kings, became "Mayor of the Palace" in 679, and in that capacity was virtually the head of the Frankish monarchy till his death in 714. (See FRANCE.)

PEPIN, surnamed *Le Bref*, or "The Short," was the first king of France of the Carlovingian dynasty, and grandson of the preceding. Having been installed in the hereditary office of "Mayor of the Palace," he dethroned Childeric III. in 750, and caused himself to be consecrated king in 752. He died in 768, leaving the crown to his son Charlemagne. (See FRANCE.)

PEPLUM, or PEPLUS, was a large full robe or shawl worn by Grecian women, and was much larger than either the *chlamys* or *pallium*, as well as finer and thinner than the latter. It was without sleeves, and was fastened by a clasp. It was worn above the common dress, and fell in rich folds around the person, sometimes, in the case of women of rank, trailing upon the ground, as alluded to by Homer, in his epithet of "trailing-the-robe" (ἑλκεσίπεπλος), applied to the Trojan ladies. (*Il.* vi. 442.) The peplum was occasionally used to veil the head. It was the most costly and ornamental of all the productions of the loom, and the art of manufacturing it was entirely oriental. The peplum was the robe of state of Minerva at Athens, with which her statue was solemnly invested every five years at the panathenæa.

PEPPER, the English name of a genus of tropical plants, and also of the fruit which is used as a condiment. The most important of these is black pepper, the dried ripe berries of *Piper nigrum* (Linn.), Nat. Ord. *Piperaceæ*, a shrubby, climbing plant, which has for ages been cultivated in India. It has been introduced into the West Indies, tropical Africa, and South America, where it succeeds admirably. The earliest mention of pepper is by Hippocrates, who employed and recommended it as a medicine. Pliny refers to it as a condiment; but it is doubtful if he could have referred to the true pepper, as he declares that it has neither strength nor taste to recommend it.

The short spike-shaped clusters of berries are produced in great abundance, and when ripe the berries resemble those of our common holly in size and colour, but they lose their bright scarlet colour and smoothness in drying, and become wrinkled and black. In this state we receive them, and they are ground into the coarse grey powder known at table as *black pepper*. *White pepper* is the produce of the same plant, but in order to manufacture it, the black wrinkled coats of the seeds are removed by soaking and friction; they are then somewhat smaller, perfectly spherical, and of a light drab colour. It is ground to powder, and used in a similar manner, and is by many preferred in consequence of its apparently superior appearance, but it loses both strength and flavour by the manipulation. *Long pepper* is the produce of a distinct species, the *Piper longum* of Linnæus, or *Chavica Roxburghii* of Miquel, a native of the Circar Mountains, where it is gathered in its wild state. It is also cultivated in some parts of India. The time for gathering it is just before ripening, when the fruits are very small, and are compactly pressed together upon a small cylindrical spike, which, with the fruit, is about an inch and a half in length, and a little thicker than a quill: when dried it is of a light greyish colour. We receive it from Bengal; but the quantity imported is inconsiderable, as its qualities are analogous to those of white pepper. It enters into certain medicinal preparations, and is a favourite in some culinary operations, particularly the manufacture of pickles. *Betel pepper*, the leaf of which is so extensively used in India and its islands as a masticatory, is the produce of *Piper Betel* (Linn.), or *Chavica Betel* of Miquel. It is not imported into Europe. *Cubeb pepper* is the dried berries of *Cubeba officinalis*. They are rather smaller and less wrinkled than those of black pepper, and are of a dark brown colour. Cubeb pepper is extensively used in medicine, and has been in high esteem from a very early period. It was employed by the Moors; and in England, during the reign of Edward I., the London merchants held the right to levy a toll of one farthing per pound upon all cubebs carried over London Bridge,—an indication that even then this medicinal pepper constituted an important article of commerce. In 1856 the imports to the United Kingdom were 25¼ tons, worth from L.5 to L.6 per cwt. *Cayenne pepper* is a compound condiment, the principal ingredient in which is the epidermis and pulp of the common capsicum (*Capsicum annuum*, Linn., Nat. Ord. *Solanaceæ*), a plant very extensively cultivated in most tropical countries, but said to have been procured originally from South America. The best Cayenne pepper is made in the West Indies. The berries, which are often larger than an egg, although other varieties are scarcely larger than a clove, are opened, and the seeds are taken out; the scarlet epidermis and pulp are then well beaten up with flour and salt into a paste, which is afterwards baked until quite hard, and then ground into a coarse powder, which is put into well-corked bottles for use. Other methods are used, but this is the mode of preparing the much-prized West India Cayenne pepper. The *Neilgherry pepper*, so highly esteemed by East Indian epicures, is prepared in a similar manner from the berries of a yellow variety of the same species, which is cultivated for the purpose on the Neilgherry Hills. It is flavoured with cumin and other aromatic seeds. The two last-mentioned condiments, though so essentially different from the true peppers, pay the same duty (6d. per lb. and 5 per cent.), and are included in the same returns as the others, with the exception of cubeb pepper, which, as a drug, is duty free. The quantity imported in 1856 was 4826 tons, worth L.224,746. Of this enormous quantity, 2238 tons were re-exported. It was

principally imported from British India direct; but some was also sent from the Dutch possessions in Java, and other places.

Pepper is occasionally adulterated with farinaceous matter, such as starch or powdered rice; and bone-dust, known to the trade as "ivory-dust," is sometimes used to adulterate white pepper. An adulterate for pepper, under the name of "P.D." (*i.e.*, pepper-dust), is manufactured from rape or linseed cake, mustard dross, and Cayenne pepper. (See "Blue-book" on *Adulteration of Food*, &c., 1856.)

PEPYS, Samuel, author of the well-known *Diary* which bears his name, was descended from the Pepyses of Cambridgeshire, and was born on the 23d of February 1632. His family had some pretensions to gentility, but his father exercised the humble trade of a tailor in the city of London. Passing from St Paul's school in 1650, young Pepys became a sizar in Trinity College, Cambridge, but removed shortly after to Magdalen College. The only record we possess of his university career is contained in a memorandum of discipline entered in the Register-book of his college, where we read how Samuel and one Hind "were solemnly admonished for having been scandalously overserved with drink ye night before." The next notice we obtain of his progress is in October 1655, when we discover that he has married a girl of fifteen fresh from a convent. As this young lady had more of pedigree than portion, Pepys was glad to accept of an asylum in the family of his cousin, Sir Edward Montagu, afterwards Earl of Sandwich, a gentleman who proved his fast friend through life. He attended his patron on his expedition to the Sound in March 1658, and on his return received a clerkship connected with the Exchequer. It was about this time that Pepys began his interesting *Diary*, which he continued without interruption from 1st January 1659–60 for upwards of nine years, when defective vision compelled him to desist. His new appointment of Clerk of the Acts of the navy, in June 1660, brought his valuable business talents into notice, and he soon gained the confidence and esteem of the Duke of York, then Lord High Admiral. The intelligence and energy which Pepys brought to bear upon the reformation of the affairs of the navy, were attended with the best results during the critical times consequent upon the Dutch war. The plague visited the metropolis in 1665, but Pepys courageously stood by his post when every branch of the service was completely deserted. The fire of London followed; and no man did more to arrest the progress of that calamity than the Clerk of the Acts. On the resignation of the Duke of York in 1673, upon the passing of the Test Act, Pepys was appointed by his Majesty Charles II. to the important post of Secretary to the Admiralty. His close connection with the late Lord High Admiral was like to involve the new secretary in a share of the odium to which that nobleman was exposed. Pepys and Sir Anthony Deane were committed to the Tower on the 22d of May 1679, on the charge of being secret enemies of the Protestant cause, and of maintaining a clandestine correspondence with the French government respecting the condition of the English navy. They had to find security in L.30,000; but the foul depositions were shortly afterwards withdrawn, and the prisoners discharged. Charles having taken a fancy for again changing the constitution of the Admiralty, Pepys lost his post for a time as secretary. Meanwhile he accompanied Lord Dartmouth to Tangier, and employed his shorthand in preserving some records of the expedition. These notes were deciphered and published in 1841 from the MS. in the Bodleian Library. On his return, Pepys was re-installed in his secretaryship; a post for which no man in England was better qualified, and which he was allowed to occupy till the reign of James II. came to an end. He enjoyed much of the confidence of the latter monarch. We are told that on the arrival of the news that the Prince of Orange had landed, James was sitting to Kneller for his picture, which was intended as a present to the secretary of the Admiralty. That his "good friend might not be disappointed," the king commanded the painter to proceed, and complete the picture. Much of the credit frequently accorded to James II. for "renovating the navy" is unquestionably due entirely to Pepys. For the part borne by him in the naval history of the period the reader will find ample details in his *Memoirs relating to the State of the Royal Navy of England, determined December* 1688, 8vo, London, 1690. The studious retirement which Pepys sought, on being deprived of his official employments at the succession of William and Mary, was devoted to the arrangement of his extensive materials for a general history of the *Navalia* of England. Death came, however, to cut the work short on the 26th of May 1703.

Judging from the great variety, both of his duties and amusements, Pepys must have been a man of singular versatility. Despite his burdensome duties in connection with the affairs of the navy, which must have absorbed no ordinary degree of strength and courage, there seems to have been positively no end to the play-going and amusement in which the author of the *Diary* indulged. He sat for many years, besides, in the House of Commons; he was a connoisseur in the fine arts; he practised music; he patronized letters; and, to crown all, he was president of the Royal Society for two successive years. Among the invaluable MSS. bequeathed by him to Magdalen College, Cambridge, is to be found a remarkable collection of English ballads, from which were taken a large portion of Percy's *Reliques*. A small anonymous book in the Pepysian Library is likewise ascribed to him by Watt (*Bibliotheca Britannica*), entitled *A Relation of the Troubles in the Court of Portugal in* 1667 *and* 1668, by S. P., Esq., 12mo, London, 1667. But the work on which the reputation of Pepys chiefly rests is the *Diary* already alluded to, which was exhumed from its stenographic obscurity by the skill of John Smith (then a young student at Cambridge, afterwards rector of Baldock, Herts), and published, with a selection from the author's private correspondence, by Lord Braybrooke, in 2 vols. 4to, London, 1825. A third edition appeared, by his lordship, in 1848, containing very extensive and interesting additions formerly left out, with a Life and Notes, extending in all to 5 vols. 8vo. There is perhaps no book, either in our own or any other language, which presents such lively and truthful delineations of the society and manners of a former age. The *Diary* of Pepys is invaluable as a history of the court and times of Charles II.; yet, from its endless diversity of quaint gossip and amusing detail, drawn from domestic life and personal experience, it is, at the same time, unquestionably the most interesting book of its kind in existence.

PERA, a suburb of Constantinople, N. of the "Golden Horn," and connected with the city proper by a bridge of boats. It occupies the summit of the hill on which Galata is built, and is separated from that suburb by a wall, and entered by gates, which are closed during the night. Owing to its lofty and salubrious position, Pera is chiefly inhabited by Europeans; and it has not at all a Turkish appearance, but rather resembles a small Italian town. Most of the foreign ambassadors and the dragomans reside here. A great number of houses, including the palace of the British ambassador, were burned down in 1831; but these have been since rebuilt in a better style than formerly. Since then it has several times suffered from fire. There are a Greek and several Roman Catholic churches, a Mohammedan college, and a monastery of dervishes.

PERAK, an independent state on the west coast of the Malay Peninsula, lies between Keddah on the N., and Sangalore on the S. It is watered by a river of the same

name; and is partly mountainous, and partly consists of rich alluvial plains. There are valuable tin mines, producing upwards of 3600 cwt. of tin annually. Gold is also obtained by washing in many of the streams. The country was at one time subject to Siam, but is now governed by a sultan of its own. The population is estimated at 35,000 Malays, exclusive of the aboriginal tribes in the interior.

PERAMBULATOR, in surveying, an instrument for measuring distances, called also an *odometer*, and a *surveying-wheel*.

PERCEPTION. See METAPHYSICS.

PERCEVAL, SPENCER, an English statesman, the second son of John, Lord Egmont, was born in 1762, and received his education at Harrow, and at Trinity College, Cambridge. Becoming a member of Lincoln's Inn, and pursuing the study of law with a close and unwearied attention which stooped to the most minute details, he soon laid the foundations of future eminence. Accordingly, he had not been long in Parliament as member for the borough of Northampton, when he entered upon a career of promotion. Under the Addington administration, the office of solicitor-general was conferred upon him in 1801, and the office of attorney-general in 1802. On the overthrow of the Grenville ministry in 1807, he was appointed chancellor of the exchequer; and on the retirement of the Duke of Portland from the premiership in 1809, he succeeded to the post of prime minister of Great Britain. His administration was marked by strong opposition to the tolerant views which had ruined his predecessors; and he is one of the few English statesmen who have rendered themselves notorious from the rancour of their religious intolerance. He seems to have been a man of a cold, ungenial nature. Perceval was still at the head of affairs when he was shot by an assassin named Bellingham in the lobby of the House of Commons on the evening of the 11th May 1812.

PERCH (Lat. *pertica*, a long staff or pole frequently used in measuring land) is used, like the word *pole*, as a denomination both of lineal and of superficial measure. As a measure of length, it is equal to $5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet; in square measure, the perch is the $\frac{1}{40}$th part of a rood, or equal to $30\frac{1}{4}$ square yards. (See WEIGHTS AND MEASURES.)

PERCIVAL, THOMAS, an eminent physician and moralist, was born at Warrington in Lancashire in 1740. His characteristic enthusiasm began to appear at an early age. After studying with great ardour at the newly-instituted academy of his native place, he devoted himself to the medical profession. He began his studies at Edinburgh in 1761, continued them at London in 1764, and finished them by graduating at Leyden in 1765. But it was not until 1767, when Percival commenced to practise as a physician in Manchester, that his enthusiasm obtained its full scope. Fond of his profession, addicted to scientific investigations and discussions, earnest, and religious, he now entered upon a career of wide and varied activity. He became a frequent contributor to the *Philosophical Transactions* of London; and he became the chief instrument in establishing the Literary and Philosophical Society of Manchester. His numerous papers on medical subjects were devoted to the cause of public health; and his *Moral Dissertations*, *Instructions to Children*, and *Medical Ethics* were consecrated to the interests of public morality. His professional duties were also discharged with the most conscientious assiduity till his death in August 1804. The entire works of Dr Percival, accompanied with a Life, were published by his son, in 4 vols. 8vo, London, 1807.

PERCY, THOMAS, Bishop of Dromore, editor of the well-known *Reliques of Ancient English Poetry*, was born of humble parents at Bridgenorth in Shropshire on the 13th of April 1728. He had his elementary education at the free school of his native town, and entered Christ Church, Oxford, as an exhibitioner in July 1746. On being presented to the vicarage of Easton-Mauduit in Northamptonshire, and to the rectory of Wilby in 1756, he commenced a career of faithful pastoral labour, relieved as often as leisure would permit by the cultivation of literature. In 1761 he came before the public with a translation from the Portugese of a Chinese story in four volumes, entitled *Hau Kiou Choaan*. This performance was followed up by *Chinese Proverbs*, and a new version of *Solomon's Song*. In 1763 he published a translation into Latin prose of five pieces of Runic poetry, and the year following a *Key to the New Testament*. Percy had by this time formed an intimacy with the most eminent men of letters then in England. Samuel Johnson visited him at his vicarage in 1764, and spent three very happy months in the society of the learned ecclesiastic, then in eager pursuit of old heroic ballads and songs. It does not appear, however, that Johnson showed a very lively sympathy with those reliques of ancient minstrelsy. Men of letters and professed antiquarians gave him their aid or encouragement; and "the last male descendant of the ancient house of Percy" gave "Otterbourne" and "Chevy Chase," and the rest of the famous *Reliques*, to the world in 1765. The greater part of this collection was taken from an ancient folio manuscript in the editor's possession, containing nearly 200 compositions of all times and dates, from the ages prior to Chaucer to the conclusion of the reign of Charles I. The Pepysian Library at Magdalen College, Cambridge, likewise furnished some valuable pieces. (See PEPYS.) The reception given to these immortal ballads was at first by no means enthusiastic. Percy received 100 guineas for the first edition; and what was more substantial, was made chaplain in ordinary to the king in 1769, dean of Carlisle in 1778, and bishop of Dromore in 1782. In this Irish retreat, where a century before Jeremy Taylor had nursed his fine genius to a ripe maturity, Percy continued to prosecute his literary studies, to administer comfort to the poor, and spiritual consolation to all. In addition to the works of this elegant scholar already specified, he in 1770 printed the *Northumberland Household Book*, and a poem connected with the history of the family of Percy, written in imitation of the old ballad, and entitled *The Hermit of Warkworth*. It was during the same year that his translation of Mallet's *Northern Antiquities* was given to the public. Interesting remains of Bishop Percy are still to be found in *The Percy Correspondence*, published by John Bowyer Nichols. His assiduous application to study, and especially to old manuscripts, cost Percy his eyesight. He had become quite blind before his death, which took place on the 30th of September 1811, in the 83d year of his age.

PERDICCAS, the name of three kings of Macedonia. The first is supposed by Herodotus to have been the founder of the monarchy; the second was the son and successor of Alexander I.; and the third was the son of Amyntas II., and the successor of his brother, Alexander II. (See MACEDONIA.)

PERDICCAS, one of the most distinguished of the generals of Alexander the Great. (See MACEDONIA.)

PEREIRA, JONATHAN, a distinguished pharmacologist, was born on the 22d of May 1804 in the parish of Shoreditch, London. Passing from a classical academy, Queen Street, Finsbury, where he had received his preliminary education, he was at the age of fifteen articled to a navy surgeon in the City Road. In 1821 his apprenticeship was brought to a termination, and he entered as a student at the Aldersgate General Dispensary, and at St Bartholomew's Hospital. At these institutions he had an opportunity of devoting himself with ardour to those studies which he had prosecuted with so much zeal in private during the years of his apprenticeship. In 1823 Pereira obtained the appointment of apothecary at the Aldersgate Street Dispensary, and began to give lessons to

private pupils preparatory to their medical examination. His success in this undertaking already pointed him out as a person destined to rise to distinguished eminence as a public instructor. It was during this period that he commenced his career as an author by publishing for the use of students a translation of the London *Pharmacopœia*, *Selecta e Præscriptis*, which has gone through many editions; *A Manual for the Use of Students;* and *A General Table of Atomic Numbers, with an Introduction to the Atomic Theory.* Pereira had just completed his twenty-first year when, in 1825, he was made lecturer on chemistry at the Aldersgate Street Dispensary; and three years afterwards he commenced a course of lectures on his favourite subject of Materia Medica. As a scientific teacher he soon attained an extensive popularity, and his class became the largest of the kind in London. He resigned his office of apothecary in 1832, married, and established himself in general practice in Aldersgate Street. In the winter of the same year he was elected professor of Materia Medica in the New Medical School in Aldersgate Street, and was made lecturer on chemistry at the London Hospital. To pave the way for his great work, *The Elements of Materia Medica*, on which he was then busily engaged, Pereira published his lectures on that subject in the *Medical Gazette* for 1835–6–7, which contributed greatly to raise his reputation both at home and abroad. His *Elements* appeared in 1839–40; and about the same time he was appointed examiner in Materia Medica at the London university. He was chosen assistant physician to the London Hospital in 1841, having previously become a licentiate by examination of the College of Physicians, and having obtained the degree of M.D. from the university of Erlangen. On the opening of the School of Pharmacy in 1842, Dr Pereira delivered two lectures at that institution "On the Elementary Composition of Food," which he subsequently amplified into *A Treatise on Food and Diet.* In 1843 he published his *Lectures on Polarized Light;* and during the same year became professor of Materia Medica to the Pharmaceutical Society, a position which he continued to occupy till 1851. The greater number of Pereira's valuable contributions to the *Pharmaceutical Journal* were made at this period. In 1845 he was elected a fellow of the Royal College of Physicians, and shortly afterwards was appointed curator of the museum of that institution. His death, which took place on the 20th of January 1853, in the forty-ninth year of his age, was caused by the rupture of a blood-vessel about the heart, induced by the effects of a severe fall. As an authority in Materia Medica, Dr Pereira had few equals in Europe.

PEREJASLAV, or PEREJASLAVL, a town of European Russia, government of Poltava, at the confluence of the Alta and the Frubesh, 176 miles W.N.W. of Poltava. It is an ancient town, and is defended by an earthen wall and a dilapidated fortress. Brandy is made here, and some trade is carried on in corn and cattle. Pop. (1852) 10,848.

PEREKOP, a town of European Russia, in the government of Taurida, stands in an unhealthy position on the isthmus of the same name, joining the Crimea to the mainland, 88 miles N.N.W. of Simferopol. It is defended by irregular wooden fortifications and by a strong castle. There are here a Greek church and a mosque; and large fairs are held, frequented chiefly by the Nogai Tartars. The principal trade carried on is in salt, which is obtained in the neighbouring steppes. Pop. (1849) 4116. The isthmus of Perekop is about 20 miles long, and 4 miles broad at the narrowest part. It separates the Gulf of Sivach on the E. from that of Perekop on the W., and where narrowest is crossed by a rampart and ditch.

PEREZ, ANTONIO, the natural son of Gonzalo Perez, for a long time secretary of state to Charles V. and Philip II., was born in 1541 at Monreal de Ariza in Aragon, and legitimated by imperial diploma in 1542. In his boyhood he accompanied his father, who attended the court through Europe, and received the elements of education at Louvain and Venice, which he finished in Madrid. Trained by his father to succeed him, he became, at the death of the latter, the principal of the two secretaries of state, and had the charge of the *despacho universal.* The royal council was divided into two hostile parties, headed respectively by Ruy Gomez, Prince of Eboli, and by the Duke of Alva: Perez adhered to the former, which had been all-powerful since the failure of Alva in the Netherlands, and continued so after the death of Ruy Gomez in 1573, till his own disgrace in 1579. Adroit, devoted, and unscrupulous,—an able writer, and assiduous in business,—he had by degrees assumed the highest place in the king's confidence, and was the depositary of the dangerous secrets of that suspicious tyrant. In this unenviable eminence he behaved himself imprudently, creating enemies among the nobles by ostentatious contempt, as well as by the wealth which he extorted from petitioners, and acquired (as Spanish ministers have generally done) by the sale of offices and titles. His own account of the disgrace which determined the whole of his subsequent history is, that, being authorized by the king to ensnare Escovedo, then supposed to be engaged in a plot for securing the Spanish crown for his master, Don Juan, the king's brother, Perez, after several unsuccessful attempts at poisoning Escovedo, caused him to be stabbed in the street on the 31st of March 1578. Perez's real motive, however, for the murder, was to get rid of a dangerous enemy; for Escovedo was acquainted with an intrigue of Perez with the Princess Eboli, the king's mistress, and the murderer feared his conduct might reach the ears of Philip. That this was the real motive of Perez was long questioned by historians. So high an authority as Ranke discredited it; but it has been placed beyond doubt by the researches of Mignet, which appeared first in the *Journal des Savans*, and were afterwards published separately, and appeared in an English translation in 1846. Rumour at once fastening on the real motive and culprit, the relatives of Escovedo demanded justice; and having discovered the truth, Philip had the Princess Eboli and Perez simultaneously arrested. Perez was sentenced in 1585 to ten years' banishment (including two years' close imprisonment), and heavy restitution and fine. He was shut up in the fortress of Turreguano, where he had the society of his wife, Juana Coëllo, whose whole life gave proof of a remarkable fidelity and self-devotion. To compel him to give up the documents that implicated Philip, he was put to the torture (February 1590), a stretch of power which had no other effect than to procure for him the sympathy of the nobles, whose privileges were violated in his person. On the 20th of July of the same year, assisted by his faithful friend Gil de Mesa, he escaped to Saragossa in Aragon, and placed himself under the protection of the *fueros* or independent jurisdiction of that kingdom. The events that ensue belong to Spanish history; for it was the protection Perez received from the fueros, and the spirited resistance to the arbitrary invasion of them in his case, that gave Philip, who had been long secretly undermining them, the pretext for their abolition by force of arms.

Acquitted by the court of Saragossa, the attempt was made by the monarch's instruments to transfer Perez forcibly to the prison of the Inquisition, a charge of heresy being got up against him out of the passionate blasphemies he was too apt to utter when enraged by his misfortunes. A popular insurrection set him at liberty, in which the Marquis of Almenara, viceroy in Aragon, lost his life.

In the reaction produced by this unlucky catastrophe, the attempt was repeated under more legal forms; but a second insurrection, contrived by the friends of Perez, frustrated it, and he was able to escape to France. He

was received with kindness at Pau by the Princess Catherine, who brought him to her brother Henri IV., at Tours, in the spring of 1593. Henri sent him on a secret mission to the coast of England, where he warmly and ably seconded the active counsels of the Earl of Essex, which well accorded with his own animosity against his former master. Through Essex he became intimate with Francis and Antony Baca, and received a pension of L.130. While in England he published his *Relaciones* in 1594, under the name of Raphael Pelegrino. In January 1595 he was recalled by Henri IV., who had declared war against Philip II. He received as residence a house that had belonged to the Duc de Mercœur and a guard to protect him against assassination. His position, however, was precarious and irksome. An unsuccessful mission to England in 1595, aggravated his discontent, and the part he played in the treaty with Spain in 1597 had not the effect of strengthening his interest with the French king. The succession of Philip III. in 1598 raised his hopes again; but it was not till April of the following year that his wife and children were liberated. All the efforts he made to get himself recalled were, however, vain; a mission which he undertook to England in the interest of Spain in 1604, and on the strength of which he resigned his pension, ignominiously failed: he was obliged to leave England as soon as he had arrived, and returned to France to spend his last days in want, solitude, and despair. He died 3d November 1611, and was buried in the Célestins.

Perez has an eminent place in Spanish literature. Besides the *Relaciones* above mentioned, the *Memorial* and *Comentarios* relating to that work, which is not very trustworthy, he published *Cartas Familiares*. Many of these letters are in Latin; those, namely, to Essex and his other English and French friends. They have the same essential qualities as those in his own language to his family and friends in Spain. His faults are those of his age; and some of them were adopted from the fashionable euphuism of England. He has conceits, false and strained analogies, in abundance; the whole vocabulary of mythology, and the fabulous natural history in vogue, are at his command; of Tacitus he imitated the compression and the obscurity; he affected the sententious smartness of Seneca: these were his favourite authors. On the other hand, he has passages of a noble and touching pathos, happy similitudes well hit off, and much of the bitter wisdom of disappointment. He had seen the great very closely, had been the secretary and agent of a dark and tortuous tyrant, knew well and cleverly delineates the Machiavelism of the age. Many of his sharp sentences have become proverbial; many deserve to become so. A Life of Philip II. by him is in existence, but has not been published.

PERFUMERY is the art of preparing certain substances for the gratification of the sense of smell. But according to a modern professor of the art (Madame Celnart, *Manuel du Parfumeur*, Paris, 1845), perfumery has a much more extensive range, including the preparation of *volatile oils*, *pommades*, *absorbent powders* for increasing, and *depilatories* for diminishing the growth of hair; *creams* and *cosmetics* for the skin; almond and other *pastes; dentifrices*, and *mouth-washes; essences* and *scented waters;* dry perfumes, such as *pastilles*, *cassolettes*, and *printanniers*, or little perforated ivory boxes containing a dry scented paste, to be worn in the pocket; *sachet powders* for insertion in silken bags or ornamental envelopes; *aromatic vinegars*, and *toilet soaps*, *hair powders*, and *bandolines*, hard and liquid, for dressing the hair. All these names indicate as many different classes of perfumes, and each class sometimes contains an almost endless variety, as in the various scents for the handkerchief, oils for the hair, &c.

The use of perfumes has been common among most nations from the earliest times. The monuments of ancient Egypt represent the censer exhaling its grateful odour before the presiding deity; and the surfaces of tombs often represent the preparation of spices and perfumes for the embalming of the dead. The unrolling of the mummy in our museums has placed in our hands the costly perfumes actually used by the ancient Egyptians. Frequent reference is made in Holy Scripture to perfumes. In Exod. xxx., Moses is directed to take pure myrrh, sweet cinnamon, sweet calamus, cassia, and oil of olive, which he is to compound, "after the art of the apothecary," for a holy anointing oil. He is also directed to take sweet spices, stacte, onycha, galbanum, and pure frankincense, to make a perfume to be placed "before the testimony in the tabernacle of the congregation." Several perfumes are also mentioned in the Canticles,—iv. 14; Ps. xlv. 8; Prov. vii. 17; Jer. vi. 20; and other passages, of which the most familiar in the New Testament is in Mark xiv. 3, where a woman "having an alabaster box of ointment of spikenard, very precious, brake the box, and poured it on his head." The ancient Greeks and Romans made free use of perfumes, which they carried in costly and elegant boxes to the bath, after the use of which they anointed and scented themselves. Perfumes are still largely used in the East, where it is the custom to sprinkle guests with rose-water, and to perfume them with aloes-wood at the close of a visit, as a mark of hospitality and friendship. The use of perfumes in Great Britain, at least among the male sex, has greatly declined since the free use of soap has become general. The man who is most fastidious about his dress now hesitates to employ perfumes freely, lest he should become obnoxious to the sarcasm of the poet Cowper:—

"The sight's enough; no need to smell a beau."

Still, however, the trade in perfumes is enormous, a considerable portion of the industry of the south of France being employed in their preparation. Cannes is celebrated for perfumes produced from the rose, tuberose, cassia, jasmine, and orange *neroli*. At Nismes, thyme, rosemary, aspic, and lavender are manufactured. Nice is famous for the products of the violet and *reseda;* Sicily for those of the lemon, the bergamot, and the orange; England excels in the preparation of lavender and peppermint; Mitcham in Surrey, and Hitchin in Hertfordshire, being celebrated for their essential oils.

Perfumes are chiefly of vegetable origin, although there are a few of animal, such as musk and civet, and of chemical, such as the salts of ammonia. Various parts of a plant may contribute odour: in some cases it is the root, as in the iris; in others, the stem or wood, as in cedar; or it may be the leaves, as in mint; or the flower, as in the rose and the violet; or the seed, as in the Tonquin bean; or the bark, as in cinnamon. Some plants give more than one odour: thus the orange tree yields three,—namely, *petit grain*, from the leaves; *neroli*, from the flowers; and the essential oil of orange, called *Portugal*, from the rind of the fruit.

Vegetable odours are due to volatile oils contained in certain small vessels or sacs, or generated from time to time during the life of the plant, as when it is in blossom. Some odours exude by incision, as in the case of certain odoriferous gums, such as benzoin; or balsams, which are mixtures of an odorous oil and an inodorous gum. Some balsams are prepared, in the country which produces the plants, by boiling the plant in water, straining, and evaporating to the consistence of treacle; as in the case of balsam of Peru, which is prepared from the *Myroxylon peruiferum*. Such balsams are used for mixing with soap, and in some cases medicinally.

Perfumes are for the most part prepared by one of four operations, namely,—(1.) *Expression;* (2.) *Distillation;* (3.) *Maceration;* (4.) *Absorption* or *enfleurage*. By the first operation essential oils may be obtained, such as the oil of orange, of lemon, or of citron peel. The peel is packed

in a cloth bag, and subjected to pressure in a powerful iron press. The oil which exudes is contaminated with the watery extract, but the different fluids separate on being left to repose in appropriate vessels, and the oil can be removed by means of a pipette. In the second process, the herbs are put into a still, together with a quantity of water, which being raised to the boiling point, the volatile otto comes over with the steam. Spirit is sometimes used in the still, but it is better to draw the oil first with water, and then to dissolve the oil in spirit. The products of the distillation are put into a funnel, and they separate by standing. The stills are heated by means of steam, by which the risk of burning and imparting an empyreumatic flavour to the products is avoided. Some idea of the extensive nature of the operation of distilling may be formed from the fact, that at Mitcham a ton of herbs is distilled at one operation. With the exception of the essential oils of lavender and peppermint, the south of France is the great seat of the manufacture of essential oils,—such as those of the rose, neroli, lemon-thyme, and rosemary. In preparing the essence of roses, the water and the roses are put into the still until one-half of the water has been distilled off, and when a considerable quantity of water of the first distillation has been obtained, it is used as water upon fresh rose-leaves; and this plan is repeated five times. In distilling orange-flowers to obtain the essence of neroli, the same process is adopted; but orange-flower water is obtained at the first distillation.

By means of maceration, or, as the perfumer sometimes calls it, *infusion*, a variety of pommades, scented oils, and scented spirits are prepared. The vessel containing the liquid, such as the fat, oil, or spirit, together with the essential oil, or the parts of the plant which afford the scent, is heated by means of a water-bath or *bain-marie*. The fat for pommades should be first pounded in a marble mortar until the membranes are completely torn: it should then be heated in a water-bath, skimmed, and filtered through canvas. Mr Piesse, in his work on *Perfumery* (2d edit. 1856), speaks of the *oil of behn*, from Jamaica, as being a perfectly inodorous fat oil, well adapted for extracting the odours of flowers by maceration. In preparing rose, orange-flower, and cassia pommades, a quantity of lard and beef suet are melted in a pan called a *bugadier;* the rose-leaves are stirred in, and left for twenty-four hours, when the mass is again melted, strained, and fresh flowers are added; and so on for ten or fifteen times. In some cases the pommade is made into rectangular bricks, and pressed to separate the solid matter from the soft pommade: the bricks are then put into a perforated barrel, and pressed until the pommade exudes and flows into a copper vessel placed under the trough of the press. In preparing scented spirits, the essential oil and spirits of wine are digested in a water-bath, and frequently agitated during three days, when the spirit is drawn off into a second digester, and after three days to a third digester, with similar treatment. The celebrated *eau de Cologne* is prepared by distillation and infusion, the latter process being preferred. The successful preparation of this perfume is regarded as the perfection of the art. The various essential oils of which it is composed ought to be combined so harmoniously that no one of them shall be perceptible, not only at the first impression, but during the evaporation of the scent; a remark which should apply to other perfumes. When the ingredients differ but little among each other in odour and volatility, the desired result may be more easily attained. The constituents of *eau de Cologne* are said to be the essential oils of the lemon, the citron, and the orange, prepared from the fruit in different stages of maturity, and they approach so closely to each other as to produce only a single aromatic impression. Minute proportions of other oils are added, such as otto of roses, oil of cloves, or oil of cinnamon; but the *eau de Cologne* is regarded as of inferior quality if a residuary odour of either of these substances remains after volatilization. Perfumes for the handkerchief are known to the perfumer as simple or compound,—the former being called *extracts, esprits*, or *essences;* and the latter, *bouquets* or *nosegays*.

By the process of absorption or *enfleurage* pommades and scented oils are extensively prepared, for which purpose a square four-sided frame or *chassis*, two or three inches deep, with a pane of glass resting on its inside ledges, is used. On this pane of glass a simple pommade of hog's lard and suet is spread, and into this sweet-scented flowers are stuck every day for two or three months, until the pommade is sufficiently rich in perfume. Several thousand frames are operated on in this way, and they are arranged in piles over each other. Pommades of jasmine, tuberose, violet, &c., are prepared in this way. The oils of the same flowers are similarly prepared. Cotton cloth, stretched in an iron frame, is imbued with the best olive-oil, and completely covered with a thin layer of flowers. Upon this is placed another frame treated in the same manner, and a pile is made in this way; and when the oil is saturated with the odour of the flowers the pile is carefully pressed, and the scented oil flows out. Rose, orange-flower, and cassia oils, however, are made by infusion.

For the proportions in which the various ingredients are used, particulars of manipulation, apparatus, &c., we must refer to books appropriated to the subject, such as that of Mr Piesse; but we cannot close this short article without remarking how so apparently trivial a subject as perfumes rises in dignity as soon as it touches on chemical science. So long as the perfumer confined himself to empirical processes and shallow secrets, science did not disturb his operations; but when it was asserted, at the time of the Great Exhibition of 1851, that certain essences in extensive use had for some time previously been prepared by artificial means, the chemist took a lively interest in the perfumer. It appeared that a scent called *winter-green oil*, obtained from an ericaceous plant, the *Gaultheria procumbens*, had been imported in considerable quantities from New Jersey in America. Now, it was found that this oil was a true compound ether, consisting of salicylic acid and pyroxylic spirit, and capable of being formed by a combination of these substances, so as to possess all the characters of the natural product. This observation led to the discovery, that among the numerous ethers prepared by the chemist, some, on being properly diluted, presented the odour of certain fruits so decidedly that it appeared all but certain that the fruits themselves were indebted to these ethers for their odours. (See CHEMISTRY, vol. vi.; also OILS, *Essential*.) (C. T.)

PERGAMUS, or PERGAMUM, an ancient city of Mysia in Asia Minor, was situated on the north bank of the Caïcus. The facts regarding its origin are not authenticated. It is said to have been founded by a colony of Arcadians, and to have derived its name from Pergamus, a son of Pyrrhus. At any rate, in the time of Xenophon it was a strong town perched on the top of a conical hill, and numbering many Greeks among its inhabitants. In course of time its population began to increase; houses began to be grouped round the foot of the Acropolis; and the city continued to grow in importance until about 283 B.C., when it became the seat of a kingdom. The first sovereign was one Philetærus, an eunuch, and a Paphlagonian by birth. This man being in the service of Lysimachus, King of Macedonia and Thrace, was appointed by him keeper of the treasures lodged in Pergamus. Whilst he held this employment, having fallen under the displeasure of Arsinoë, wife of Lysimachus, she found means to excite a quarrel between him and his master, upon which Philetærus seized on the town, together with the treasures entrusted to his care. At first he offered his service, together with his

treasure, to Seleucus, the King of Syria; but both Seleucus and Lysimachus dying soon afterwards, he contrived to keep possession of the town and treasure until his death, which happened in 263 B.C., twenty years after his revolt from Lysimachus.

The city of Pergamus was left an independent state to Eumenes I., the nephew of Philetærus. This ruler laying hold of the opportunity offered by the dissensions amongst the Seleucidæ, possessed himself of many strongholds in the province of Asia; and having hired a body of Galatians, defeated Antiochus Soter near Sardis. By this victory he obtained possession of the greater part of Asia. But he did not long enjoy his acquisitions, for he died next year of immoderate drinking.

Eumenes was succeeded, in 241 B.C., by Attalus I., who was also a nephew of Philetærus, and who was the first to assume the title of King of Pergamus. He defeated the Gauls, who seemed desirous of settling in his territory; and, according to Livy, he was the first of the Asiatic princes who refused to pay a contribution to these barbarians. Taking advantage of the wars in which Seleucus Ceranus was engaged, he invaded the territories of that monarch, and conquered all the provinces on the Anatolian side of the Taurus. Seleucus, however, with the aid of Achæus, soon deprived him of all his newly-acquired territories, and even besieged him in his capital. Upon this, Attalus, inviting to his assistance the Gauls who had settled in Thrace, not only obliged the enemy to raise the siege of Pergamus, but quickly recovered all the provinces he had lost. After this he invaded Ionia and the neighbouring provinces, where several cities voluntarily submitted to his sway. Thence he advanced to Apia, and, encamping on the banks of the River Megithus, received homage from the neighbouring nations. But here the Gauls, being frightened by an eclipse of the moon, refused to proceed farther; a circumstance which obliged the King of Pergamus to return to the Hellespont. Attalus now entering into an alliance with the Romans, joined them in their war against Philip, King of Macedonia. In this war, in command of the Rhodian fleet, he not only drove the Macedonians quite out of the Greek seas, but having landed his men, he invaded Macedonia, and obliged Philip to raise the siege of Athens. For these services the Athenians not only heaped on him all the favours they could bestow, but called one of their tribes by his name,—an honour which they had never before bestowed upon any foreigner. Attalus next attempted to organize a general confederacy of the Greeks against Philip. But whilst he was haranguing at Thebes, with a view to this object, and exhorting the Bœotians to enter into an alliance with the Romans against their common enemy, he fell in a fit of apoplexy. Having somewhat recovered, he was carried by sea to Pergamus, where he died soon after his arrival, in 197 B.C., in the seventy-second year of his age, and forty-third of his reign.

Attalus was succeeded by his eldest son Eumenes II. The latter was exceedingly attached to the Romans. He refused the daughter of Antiochus the Great in marriage, lest he should thus be led into a quarrel with that people. He also gave intimation to the Roman Senate of the transactions of Ariarathes, King of Cappadocia, who was making great preparations both by sea and land. Nor did his fidelity stop here. When he saw the war about to break out between Antiochus and the Romans, he sent his brother Attalus to Rome in order to give information of the proceedings of Antiochus. At the battle of Magnesia, too, he behaved with the greatest bravery, not only sustaining the first attack of the enemy's elephants, but driving them back again upon their own troops, and thus throwing the hostile ranks into confusion, and contributing materially to the complete victory of the Romans. Such assiduous services were well rewarded. On the conclusion of peace between Antiochus and the Romans, his dominion was extended over all the countries in Asia Minor west of Mount Taurus. Soon after this Eumenes engaged in an unsuccessful contest with Prusias, King of Bithynia, who made war upon him by the advice of Hannibal, the celebrated Carthaginian general. The Romans, however, interfered, and by their deputies not only put an end to the differences between the two kings, but prevailed on Prusias to betray Hannibal. Eumenes being thus freed from such a dangerous enemy, engaged in a new war with the kings of Cappadocia and Pontus, in which he proved victorious. His friendship for the Romans he now carried to such a degree of enthusiasm that he went in person to Rome to inform them of the machinations of Perseus, King of Macedonia. This journey, however, had almost proved fatal to him. On his return, as he was going to perform a sacrifice at Delphi, two assassins, sent by Perseus, rolled down two great stones upon him as he entered the straits of the mountains. He was so severely injured that a report of his death was spread over Asia; and on reaching home, he found that his brother Attalus had married his wife and assumed his crown. In spite of this flagrant attempt upon his life, however, Eumenes, on the outbreak of the war between the Romans and Macedonians, entered into negotiations with Perseus. He offered, if the latter would pay him a sum of money, to influence the Romans to grant him a safe and honourable peace. These negotiations were indeed broken off prematurely, but not before the Romans had begun to be suspicious, and to entertain no little jealousy of their old friend, and to heap favours upon his brother Attalus. Eumenes in alarm resolved to proceed in person to Rome, in order to justify himself. But the Senate having already condemned him in their own minds, resolved not to hear his vindication, and made an act that no king should be permitted to enter the gates of Rome. Accordingly, on landing at Brundusium, he was met by a quæstor, and ordered to quit Italy and go back to Pergamus without delay. On his return, the Gauls, encouraged by the cold reception which he had met with at Rome, invaded his territories, but were repulsed with great loss. This produced new complaints at Rome. Eumenes was accused of keeping up a secret correspondence with the King of Macedonia; and the senators having conceived the most implacable hatred against him, seemed absolutely bent on his destruction, when he died in 159 B.C., in the thirty-ninth year of his reign, leaving his kingdom and his wife to his brother Attalus.

Attalus II., in the commencement of his reign, found himself greatly distressed by Prusias, King of Bithynia, who not only overthrew him in a pitched battle, but advanced to the very walls of Pergamus, ravaging the country as he marched along, and at last reduced the royal city itself. The king, having saved himself by a timely flight, despatched ambassadors to Rome for assistance. Prusias was accordingly obliged to conclude a peace with his adversary, and to give indemnities. The last enterprise in which we find Attalus engaged was against Andriscus, the pretended son of Perseus, King of Macedonia, in which he assisted the Romans. After this he gave himself up to ease and luxury, committing state affairs entirely to his ministers; and thus continued till his death, which happened in the eighty-second year of his age, about 138 B.C.

Attalus II. was succeeded by Attalus III., the son of Eumenes II., and of Stratonice, the daughter of Ariarathes, King of Cappadocia. This prince is said to have been deprived of his senses through the violence of his grief for his mother's death; and, indeed, throughout his whole reign, he behaved more like a madman than a person of sane mind. On the death of this tyrant in 133 B.C., a will was found, by which he left the Roman people his heirs, upon which they seized on the kingdom, and reduced it to a province of their empire by the name of Asia Proper. Aris-

tonicus, however, a son of Eumenes by an Ephesian courtesan, reckoning himself the lawful heir to the crown, assembled a considerable army in order to maintain his pretensions. The news were speedily carried to Rome; and Licinius Crassus, the *pontifex maximus*, was sent into the East to vindicate the Roman claims. But he managed matters so ill that he was entirely defeated and taken prisoner by Aristonicus. Aristonicus did not long enjoy the fruits of his victory. He was soon surprised by Perpenna, the new consul, who obliged him to venture an engagement at a disadvantage, defeated him, and took him prisoner. The Pergamenians, notwithstanding the defeat and captivity of their leader, still held out with such obstinacy that Aquilius, the succeeding consul, was obliged to besiege and take by force almost every city in the kingdom. At last, however, the whole country being reduced, Aquilius triumphed, and the unhappy Aristonicus, being led in chains before his chariot, probably ended his miserable life in a dungeon.

The city of Pergamus retained its importance long after its subject territory had been thus reduced into the form of a Roman province. It still continued to be famous for its magnificent library, which had been founded by Eumenes II., and which contained, according to the ordinary reports, about 200,000 volumes. In the times of the New Testament it was the seat of one of the Seven Churches mentioned in the Apocalypse. In the age of Pliny it was by far the most celebrated city of Asia. Yet after passing into the Byzantine empire Pergamus gradually declined, and in course of time was transformed into the modern city of *Bergamah*. The ruins of a palace, of the temple of Æsculapius, of a theatre, and of other public buildings, are the only remnants of its ancient grandeur.

PERGOLESE, Giovanni Battista, one of the most celebrated musicians of the Neapolitan school. Among his biographers, Italian, French, German, and English, there are conflicting statements regarding his birthplace, the date of his birth, his surname, and the conservatory in which he was trained at Naples. By some of those he is surnamed Jesi; by others Pergolese, or Pergolesi; and is said to have been born in 1704 or 1707 at Pergola, a small town in the duchy of Urbino; and to have been educated in the conservatory of St Onofrio at Naples. According to the Marchese di Villarosa, who published a biography of Pergolese in 1831, and who had in his hands the official certificate of the musician's birth and baptism, Pergolese was the true surname, his birthplace Jesi, a small town near Ancona in the Papal States, and the date of his birth ten o'clock on the night of the 3d of January 1710. The Marchese di Villarosa asserts also that Pergolese was admitted in 1717 into the Neapolitan conservatory *dei Poveri di J. C.*, and not into the conservatory of St Onofrio, as has been so often stated. There Pergolese studied the violin under Domenico de Matteis, and musical composition under Gaetano Greco, and Durante, Greco's successor. It appears that Pergolese was patronized by the noble families Stigliano and Caracciolo. In his earlier productions he adhered to the severer style of Greco and Scarlatti, but afterwards adopted that of his fellow-student Vinci, who considered melodic freedom and dramatic expression to be the chief objects of music. Padre Martini remarked that some passages in the sacred music of Pergolese were more suitable for operatic compositions. His first great work was the oratorio of *San Guglielmo d'Aquitania*, in 1731. In 1731 and 1732 he composed his operas *Sallustia*, *La Serva Padrona*, *Lo Frate Innamorato*, *Il Prigionier Superbo*; and in 1734 the opera *Adriano in Siria*, and the intermezzo *Lirietta e Tracollo*. In the same year he was appointed chapel-master of the church of Our Lady at Loretto. In 1735 he produced the operas *I Flaminio* and *Olimpiade*. Suffering from pulmonary consumption, he retired to Pozzuoli, near Naples, and there composed his cantata *Orfeo*, a *Salve Regina*, and his famous *Stabat Mater*. He died there on 16th March 1736, and was buried in the cathedral church. Besides the above-mentioned works, Pergolese composed the following:—A three-act intermezzo, *La Contadina Astuta*; *Amor fa l' Uomo Cieco*; *Recimero*; *Il Maestro di Musica*; *Il Geloso Schernito*; two *Salve Regina*; a Mass for two choirs; a Miserere for four voices; a Confitebor for five voices; a Motett; a Mass for two voices; a Mass in D major; the score of an Oratorio on the Birth of Christ; a Laudate, with accompaniments; a Dixit, with accompaniments; four Cantatas for a voice, with harpsichord and violin; a Mass for ten voices; a Dixit for ten voices; a Confitebor in Canto-Fermo for four voices; six Cantatas, three of them with accompaniments for violin, viola, and bass, and three with harpsichord accompaniments; a violin Concerto; and thirty Trios for two violins, violoncello, and harpsichord. (G. F. G.)

PERIANDER, Tyrant of Corinth, succeeded his father Cypselus, about 625 B.C. He began to rule with a mild and beneficent sway, yet soon adopted a system of vigorous and salutary despotism. His first measure was to insure internal peace by shutting up the clubs, common tables, and other scenes of political discussion, by removing or strictly watching all the citizens of high birth and influence, and by prohibiting all that wasteful extravagance which might result in wanton misconduct or factious poverty. Then, in order to strengthen his power, he enrolled an army, equipped a fleet, and entered into leagues with both Grecian tyrants and barbarian kings. At the same time, it was his care to adorn his capital with magnificent architecture, and to grace his court with men of philosophy and letters. The last days of Periander were clouded by domestic misfortune. His wife Melissa died in consequence of a blow which he had given her in a fit of jealous rage. His younger son Lycophron was assassinated by the Corcyræans while residing among that people. The only member of his family that was left was his idiot son Cypselus. Overwhelmed by these calamities, the hoary tyrant died at the age of eighty, and after a reign of forty years. Periander is said by his biographer Diogenes Laertius to have left behind him a didactic poem, which consisted of moral and political precepts, and amounted to 2000 verses. It was this work, in all probability, which led some to rank him among the seven sages of Greece.

PERICARP. See Botany.

PERICLES, the greatest of Athenian statesmen, was born about the beginning of the fifth century B.C. The family influences amid which he was brought up were well calculated to foster political ambition. His extraction was noble; his patrimony was splendid; his relations held some of the high offices in the state; his maternal grandfather Cleisthenes was one of the expellers of the Pisistratidæ; and his father Xantippus was the conqueror of the Persians at the battle of Mycale. Yet these advantages of birth did not induce the youthful Pericles to enter prematurely into the arena of politics. Like an ancient athlete who subjected himself to a careful process of training before entering the lists at Olympia, he patiently prepared himself by the most thorough education. From Damon, a professed teacher of music, but in reality an inveterate politician, he learned the history and principles of the Athenian constitution. In the school of Zeno the Eleatic, he acquired the art of carrying an argument into the most intricate subtleties and sophistries, and of "making the worse appear the better reason." But it was especially under Anaxagoras, "the Intelligence," as he was called, that his mind attained its fullest development. In the genial atmosphere of that great man's philosophy his intellect expanded to receive the rays of truth, his heart warmed

with the largest sympathies, and his spirit stood forth clear, serene, and calm. The refining influence even passed into his outward frame. His features assumed a settled repose, and his bearing became instinct with an easy dignity.

Thoroughly prepared by this complete process of training, Pericles began his political career about 469 B.C. In no long time he was the recognised leader of the democratic party against the warlike Cimon, the chief of the aristocracy. His conduct in this position was very unlike that of other demagogues. Dwelling apart in self-satisfied seclusion like a king, and wrapped up in his own thoughts like a philosopher, he showed himself to be the master and not the slave of the mob. He would not injure his self-respect by making his power subservient to his avarice, and wringing from the horny grasp of labour its hard-earned gains. He would not demean his talents by studying the vicious tastes of the populace, and by haranguing them on every paltry occasion. To parade himself often in public, and to mingle in the society of his friends, was, he thought, to impair his magisterial dignity. Even to wince under popular abuse, or to return the enmity of political adversaries, was, according to him, to act unworthy of a man of superior capacity. He pursued a far different line of policy. The art of raising Athens to the height of prosperity was the only subject worthy of his study. The quiet of his own chamber was his only proper sphere. When he condescended to punish any public insolence, he waited silently until the reviler had exhausted himself, and then ordered his servant to light the rascal home, or to do him some other act of kindness. When it pleased him to court the favour of the people, he did it like a prince, giving them money out of the treasury to frequent the theatres, and paying them for their military service and for their attendance at the courts of justice. When he deigned to appear as a public orator, it was for some great cause worthy of his transcendent genius. Then his usual cloak of calm reserve was thrown aside, and he stood forth in all the native earnestness of his character. He mounted the *bema* with his oration thoroughly premeditated, and began to speak with a prayer to the gods that no inappropriate word might fall from his lips. All the resources of his highly-gifted nature were immediately brought into play. He wielded the powers of his majestic intelligence and the stores of his spacious imagination with consummate ease and mastery. His gestures rose into commanding dignity, his words flowed fast and free, and nothing could resist the winning sweetness of his tone. The people swayed hither and thither before the breath of his mouth. "When I throw him," said his political antagonist Thucydides, "he swears he has never been down, and even persuades the populace to believe it." In fact, he was, as his contemporaries called him, a real *Olympian*. He thundered and he lightened, and darted from his tongue the bolts of almighty Jove. Nor was the foreign policy of Pericles, though less imposing, at all less far-sighted and less successful than his internal policy. He managed to take no active part in the expedition which resulted in the defeat of the Athenians at Tanagra in 457 B.C. The disastrous inroad of Tolmides into Bœotia in 447 B.C. was stigmatized with his disapproval at its very outset; and his remark on that occasion, that Time, the best of all counsellors, would corroborate his advice, became ever memorable. His measures were also successful in saving the city in 445 B.C. from a threatened revolt of her tributaries, and a simultaneous invasion of the Lacedæmonians. Bribing the Spartans to return in peace to their own country, he concentrated all the strength of the state against the factious Eubœans, brought them to terms of submission, and thus crushed a dangerous insurrection in the bud.

It was about 444 B.C., when Pericles had become absolute master of the Athenian destinies, that the most comprehensive and most magnificent schemes of policy that were ever entertained by any heathen statesman began to pass before his mind. The greatness of Athens, he thought, must be made to depend upon the concentrated influence of every excellence. She must be at once a fortress of strength, a city of palaces, an abode of refinement, and a temple of the gods. Her friends must be fascinated by her beauty and attractions; and her enemies must be overawed by her splendour and majesty. Her citizens and dependents must love and admire her as a cherishing and peerless mother; and all Greece must reverence and obey her as a stately mistress and an accomplished teacher. The first measure of Pericles for the execution of this great plan was to establish the political superiority of the city. Continuing the Athenian policy of exacting tribute in lieu of military service from the rest of the Hellenic confederacy, he drained the resources of the other Greek cities, and amassed the money within his own. Urging as a plea that Athens, if she protected the independence of Greece, might use this money for any purpose whatever, he employed it in rearing up the fabric of the national strength. A third long wall was built to the Piræus, in order that the communication between the city and its port might be rendered more secure. A fleet of sixty galleys was sent out to sea for eight months annually, in order that the sailors might be inured to service, and the ships be kept ever ready for action. Several colonies were planted to draw away the surplus population from the city, and to extend the commerce and influence of the state. At the same time, the right of Athens to arbitrate in all important disputes between her subject allies was pertinaciously claimed; so that in 440 B.C. the island of Samos, after a blockade of nine months, was reduced and punished for setting at nought this asserted supremacy. Nor, while Pericles was thus strengthening the outward fortifications, did he neglect to attend to the interior arrangements of the city. He set all the arts into their fullest activity to make it a theatre of beauty, pleasure, and refinement. Solemn festivals and religious pageants were prepared to relieve the attention and fascinate the eye. The great dramas of Æschylus, Sophocles, and Euripides were employed to stir the imagination and elevate the soul. But it was the illustrious Phidias and his able coadjutors that were specially honoured to complete the beautiful and sublime spectacle. At their command, the genii of painting, and sculpture, and architecture were summoned to fabricate a gorgeous crown for this queen of cities. Accordingly, up on the brow of the Acropolis, with wonderful rapidity, were reared two grand and elegant structures of white marble—the Propylæa, with its lofty porticoes, and the Parthenon, the most exquisite fabric that Grecian genius ever designed. The inner walls of these edifices were crowded all over with painted and sculptured figures; the intermediate ground was studded with statues; and towering over all, and visible to the mariner as he doubled the distant Cape of Sunium, rose the colossal image of Athene Promachos, with shield upraised and javelin balanced, as if in the act of protecting her favourite city, the seat of her worship and her name.

While these great works and enterprises raised Athens to a transcendent height of power and glory, they were only the occasion of involving the latter years of their great author in trial and difficulty. The Spartans, jealous of the supremacy which the Athenians were establishing under his administration, began to organize a conspiracy, and to meditate the Peloponnesian war. His political adversaries, taking advantage of the excitement produced by coming hostilities, commenced to assail him. They vented severe criticisms upon his government, charged him with the design of assuming the tyranny, and condemned his defensive attitude towards the hostile Lacedæmonians. The comic

poets threw every available scandal at his head, and made him the butt of every species of ridicule. There were some who, not content with attacking him directly, aimed at him indirectly by assailing his connections and acquaintances. His friend Phidias was arraigned for introducing his portrait on the shield of one of the statues of Minerva, and was thrown into prison, and left there to die. His paramour, the notorious Aspasia, was accused of pandering to his licentiousness, and was only acquitted after he had descended to plead for her life with tears and entreaties. His aged teacher also, Anaxagoras, was charged with overturning the national religion, and was sentenced to pay a fine, and to go into banishment. Yet the great statesman, completely mailed in his own probity, withstood these darts of calumny, and addressed himself to meet the attack of the Peloponnesians, who had now declared war. His tactics were directed by a policy as thorough-going and effective as it was cautious. Knowing that the enemy was superior in land forces, he collected all the moveable property of the Athenians within the walls of the city, and contented himself with assuming a defensive attitude towards the advancing invaders. Knowing also that Athens was the undisputed mistress of the seas, he sent out a fleet to make descents and reprisals upon the coasts of the Peloponnesus. This system of strategy was carried on efficiently during the first two years of the war. It might have been continued with the same result, and might have brought hostilities to a successful issue, had not an unforeseen disaster occurred to remove the able general and administrator. A plague broke out in Athens, raged with dreadful malignity, and threw the citizens into a ferment of irritable discontent. Pericles was made the scape-goat of all the national calamities, and was condemned to suffer the unreasonable ill-humour of the ungrateful populace, and the indignity of being fined. A series of private afflictions at the same time fell fast and fearfully upon him. Many of his relations and political friends died of the epidemic. His family also gradually wasted away. At length his only surviving legitimate son was carried forth lifeless. The stoical fortitude of the solitary old man now broke down. As he placed the funeral garland upon the head of the ill-starred youth, he burst into a flood of tears, and sobbed aloud. He resumed his public duties; but it soon became evident that public ingratitude and domestic misfortune had prostrated his strength and spirit. About the middle of the year 429 B.C., a slow fever seized him, and he lay down upon his death-bed. As the closing hour drew near, his attendants, thinking him in a stupor, stood round the couch recounting the deeds of the great soul that was preparing to depart. "You have forgotten," muttered he, "my greatest praise: you have not noticed that no fellow-citizen has ever put on mourning on my account." These were the last words of this great Athenian.

The authorities for the biography of Pericles are Plutarch and Thucydides. (See also the Grecian Histories of Grote and Thirlwall.)

PERIGEE (περί, *near*, γῆ, *the earth*) is that point of the moon's orbit at the least distance from the earth. In this sense it is opposed to *apogee*. (See Astronomy.)

PÉRIGUEUX, a town of France, capital of the department of Dordogne, is built in the form of an amphitheatre on the right bank of the Isle, here crossed by a fine bridge, 68 miles E.N.E. of Bordeaux, and 296 S.S.W. of Paris. It consists of two parts, the town proper and Puy-Saint-Front. The former of these is substantially though irregularly built of freestone. The streets are narrow; and many of the houses are curiously ornamented. The ancient ramparts are now replaced by boulevards; and a fine public walk in the highest part of the town commands a beautiful view of the valley of the Isle. The cathedral of St Front is a very remarkable edifice; it is an exact copy of St Mark's at Venice, having five domes, and a tower 197 feet high at the W. end. The prefecture of Périgueux is a fine edifice of modern date; and the church of the Jesuits is also a beautiful structure. There are here a public library, containing 16,000 volumes, a museum of antiquities, court-house, barracks, hospital, theatre, and other buildings. In one of the suburbs stands a round tower of Roman origin, 100 feet high; also a Roman arch and amphitheatre. The manufactures principally carried on in the town are those of paper, woollen fabrics, hosiery, leather, cutlery, brandy, and the celebrated pies of Périgueux, made of partridges and truffles, and which form a considerable article of export. An active trade is carried on in flour, salt, iron, wood, pork, groceries, &c. Périgueux occupies the site of the ancient Vesunna, which was at the time of the Roman invasion the capital of the Petrocorii. Under the empire it was a place of no small importance, as it stood at the junction of five roads and was strongly fortified. Périgueux, along with Aquitaine, was ceded to the English by Louis IX. After having been recovered by the French, the town was again lost; but it was finally taken from the English by Charles V. During the civil wars of the Reformation it was a stronghold of the Protestants till the year 1581; and it was not till 1653 that it came into the power of the Crown. Pop. (1856) 13,291.

PERIHELION (περί, *near*, ἥλιος, *the sun*) is that part of the orbit of a planet or comet at its least distance from the sun. In this sense it is in opposition to *aphelion*. (See Astronomy.)

PERIM, or Mehun, an island in the Strait of Bab-el-Mandeb, off the coast of Yemen in Arabia, and having its southern extremity in N. Lat. 12. 38., E. Long. 43. 23. In form it is oval, 3½ miles in length from W.N.W. to E.S.E., by 2½ in breadth; and it divides the entrance of the Red Sea into two channels, called the Great and Little Straits respectively; the former, between Perim and the African coast, being 13 miles broad, and the latter, formed by the island and Cape Bab-el-Mandeb, 1¾. The Little Strait is the one most frequently used by vessels entering the sea, as it is quite safe, though varying from 7 to 13 fathoms in depth, and as it affords good anchorage; whereas in the Great Strait, where the depth varies from 13 to 25 fathoms, there are only a few places where anchorage can be obtained; but during the night, with a favourable breeze, the wider passage is to be preferred. The island is a bare black rock, without water, and almost entirely destitute of vegetation; but it has on the S.W. side a magnificent harbour, more than 1½ mile in length, and from a half to three quarters of a mile in breadth, with a depth of 7 or 8 fathoms. It is capable of containing forty men-of-war; and the entrance is safe, being about half a mile wide, and 16 fathoms deep. The island of Perim commands the entrance of the Red Sea; and for this reason it has been twice occupied by the British in order to defend the approach to India. The first occasion on which it was occupied was in 1799, in order to guard against the designs of the French, who were then in possession of Egypt. The island was, however, abandoned in 1801, when that danger had passed away. In recent times, the project of the Suez Canal has given rise to similar apprehensions; and the island was a second time occupied, February 1, 1857, and formally taken possession of on the 14th of the same month. Since that period fortifications have been erected on the island, under the guns of which all vessels have to pass that sail through the straits.

PERIMETER, the bounds or limits of any figure or body. The perimeters of surfaces or figures are lines, and those of bodies are surfaces. In circular figures, instead of perimeter, we say circumference or periphery.

PERIOD, in *Astronomy*, is the time occupied by a star or planet in making a revolution round the sun, or the

duration of its course till it return to the same part of its orbit. (See ASTRONOMY.)

PERIOD, in numbers, is applied to the recurring part of a circulating decimal.

PERIOECI (περίοικοι) is an old geographical term used to denote those who dwell under the same latitudes but under opposite longitudes, just as *antœci* (ἄντοικοι) meant those under the same longitude but opposite latitudes, and *antipodes* (ἀντίποδες) those under opposite latitudes and opposite longitudes.

PERIPATETICS (περιπατέω, *I walk about*), a term applied to the disciples of Aristotle, because he taught them while *walking* in the περίπατος, or promenade of the Lyceum at Athens. *Peripatetic* accordingly came to be equivalent to Aristotelian. (See ARISTOTLE, and ARISTOTELIAN PHILOSOPHY.)

PERIPHERY (περιφέρω, *I carry round*) signifies, according to the Greek use of the term, the circumference of a circle. It is usually applied, however, by the moderns both to rectilinear and to curvilinear figures.

PERIPHRASIS (περί, *about*, φράζω, *I speak*) signifies properly circumlocution, and is applied to that figure of rhetoric in which more words are used than are necessary to express the idea, with the design of avoiding common and trite modes of expression, and thus giving dignity and elevation to the discourse. The periphrasis is of great use on some occasions; and it is often necessary, to make things be conceived which it is not proper to name. It is sometimes polite to suppress the names, and only to intimate or allude to them. These turns of expression are also particularly serviceable in oratory; for the sublime admitting of no direct citations, there must be a compass taken to insinuate the authors whose authority is borrowed. A periphrasis, by turning round a proper name in order to make it understood, amplifies and raises the discourse; but care must be taken that it be not too much swelled nor extended *mal à propos*, in which case it becomes flat and languid.

PERIPNEUMONY (περί, *about*, πνεύμων, *the lungs*) signifies properly an inflammation of the substance of the lungs, as distinguished from pleurisy, or the inflammation of the membrane which invests the lungs.

PERISTALTIC (περιστέλλω, *I involve*) is an epithet given to a vermicular spontaneous motion of the intestines, performed by the contraction of the circular and longitudinal fibres of which the fleshy coats of the intestines are composed; by means of which the food, chyme, chyle, fæces, &c., are kept moving towards the termination of the alimentary canal.

PERISTYLE. See Glossary to ARCHITECTURE.

PERITONEUM (περιτόναιον, from περί, *about*, and τονόω, *I stretch*) is the fine membrane which lines the inside of the abdominal cavity, and envelopes every portion of the intestines. Inflammation of the peritoneum is called *peritonitis*.

PERJURY is defined by Sir Edward Coke to be a crime committed when a lawful oath is administered in some judicial proceeding, to a person who swears wilfully, absolutely, and falsely, in a matter which is material to the issue or point in question. In ancient times it was in some places punished with death; at other periods it made the false swearer liable to the punishment due to the crime which he had charged the innocent person withal; and at others, again, it subjected him to a pecuniary fine. But though it escaped human, yet it was thought, amongst the ancients in general, that the Divine vengeance would most certainly overtake it; and there are upon record many severe inflictions believed to be from the hand of God, as monuments of the abhorrence in which this atrocious crime is held by the Deity. (See OATHS.) Perjury is a misdemeanour at common law, and is punishable by fine and imprisonment, and by transportation for a period not exceeding seven years. Owing to the painful increase of perjury, all courts of justice, civil or criminal, down to petty sessions, are now empowered by stat. 14 and 15 Vict., c. 100, § 19, forthwith to commit and direct to be prosecuted any one appearing to them to be guilty of perjury.

PERIZONIUS, JACOB, a learned Dutchman, was born at Dam, in the province of Groningen, in 1651; studied at Deventer, and afterwards at Leyden. He applied himself with great ardour to philology and history; and in 1674 was appointed rector of the gymnasium at Delft. In 1681 he removed to the academy of Franeker as professor of eloquence and history, and accepted the chair of history, eloquence, and the Greek language in the university of Leyden. During his whole life he plied his pen with great industry in connection with his favourite pursuits. But his assiduous and uninterrupted labours at length undermined his health, which was naturally delicate, and after languishing for some time in a hopeless condition, he died at Leyden on the 6th of April 1715.

Perizonius, though a man of an amiable and obliging disposition, was nevertheless sensative, and fond of disputation. He engaged in several keen controversies, particularly with Ulric Huber, professor of law at Franeker, on the sense of a passage in the Epistle of St Paul to the Philippians; with Francius, professor of eloquence at Amsterdam; with James Gronovius on the death of Judas Iscariot; with John Leclerc, on the subject of Quintus Curtius; and with Kuster on the *æs grave* of the ancients.

The works of Perizonius all display erudition, but are deficient in order and method Besides good editions of various authors, he wrote *Animadversiones Historicæ*, Amsterdam, 1685, in 8vo; *Q. Curtius Rufus in integrum restitutus, vindicatus*, Leyden, 1703, in 8vo; *De Doctrinæ Studiis, nuper post depulsam barbariem diligentissime denuo cultis et desideratis, nunc vero rursus neglectis fere et contemptis*, Leyden, 1708, in 8vo; *Rerum per Europam sæculo XVI maxime gestarum Commentarii Historici*, ibid. 1710, in 8vo; *Origines Babylonicæ et Ægyptiacæ*, Leyden, 1711, 2 vols. 8vo,—a work full of curious and interesting remarks on the chronology of Egypt, in opposition to Marsham, Usher, Capell, Pezron, and some other chronologists; *Opuscula Minora, Orationes atque Dissertationes varii et præstantioris argumenti*, Leyden, 1740, 2 vols. 8vo, preceded by a Life of Perizonius, and a catalogue of the manuscripts which he bequeathed to the library of Leyden. Amongst the works edited by this able scholar may be mentioned the *History of Ælian*, 1701, in 2 vols. 8vo; and the *Minerva of Sanctius*, 1714, in 8vo.

PERLEBERG, a town of Prussia, in the government of Potsdam, on the Stepnitz, 73 miles N.W. of Berlin. It contains a Protestant church and chapel, courts of law, and public offices, as well as manufactories of cloth, chicory, and beer. A much-frequented market for flax is held here. Pop. 6438.

PERM, a government of Russia, lying partly in Europe and partly in Asia, between N. Lat. 56. 30. and 61. 30., E. Long. 53. 20. and 64. 10., and bounded on the N. by the governments of Vologda and Tobolsk, E. by that of Tobolsk, S. by that of Orenburg, and W. by that of Viatka; length from N.W. to S.E., 520 miles; breadth about 400; area, 129,100 square miles, being more than double that of England and Wales. It is divided into two parts by the Ural chain, which traverses it from N. to S., forming the boundary between Europe and Asia. Of these parts, the eastern or Asiatic is considerably the smaller. The mountains rise very gradually and almost imperceptibly; the loftiest summit in this government being that called Pavdinskoi Kamen, which is more than 6000 feet above the level of the sea. The principal pass across the Urals is that which leads from Perm by Kungur and Yekaterinenburg to Tobolsk. A large portion of the surface is occupied with mountains, which are for the most part wooded, the woods containing in many places extensive marshes. The eastern portion of Perm is watered by the Sosva, the Tura, and the Sceth, tributaries of the Tobol, which itself discharges its waters by the Obi into

the Arctic Ocean. The principal river W. of the Ural chain is the Kama, an affluent of the Volga, which flows in a winding course through the country from N. to S., and receives many smaller streams. There are also numerous lakes in the government, most of them lying in the eastern portion; and mineral springs exist at various places. The southern part of the government, on the European side, is generally fertile and well cultivated, but the other portions are better fitted for pasture than for agriculture; and a great part of the land is allowed to lie uncultivated. There were in 1849, 6,948,992 acres of arable land, 5,382,283 of meadow land, 53,818,205 of wood, and 2,181,887 of waste land, in the government. The quantity of corn of all kinds raised in the same year was 34,086,933 bushels, and that of potatoes, 922,184 bushels. The corn produced is not, however, sufficient for the supply of the inhabitants. Rye, barley, and oats are the chief kinds of grain; flax is also grown. In the forests, of which nearly a half belong to the Crown, the pine, the larch, and the lime are the chief trees; the oak, the elm, the cedar, and others abound in the south-eastern parts. The climate in the northern and in the mountainous regions is cold and rigorous; on the higher summits snow lies for a great part of the year. The forests of the country abound in game, and the rivers in fish. Fur-bearing animals are also numerous. Of domestic animals the government contained in 1849, 731,693 horses, 615,277 horned cattle, 889,437 sheep, 296,427 swine, and 40,164 goats. The chief riches of Perm are its minerals, which are extensively worked, and afford employment to a vast number of the inhabitants. Gold, silver, platinum, iron, copper, lead, together with salt, marble, loadstone, diamonds, and precious stones, are the principal produce of the mines. The timber of the forests is extensively used for fuel in working the mines. The following table exhibits the quantity of different metals obtained in 1855 from the principal mines belonging to the Crown in this government:—

	Gold. Lb. troy.	Copper. Cwt.	Iron. Cwt.	Platinum (1854.) troy weight.
Yekaterinenburg......	1346	...	59,311	...
Bogossloosk.	1760	6148	...	8 lb. 9 oz.
Perm	...	5352	...	...

The manufactures in the government are inconsiderable, except those immediately connected with the mines. Cloth, leather, soap, candles, glass, &c., are manufactured; and trade is actively carried on, not only on account of the facility of conveyance by the Kama and its tributaries, but on account of the numerous fairs that are held, many of them in the large towns. About three-fourths of the population are Russians, and the remainder are descended from the ancient inhabitants of this country, and various Tatar tribes. The religion of the vast majority is that of the Greek Church; there are, however, 78,204 Mohammedans, and 9422 heathens, besides small numbers of Protestants, Roman Catholics, and Jews. The governments of Perm and Kazan are under a single military governor. In regard to education, the country is in a low state; it is under the superintendence of the University of Kazan. Perm is divided into twelve circles, and contains 1,741,746 inhabitants.

PERM, the capital of the above government, stands on the right bank of the Kama, which here receives the small rivers Danilicha and Jagoshicha, 220 miles W. of Tobolsk, and 322 N.E. of Kazan. It is environed on three sides with thick woods; and is well and regularly built, chiefly of wood, having straight and broad streets. It is the seat of an archbishop; and contains nine churches, a convent, several schools of various kinds, and hospitals. There are here extensive foundries, and refining-works for copper and iron, which are obtained in abundance from the mines in the vicinity. Trade and navigation are actively carried on. Pop. (1851) 13,262.

PERNAGOA, a town of Brazil, province of Piauhy, stands on the E. side of a large lake of the same name, 250 miles S.S.W. of Oeiras. It is the seat of a justice of the peace; and contains a fine church. Some trade is carried on in tobacco grown in the vicinity, and in horses and mules. Pop. 4000.

PERNAMBUCO, a province of Brazil, lying between S. Lat. 7. and 11., W. Long. 34. 50. and 43., is bounded on the N. by the provinces of Ceara and Parahiba, N.W. and W. by that of Piauhy, S. by those of Bahia and Alagoas, and E. by the Atlantic; area, 61,633 square miles. It consists of two distinct regions, one lying near the coast, and the other on the table-land of the interior. The coast, which is fringed with coral reefs, is low and uninteresting, and the adjacent country level; but farther from the sea there is a succession of hills and dales, and still farther to the W. the ground becomes stony and sterile, as it rises into the table-land which is known by the name of the Serrao de Pernambuco. This region forms a part of the table-land of Brazil, and consists in a great part of salt steppes, though in some parts there are excellent pasture-lands and fields of cotton. The principal mountains in the province are those of Borborema, which form its northern and western boundary; and the most important river of the province, or of any other in Brazil belonging wholly to the country, is the San Francisco, the largest stream that falls into the Atlantic between the Amazon and the Plata. It only forms part of the southern boundary of Pernambuco; and the affluents it receives here are so few and insignificant that the country is in general very dry and sterile. Some gold is found here, and excellent marble might be quarried. The forests yield abundant supplies of timber of various kinds suitable for ship-building, for carpentry, and for ornament. Dye-woods are also obtained. The climate of Pernambuco is hot and moist in the interior, but more agreeable in the maritime district. The soil of the latter is in many parts rich and fertile, producing cotton, sugar, cocoa, maize, mandioc, and a variety of fruits, medicinal herbs, and vegetables. Manufactures can hardly be said to exist in Pernambuco; but there are sugar-works and distilleries. The trade of the province is considerable, and is chiefly carried on through the port of Pernambuco. The province appoints six senators and thirteen deputies to the legislature. Pop. (1856) 950,000.

PERNAMBUCO, the capital and principal seaport in the above province, stands on the Atlantic, at the mouth of the Capibaribe, 210 miles N.E. of Bahia; S. Lat. 8. 5., W. Long. 34. 52. It consists of the towns of Pernambuco proper, or Recife, and Olinda, which are about 3 miles distant from each other. (See OLINDA.) The former stands upon a flat, and is divided into three parts, occupying respectively a peninsula, an island, and the continent. Recife, or Pernambuco properly so called, is built upon a peninsula which extends to the southward of Olinda. This is the most mercantile part of the threefold city. S. Antonio stands upon an island or sand-bank formed by the arms of the Capibaribe, being connected with Recife by a long bridge almost entirely constructed of stone. The third division of the city is situated on the mainland, to the westward of the other two, and is joined to them by a wooden bridge, considered as the largest in Brazil. This portion of Pernambuco is called Boa Vista, where the richer inhabitants reside. The appearance of the country, when Pernambuco is approached by sea, is described as charming. The hills are clothed with wood, gradually rising towards the interior; but none of them is of any considerable height. Recife contains regular though narrow streets, and houses of brick, three or more storeys in height. Besides several churches, there stand here the custom-house and the residence of the port-admiral; but the most of the provincial authorities reside in S. Antonio, where

the streets are broad, and the houses large, the ground floors being generally occupied with shops. Among the public buildings here are the treasury, town-hall, prison, barracks, governor's palace, &c. There are several public squares, and the general appearance of this quarter is very lively. The principal street of Boa Vista is broad and handsome, and there are here many elegant buildings. A long embankment connects the sand-bank and town of S. Antonio with the mainland at Affogados, to the south and west of Boa Vista. The position of Pernambuco, on the most easterly point of South America, renders its harbour one of much importance; and the nature of the harbour is no less favourable for commercial purposes. It is formed by a singular reef, probably of coralline structure, which extends for 1500 miles along the Brazilian coast, from the province of Bahia to that of Maranhao. This remarkable reef at the top is scarcely sixteen feet in breadth. To a great depth on the outside it slopes off more rapidly than the Plymouth breakwater, but it is perpendicular within; thus forming a magnificent natural bulwark or breakwater, within which the ocean is as still as a mill-pond. In some parts it sinks under water, and there are numberless breaks, by which a communication with the sea is laid open. The harbour, which is well protected from the sea by the reef, has two deep and safe entrances; but there is a bar of sand within it, which, even at spring tides, does not admit vessels drawing more than 15 feet. This might, however, be removed by dredging. The anchorage is about half a mile in length, and of breadth sufficient to admit four rows of vessels. The harbour is defended by forts; and there is a lighthouse 80 feet high, visible to a distance of 16 or 17 miles. The commerce of Pernambuco is very important, the exports consisting chiefly of cotton, sugar, rum, hides, and dye-woods; and the imports, of cotton and linen cloth, hardware, cutlery, silks, wine, flour, cod, &c. The trade has been on the increase for some years. Pernambuco was much improved by the Dutch, who were in possession of it from 1630 to 1654. The population of the town is 12,000; of the district, 38,000.

PERNAU, a fortified seaport-town of European Russia, in the government of Livonia, stands on a flat sandy heath at the mouth of the Pernau, on the Gulf of Riga, 102 miles N.N.E. of Riga. It is well and regularly built; and contains two Lutheran and one Greek church, several schools, an orphan hospital and various other benevolent institutions. The harbour has a bar at its mouth, which obstructs the entrance of large vessels; but, notwithstanding, there is a considerable trade carried on in corn, flax, hemp, timber, leather, &c. From its low situation, it is exposed to inundation. Many remains of antiquity have been discovered in the neighbourhood of Pernau. Pop. (1849) 5740.

PÉRONNE, a town of France, in the department of Somme, on the slope of a hill in the midst of marshes, on the right bank of the Somme, 30 miles E. of Amiens. It is strongly fortified, and has a ruined castle, in one of whose towers Charles the Simple died in captivity, and Louis IX. was imprisoned by Charles the Bold of Burgundy. There are two suburbs; and the houses are well built. The chief buildings are the church of St John (a fine Gothic edifice), an ancient belfry, a town-hall, convent, hospital, theatre, and college. Manufactures of woollen and cotton stuffs, lawn, cambric, leather, sugar, and other articles are carried on here; and there is some trade in grain, wool, and brandy. Péronne was a place of much importance in the middle ages, and bore the name of *La Pucelle* ("The Maiden City"), as it was never captured till Wellington took it eight days after the battle of Waterloo. Pop. (1856) 4102.

PERORATION (*peroro*, I wind up a speech) is the concluding portion of an oration, in which all that the orator had insisted on throughout his discourse is urged afresh with greater vehemence and passion. The peroration consists of two parts; the recapitulation, in which the substance of what was diffused throughout the speech is briefly collected, and summed up with new force and weight; and the appeal to the passions, which is so peculiar to the peroration that the masters of the art call this portion *sedes affectuum*.

PÉROUSE, Jean-François Galaup de la, a distinguished French navigator of the eighteenth century, was born in 1741 at Albi, in the department of Tarn. After passing through the marine school, he entered the navy; and in 1756 was made a midshipman. Three years later, he took part in the battle of Belleisle, was wounded, taken prisoner, and carried to England, where he was detained till the peace of 1763 set him free. On returning to France, he rose through the various grades of promotion, served in the East Indies from 1773 to 1777, and when war again broke out with England in 1778, he signalized himself by several brilliant exploits. In 1782 he was sent to destroy the English settlements on the shores of Hudson's Bay. He took and destroyed Fort York, which he found undefended. Hearing that some of the garrison had fled into the woods, and were in danger of perishing from cold and hunger, or at the hands of the savages, he humanely left a supply of arms and provisions for their use. The only things of value that La Pérouse found in the fort were the papers of the governor, which, when claimed as private property, he promptly restored. When peace was restored in 1783, the French, taking up the idea of maritime discovery from their late rivals, fitted out an expedition to the Pacific. The chief command of the squadron (which consisted of two frigates, Boussole and Astrolabe) was given to La Pérouse. Setting sail from Brest on the 1st of August 1785, he doubled Cape Horn, coasted along the shores of South America, turned aside to the Sandwich Islands, and setting sail thence, spent the autumn of 1786 in exploring the coasts of Upper California. He then steered across the ocean to China; discovering Necker Island on the way, and examined the almost unknown coasts of Eastern Asia as far as Avatcha in Kamschatka, where the orders of the Russian empress procured him a kindly welcome. From this point he despatched his comrade De Lesseps overland to France with his diaries, maps, plans, &c. Leaving Avatcha towards the end of 1787, La Pérouse turned his prow to the Navigator Islands, where he lost an officer and twelve men in an encounter with the natives. To refit in peace, he next sailed to Botany Bay, where the English were then establishing their first Australian colony. Here he brought down the narrative of his travels to the latest date, and transmitted it to Europe, with a letter, in which he gave a short sketch of his plans for the future. From this time he was never again heard of. Various expeditions were sent out in quest of him, but without effect. His fate was involved in mystery till the year 1826, when an English seaman, Captain Dillon, came upon the wrecks of his squadron in the island of Wanikoro (or, as it is called by the French, Ile de la Recherche), one of the Queen Charlotte Islands. The relics, consisting of cannons, anchors, &c., were brought home, and deposited in the national galleries of the Louvre, where they are now preserved. La Pérouse's journals and letters were published at Paris in 1797, in 4 vols. 4to.

PERPENDICULAR. See Geometry.

PERPIGNAN, a town of France, capital of the department of Pyrenées-Orientales, stands, partly on the slope of a hill, and partly in a level plain, on the right banks of the Tet, at its confluence with the Basse, about 6 miles above its mouth, and 80 miles S.W. of Montpellier. It guards the passage between Spain and France by the Eastern Pyrenees, and is now one of the most strongly fortified places in France, the defences having been much improved since 1815. In form it is nearly oval, being

about 2 miles in length by 1 in breadth. The defences consist of a strong citadel, standing on the hill to the S. of the town, and separated from it by a wide glacis; by ramparts, bastions, redoubts, covered ways, &c. The inner ramparts of the citadel were erected by the Emperor Charles V., and the outer ones by Vauban. As the province of Roussillon, of which Perpignan was the capital, belonged to Spain till its cession to France in 1659, it is not to be wondered that the town retains much of its Spanish character, and its inhabitants greatly resemble those of Catalonia, on the other side of the mountains. The streets, which are narrow and dirty, are in many parts covered over with awnings, and in others with the wooden balconies of the houses. These are almost all built in the Moorish style, and have *patios*, or inner courts. In the citadel are an old square tower, and the remains of a church with a curious portal. The cathedral, which was begun in 1324, consists of a wide and lofty nave; and contains a beautifully-carved altar screen, and an ancient marble font. Near this building are the ruins of the older church of St Jean le Vieux. The buildings of the ancient university contain the public library of 20,000 volumes; and the Dominican church and convent are now used as an arsenal. Besides the buildings already mentioned, there are a town-hall, court-house, barracks, custom-house, theatre, college, diocesan school, botanic gardens, and two hospitals. Woollen stuffs, lace, playing-cards, soap, brandy, and leather are the principal articles manufactured; and a considerable trade is carried on in wines, brandy, oil, silk, wool, iron, cork, &c. Perpignan is the seat of a bishop, and of courts of the first instance and of commerce. In the year 1349, when Roussillon belonged to the crown of Aragon, the university of Perpignan was founded by King Pedro. In 1474 the town was taken by Louis XI. of France; but having been restored to Spain, it was again taken by Louis XIII. in 1642; and, along with the province of Roussillon, finally ceded to France by the treaty of the Pyrenees in 1659. Pop. (1856) 19,844.

PERRAULT, Charles, was born at Paris on the 12th of January 1628, and studied at the college of Beauvais, where he distinguished himself in scholastic disputation, and in making verses. Having completed his studies, he was admitted as advocate; but Colbert soon deprived the law of his services, and, in the year 1664, appointed him first commissary for the superintendence of royal buildings. The Academy of Painting, Sculpture, and Architecture, and that of Sciences, were founded on memoirs drawn up by Charles Perrault, who had now become comptroller-general of buildings; and he was admitted into the French Academy in 1671, in the room of the Bishop of Léon. But the impracticable character of Colbert having at length wearied out his patience, he retired from his public situation, and, devoting himself to literature, produced his poem entitled *Siècle de Louis XIV.*, which appeared in 1687, and involved him in a war with the learned, by reason of his exalting the modern in comparison with the ancient authors. He defended himself, however, in the *Parallèle des Anciens et Modernes*, which appeared at Paris in 1688, and excited the antagonism of Boileau in his *Reflexions sur Longin*. In addition to the works just mentioned, Charles Perrault wrote a considerable number of poetical pieces now all but forgotten. Perrault died at Paris on the 16th of May 1703. His son Perrault d'Armacourt was the author of the well-known *Contes de Fées*, which contain the nursery classics of "Cinderella," &c.

Perrault, *Claude*, a celebrated architect, the brother of Charles, was born at Paris in the year 1613. His father, an advocate of the Parliament, caused him to study medicine, anatomy, and the mathematics; and he even took the degree of Doctor of Physic in the faculty of Paris. But Colbert having advised him to undertake a translation of Vitruvius, the studies in which he found it necessary to engage in order to understand that writer inspired him with a decided taste for architecture, and gave a new direction to his pursuits. When the Academy of Sciences was established in 1666, Perrault was admitted a member of this body, and was employed to furnish designs and building-plans for the Observatory. But this edifice, which, with all its merits, is in a heavy style, was far from giving any indication of the talents which Perrault afterwards displayed. His grand work is the palace of the Louvre, the façade of which was designed by him, and is certainly one of the noblest monuments of architecture in France. The building had been commenced, and even part of the façade raised, according to the designs of Lavau. But Colbert, dissatisfied with these, appealed to the genius of other architects; and Perrault produced a design so superior to those of his competitors that it obtained a decided preference. Perrault furnished designs for other works, particularly the triumphal arch erected at the extremity of the Rue Saint-Antoine, the foundation-stone of which was laid on the 6th of August 1670; and in all his works he displayed that superiority of genius which was first exhibited in his translation of Vitruvius, particularly in the plates with which it was enriched, and which have ever been considered as masterpieces of their kind. The first edition of this work appeared in 1673, and the second in 1684, in 1 vol. fol.; after which the translator published an abridgment in 1 vol. 12mo; and a supplement, entitled *Ordonnances des Cinq Espèces de Colonnes selon la Méthode des Anciens*, in 1 vol. fol. Of his other productions the principal are,—*Essais de Physique*, 1680–8, 2 vols. 4to, and 4 vols. 12mo; *Mémoires pour servir à l'Histoire Naturelle des Animaux*, Paris, 1671–6, in folio; *Recueil d'un grand Nombre des Machines de son Invention*, Paris, 1700, in 1 vol. 4to. Claude Perrault assisted his brother Charles in preparing the memoirs relating to the establishment of the Academy of Sciences, and that of painting and sculpture, and took a warm interest in the success of that institution. He died at Paris on the 9th of October 1688, in consequence, it is believed, of having wounded himself whilst dissecting, in the Jardin du Roi, a camel which had died of some contagious disease.

PERROT D'ABLANCOURT, Nicolas, a French translator, was born at Chalons-sur-Marne in 1606, and was called to the French bar at the age of eighteen. His disposition seems to have been impulsive and changeable. He grew tired of law in a short time, and betook himself to literature. He became fastidious about religion, and passed from Protestantism to Popery, and from Popery back to Protestantism. Nor was he less undecided as to his place of abode. He retired from Paris to Holland, left Holland to sojourn in England, returned from England to Paris, and ultimately fixed his residence at his family seat of Ablancourt. Yet, in the meantime, Perrot was steadily engaged in translating Tacitus, Thucydides, Cæsar, Lucian, Minutius Felix, the *Anabasis* of Xenophon, four Orations of Cicero, Arrian's *Wars of Alexander*, Frontinus' *Strategematica*, and the *Apophthegms* of the ancients. These translations were appreciated on their first appearance for the elegance and happy freedom with which they gave the sense of the originals. They were, however, deficient in correctness, a fault which has long since led to their complete neglect. The death of Perrot happened in 1664.

PERRY, James, an eminent newspaper editor, was born in Aberdeen in 1756, and was educated at Marischal College in his native town. His settlement in life was attended with considerable difficulty. He had scarcely begun to study law when the pecuniary misfortunes of his father threw him loose upon the world. His application for a

clerkship in Edinburgh was unsuccessful. He indeed obtained a situation in the counting-house of a Manchester merchant; but he left it at the end of two years to repair to London as a literary adventurer. Thither his ill-luck likewise followed him. It was not until many days had passed that an accident made known his literary abilities, and procured for him the situation of a stipendiary writer both to the *General Advertiser* and to the *London Evening Post*. Perry now entered upon a successful career in newspaper literature. In 1782 his skill in the profession had become so great that he was able to start and conduct a periodical called *The European Magazine*. Appointed editor of *The Gazetteer* in the following year, he conferred a great service upon the journalism of the country by introducing the custom of employing in the reporting of any public speech a series of reporters instead of one. His success at length attained its height when he became editor and joint-proprietor of the *Morning Chronicle*. He continued in that position till his death on the 6th December 1821. Perry was the author of several ephemeral pamphlets and poems.

PERRY, a pleasant and wholesome liquor extracted from pears in the same manner as cider is from apples. (See CIDER.)

PERSÆUS, a philosopher who flourished about 260 B.C., is famous for his connection with the Stoic Zeno. He was born in the same Cretan town, Cittium; settled in the same city, Athens; lived in the same house; and adopted the same opinions. So highly indeed did the teacher of the Porch favour him that, when unable through old age to accept an invitation to the court of Antigonus Gonatus, he sent him in his stead. This honour is said to have been the occasion of the death of Persæus. Appointed by his royal patron to the command of Corinth, he was slain at the capture of that city in 243 B.C.

PERSEPOLIS, an ancient city of Persia, stood near the confluence of the Medus and the Araxes, on the spacious plain now called *Merdusht*. It was one of the wonders of the East. According to Arrian and other writers, it was from the most ancient times the capital of the Persian empire. At any rate, it is almost certain that in the reign of Darius Hystaspes it began to assume an unparalleled splendour, by becoming the site of a magnificent pile of architecture. To afford a foundation for this huge fabric, there was cut out from the side of a neighbouring hill, at a great distance from the ground, an immense platform in the shape of a series of terraces. These terraces were covered with sculptured porticoes, gigantic statues, and colossal temples and palaces. Each Persian king in succession extended and enriched the magnificent structure, until it became the crown and glory of the East. The splendour of Persepolis, however, seems to have begun to decline at the time of the overthrow of the Persian empire. Alexander the Great burned a considerable part of it, including its royal palace. After the date at which, according to the Second Book of Maccabees, Antiochus Epiphanes attempted to plunder its temples, it disappears altogether from the page of history. Yet the tall white forms of several columns, standing sentinel over the remains of many temples and palaces on the solitary plain of Merdusht, still preserve the memory of the long-perished glories of Persepolis. (A full account of these magnificent ruins is given in Sir R. K. Porter's *Travels*, Vaux's *Nineveh and Persepolis*, and Fergusson's *Palaces of Nineveh and Persepolis Restored*. See also PERSIA.)

PERSEUS, the son of Jupiter and Danäe, and the grandson of Acrisius, King of Argos, was renowned in classical fable for his wonderful adventures. No sooner had he come into the world than he was doomed to face difficulty and danger. His nervous old grandfather, terrified by a prediction of the Pythian oracle, placed him and his mother into a chest, and sent them adrift down the Argolic Gulf. The wind wafted them across the Myrtoan Sea to the island of Seriphos, and they fell into the hands of Polydectes, the selfish king of the country. At the court of that prince Perseus lived until he had grown up to be a brave and godlike young man. Then his royal patron, overawed by his superior presence, and anxious to get rid of him, commanded him to set out and bring home the head of the dreaded Gorgon Medusa. To this dangerous enterprise the youth set himself with eager alacrity. His first measure was to repair to the house of the Graiæ, —three old prophetic crones, who had only one tooth and one eye for their common use. Coming upon them unawares, and snatching their eye and tooth, he compelled them, on pain of never recovering their precious organs, to mumble out where he would get the equipment necessary for his expedition. By their direction he found the dwelling of certain nymphs, and was there supplied with winged shoes to carry him through the air, and with the helmet of Hades to render him invisible. Minerva added a mirror; and the youthful hero was now ready to dare the perilous exploit. Speeding westward through the clouds, he alighted in the country of the Gorgons, a land situated on the shore of the solitary ocean, and near the abode of eternal Night. He stepped slowly forward, averting his head lest the sight of the monsters should turn him into stone, and using the mirror to ascertain what was in front of him. Suddenly there appeared in the glass the sleeping forms of the three dread Gorgons, with their snaky locks, golden wings, and brazen hands. He struck off the head of Medusa, seized it in his hand, and sped away through the air, pursued in vain by the two remaining sisters. Another adventure awaited Perseus on his flight homewards. After turning, by means of the wonder-working head, the inhospitable Atlas into a mountain, he was passing over Ethiopia when, looking down, he saw Andromeda, the lovely daughter of King Cepheus chained to a rock, and ready to be devoured by a sea-monster. He descended, slew the monster, and won the heart and hand of the liberated maiden. The remaining days of Perseus were not so eventful. After presenting the Gorgon's head to Minerva, he is said to have settled down for life as king of Tiryns, and to have occupied himself in founding the cities of Midea and Mycenæ.

PERSEUS, the last king of Macedonia, succeeded his father Philip V. in 179 B.C., was dethroned by the Romans in 167 B.C., and died in captivity at Alba not long afterwards. (See MACEDONIA.)

PERSHORE, a market-town of England, county of Worcester, in a beautiful situation on the right bank of the Avon, here crossed by a bridge, 10 miles S.E. of Worcester, and 102 W.N.W. of London. It is well built, and consists principally of one long street. The church of Holy Cross, a fine remnant of the ancient abbey church, has a transept and a high square tower of Norman architecture; while the chancel, now used for worship, is in the early English style. There is also a small old church of St Andrew, and places of worship belonging to Baptists, Wesleyan Methodists, and Mormons. National and infant schools, and a mechanics' institution, exist here. A county court is held; and there is an annual fair held on the 26th of June. Some of the people are employed in making stockings; and a retail trade is carried on. Pop. (1851) 2717.

PERSIA.

Persia. Of the countries which have been the ancient seats of mankind, not one is more famous than Persia; and late linguistic and ethnological discoveries have revived and strengthened the interest attaching to a region which, with Assyria, Armenia, Arabia, and Egypt, supplies the most ancient records of the human race. The boundaries of Persia have fluctuated more than those of any other kingdom in the world, from the period when its monarchs rose from the government of a province to all but universal empire, down to the time when they again sank into insignificance as the rulers of a second-rate Asiatic state. In illustration of this remark, the limits of the country will be noticed under three epochs,—viz., previous to the accession of Cyrus, under Darius Hystaspes, and as they now exist. In the first-mentioned period Persia nearly coincided with the modern province of Fârs.[1] It was bounded on the W. by the Persian Gulf and Susiana, or by the Gulf, and a line drawn from a little to the northward of the point where the 30th degree of N. Lat. and 50th of E. Long. intersect each other, to the S. borders of Media; on the N. by Media, which came down to the 32d degree of N. Lat; on the E. by Carmania (*Karmán*),—that is, by a crescent-shaped line from the 32d parallel and the 55th degree of E. Long., to the coast opposite the isle of Kishm in the 27th parallel; and on the S. by the Persian Gulf. Ancient Persia, then, properly so called, did not exceed 300 miles in length from N. to S., and 230 in breadth from E. to W. In the reign of Darius Hystaspes the empire had been so vastly extended that it contained all the countries between the Indus and Sir rivers, the Aral, Caspian, Black, and Ægean seas, the Mediterranean, Red Sea, and Persian Gulf, and in addition, Thrace and Egypt, with part of Libya. It must be noted, however, that the original Persia, with probably somewhat increased dimensions, was still reckoned a distinct province; for it is specially mentioned as exempt from tribute, which the rest of the empire, divided into twenty satrapies or subordinate kingdoms, was compelled to pay to the amount of 14,560 talents, or about three and a half millions of our money.[2] In the inscriptions at Behistun, Persepolis, and Naksh-i-Rustam, lists of the provinces are given, of which it will be sufficient to mention the Behistun list. It is as follows:—Persia, Susiana, Babylonia, Assyria, Arabia, Egypt, Saparda, Ionia, Media, Armenia, Cappadocia, Parthia, Zarangia, Aria, Chorasmia, Bactria, Sogdiana, Gandaria, Sacia, Sattagydia, Arachosia, Media. The Persia of the present day is bounded on the S. by the Indian Ocean and the Persian Gulf; on the W. by a line drawn from the 30th parallel along the left bank of the Shatu'l-'Arab to Muhammarah, and thence along the Kabír Kúh, or "Great Mountain," a part of the Zagros range, which forms the western boundary of Lúristân; thence, by a curving line which passes about 15 miles to the N.N.W. of Kizil Robât; and then, running 20 miles to the W. of Lake Urumiyah, touches Mount Ararat a few miles to the E. of Baiyazíd. The northern boundary is the River Aras, from Mount Ararat to within 60 miles of the Caspian Sea; thence a waving line which touches the Caspian 5 miles to the N. of Astara, in Lat. 33. 40.; and finally the Caspian Sea and the desert of Khíva from Kasan Kulí to Sharakhs. On the E., Persia is bounded by a line drawn along the 61st degree of E. Long., from Sharakhs to the 33d parallel, when the frontier curves in to the W. to about 100 miles, and returns in an easterly direction along the mountains which form the eastern boundary of Karmân, finally curving back to the W. until it meets the Indian Ocean 10 miles to the E. of Cape Jask, in Long. 58. 5.

Aspect of the country. With the exception of the provinces of Mazandarún and Gílân, and other parts of less extent, the general aspect of Persia is that of poverty and barrenness. It has been termed a country of mountains; and a large portion of its surface is certainly mountainous, diversified with extensive tracts of desert plains, in which salt is the chief production, and, in small proportion, chiefly along the banks of the rivers, with beautiful valleys and rich pasture-lands. The valleys are not generally broad, but some are of great length, being often more than a hundred miles. The greater part of the country may be described as a table-land, supported on every side by high mountains. This table-land is shut in on the W. by the lofty mountain chain of Zagros; on the N. by that of Alburj (*Elburz*), or "The Tower,"[3] which cuts off from it the provinces of Gílân, Mazandarún and Astarâbâd; and on the S. by a lower range of hills, which runs parallel to the Persian Gulf and the Indian Ocean, at a distance of from 50 to 150 miles all the way from Abúshahr (*Bushire*) to Karâchí. On the E. alone there is no continuous chain of hills until the Sulaimân and Hâla mountains are reached, in the countries bordering on the Indus; and the line of demarcation in that direction, between Persia, Afghânistán, and Bilúchistán, is not well defined. The average elevation of this plateau is nearly that of Tehrân, or 4000 feet, and seldom sinks to 3000 feet, which is the elevation conjecturally assigned to it by Fraser. Two-thirds of this table-land are said to be desert.[4] There are no rivers of any magnitude; and what streams there are, the majority of them at least, lose themselves in the sands. From Káshân, in Lat. 34., E. Long. 51. 20., the Great Salt Desert extends eastward 400 miles to Lake Zarah in Sístân, and 250 miles from Karmân northwards to Mazandarún. The sandy desert of Sigistân is of about the same extent.[5]

The aspect of the Persian mountains is peculiarly bare and forbidding, rising abruptly from the plain, and presenting nothing to the eye but huge masses of gray rock piled upon each other; and even when they are covered with a little mouldering rock, they are still without either wood or shrubs. If for about two months in spring a scanty verdure clothe their sides, it is scorched by the heat of summer, and the country soon resumes its former barren aspect, and dreary, monotonous, reddish-brown colour.[6] Nor is the appearance of the plains more inviting, consisting for the most part of gravel washed down from the mountains, or of other equally unproductive matter, in deep and extensive beds, or of a hard clay, which, where water is wanting, as in most parts of Persia, is bare and barren. "The livery of the whole land," says Fraser, "is constantly brown or gray, except during the two months of April and May." Amongst other disadvantages, Persia labours under a general scarcity of water. The rivers are few and small, and rivulets by no means common, so that irrigation can only be applied to a small portion of the land. "In the best districts," says the above-mentioned traveller, "the small proportion of cultivated land resembles an oasis in the desert, serving by contrast to make all around it more

[1] Rawlinson's *Herodotus*, vol i., p. 575.
[2] *Herodotus*, book iii., ch. 89–98.
[3] Ferrier's *Caravan Journeys*, p. 54.
[4] Chesney's *Expedition*, vol. i., p. 78.
[5] Kinneir's *Geographical Memoir of the Persian Empire*, pp. 20 and 22.
[6] Chesney's *Expedition*, vol. i., p. 79.

Persia.

dreary. Plains and mountains are equally destitute of wood: the only trees to be seen are in the gardens of villages or on the banks of streams, where they are planted for the purpose of affording the little timber that is used in building: they chiefly consist of fruit trees, the noble chinar or oriental plane, the tall poplar, and the cypress; and the effect which a garden of these trees produces, spotting with its dark green the gray and dusky plain, is rather melancholy than cheering."[1]

As already mentioned, the provinces of Mazandarún and Gilân, adjoining the Caspian Sea, with parts of Azarbíján, form exceptions to this general description. These provinces are divided from the high table-land of Persia by the great range of the Alburj Mountains, which are connected with the mountains of Armenia, and with the mighty Caucasus chain, and eastward by a continuous chain, with the great ridge of the Hindú Kúh. They take an easterly course along the shore of the Caspian Sea, and send various ramifications southward; whilst other elevated ridges spring from the Caucasian Mountains, and penetrate the country in a S.E. direction, dividing the provinces of 'Irâk and Khuzistán, and extending along the shores of the Persian Gulf, and with other parallel chains farther in the interior, into the province of Makrân. The Caucasian chain forms the barrier between the empires of Turkey and Persia; it occupies the space between the Black Sea and the Caspian; and it is inhabited by barbarous tribes, who owned at any time but an imperfect allegiance to Persia, and who have been now brought chiefly under the more rigorous sway of Russia. The Alburj Mountains, whose average height is from 6000 to 8000 feet, present their loftiest face to the interior desert; yet they sweep down in a manner so gradual, that the valleys and ravines which they form are found to contain rich and fertile lands, well watered by numerous rivulets, and well cultivated and peopled. The loftiest peak of this range is Mount Demawend, which rises to the height of 15,000 feet[2], and is covered with perpetual snow; while the rest of the range is covered only from November until Midsummer. Fifty-five miles S. and by E. of the peak of Demawend, according to Ferrier,[3] is that remarkable pass, forming a strong barrier against the progress of an invader, which was denominated by the ancients the Caspian Gates, now called the Pass of Sardârí, which for 28 miles was said to be a narrow road between high rocks, through which a single chariot could scarcely pass, and where a handful of men might oppose the advance of an army. The districts at the southern base of the Alburj range are beautifully diversified with wood, water, and mountains, in their most varied forms, and present a luxuriant verdure all the year round. In the slope of the mountains opposite to Tehrân is the delightful tract of Shamirún[4] (or Sham'a-i-'Irún, "The Light of Persia"), about 20 miles in length, "containing nearly forty villages, clustered together amid gardens and groves, with streams of water from the heights above," to which all the inhabitants of Tehrân, who can afford it, resort in summer. On the northern side of these mountains, the provinces of Mazandarún and Gílán, and the district of Astarábád, are equally fruitful and productive. Mazandarún is most celebrated for its culture of rice, which is of very superior quality. In the central provinces of Fárs, 'Irák, and Khurásán, the valleys are generally level; in Azarbíján, to the W. of the Caspian Sea, they lie between a succession of eminences; and Kurdistán, to the N., is almost one immense cluster of small mountains, intersected occasionally by loftier ranges, on which extend table-lands of great elevation, and subject to extreme cold, as in other parts of Persia.[5] The mountain range which commences near Shíráz, approaches close to the sea in Long. 55., and at Cape Jask has an elevation of 5000 feet. It decreases in height as it runs eastwards. The salt deserts which occur in various parts of the country form one of the most striking objects in its scenery, and may be distinguished from the general dreariness of the country by a saline efflorescence, which is seen glistening in the rays of a fierce sun. This appearance, extending over an immense plain, varied by a black rock here and there protruding from its surface, its image contorted into a thousand wild and varying shapes by the effect of the mirage, which produces the most curious optical illusions on those wide extended level tracts, is a sure indication of the total desolation which reigns around. The Great Salt Desert, between Káshân and Tabbas, is the most remarkable of these tracts, and occupies a vast space in the centre of the country. It forms a long inlet between the district of Tehrân on the N., and Kúm on the S., commencing about E. Long. 50., and on the 33d parallel, and trenching on the districts of Káshân and Isfahân, expands after the 53d degree of E. Long. to a vast breadth, as far E. as Tabbas, and on the S. insulating Yezd. On the N.E. it extends as far as Turshíz, but with somewhat more frequent interruptions; and on the E. it is encroached on by projections from the more cultivated districts of Farah, Sabzâwâr, and Hírât. The appearance of these deserts is not altogether uniform. In some places the surface is dry, and produces plants which thrive in a salt soil; in others the saline efflorescence is seen on a crackling crust of dry earth; marshes occupy a considerable portion of this country; and there is accumulated in the winter months water, which is evaporated during the heats of summer, leaving a quantity of salt in cakes upon a bed of mud. In some places the soil is a perfectly hard-baked and barren clay; and in others, again, sand abounds, which is formed into hillocks in the shape of waves by the wind, and is so light and impalpable that it is blown aloft in clouds, as in the Arabian deserts, by the violent N.W. winds which prevail in summer, and proves dangerous, and frequently fatal to travellers.[6]

Rivers.

Persia has hardly a single river that can be termed navigable, for the Euphrates and Tigris cannot be considered as running within its territory. The Kárún, which flows into the Euphrates through the province of Khuzistán, and the Aras or Araxes in Azarbíján, which flows into the Black Sea, and the *Safíd Rúd* or White River, which falls into the Caspian, are its two largest rivers. The Kárún is the largest affluent received by the Tigris in Mesopotamia, and is formed of two streams. Of these, the Dizful rises in Lat. 33. 50., and after a course of upwards of 200 miles joins the Kárún in about Lat. 31. 40. The Kárún rises in the Yellow Mountains, part of the Bakhtiyárí range, in Lat. 32., Long. 51., near the river of Isfahân;[7] and after emerging from the hills, flows to Shustar, where it is made by a canal to pass E. and W. of the town. From the point where these streams re-unite the Kárún is a noble river, exceeding in size the Tigris or Euphrates, and is navigable for steamers. Its course hence, for upwards of 150 miles, is very tortuous, and it then falls into the Shatu'l-'Arab near Muhammarah. Its total course, reckoning from the source of the Dizful branch, is 430 miles; or from the source of the Kárún about 330. The Aras rises in N. Lat. 40. 40., E. Long. 42. 40.,[8] and flows almost due S. to Long. 44., when it turns E., until near Eriván it again

[1] Fraser's *Narrative of a Journey into Khorassan*, p. 163.
[2] Binning's *Two Years' Travel in Persia*, vol. ii., p. 227. 14,700 according to Ainsworth, *Geo. Jour.*, vol. viii., part i., p. 112.
[3] *Caravan Journeys*, p. 59.
[4] Binning, vol. ii., pp. 230, 231; and vol. i., p. 157, note.
[5] Sir J. Malcolm's *History of Persia*, vol., i., p. 5.
[6] Fraser's *Narrative*, &c., chap. xi.
[7] *Geo. Jour.*, vol. xvi., p 50.
[8] Chesney's *Euphrates Expedition*, vol. i., p. 10.

Persia.

turns S., after receiving the waters of Lake Sivan. In Long. 46. it again turns E., until in Long. 48. 40. it unites with the Kúr at Jasat. Its total course is about 750 miles. The Safíd Rúd rises in Ardelán, in N. Lat. 35. 45., E. Long. 46. 45., and flows in a N.E. direction, but with a great sweep to N.W., between Long. 48. and 49. 15., into the Caspian. Its total course is 490 miles. The Helmand cannot with any propriety be termed a Persian river, as it flows eastward of Persia, through the independent territory of Afghânistân.

The principal Persian lake is Lake Urumiyah. This lake is 80 miles in length from N. to S., and 20 miles in breadth. Its chief feeders are the rivers Aji Su, or River of Tabríz, and the Jagetu and Tatau. The Aji Su rises in N. Lat. 38. 10., E. Long. 47. 45., and after leaving the city of Tabriz, 5 miles off on its left bank, enters the Urumiyah Lake in Lat. 37. 48., Long. 45. 40. Its total course is about 180 miles. The Jagetu has a total course of 140 miles. It rises in Lat. 35. 40., Long. 46. 30., and enters the lake in Lat. 37. 13., Long. 45. 52 The course of the Tatau is about 90 miles. The greatest depth of the Urumiyah Lake is 24 feet, but the average is not more than 12. It stretches from N. Lat. 37. 5. to 38. 15., and lies 4300 feet above the sea-level. Ten miles to the W. of it is a town of the same name, the birth-place of Zartasht or Zoroaster. It contains 25,000 inhabitants, of whom 22,000 are Muhammadans, and the rest Jews and Nestorians. Several mounds of nearly 100 feet high, composed of ashes, show where the great altars were situated. The lake is now fast drying up, and around it for several miles are tracts of sparkling salt. The waters of the lake are intensely salt, and so heavy that the strongest wind has little effect upon them. If stirred by a tempest, they subside almost immediately when a lull takes place. The whole of Kurdistân is supplied with salt from this lake.

Soil and products.

The nature of the soil in Persia may be inferred from the description given by travellers of the aspect of the country. Yet it is extraordinary how vegetation thrives in the country, even with the rudest cultivation, whenever there is the smallest supply of moisture. Morier mentions that in the plain of Abúshahr (*Bushire*), which stretches into the interior from the Persian Gulf, which all travellers agree in calling a barren land, and which has no other moisture than the dews, and occasionally winter showers, the seed produces one hundred to seven; and that a sprinkling of seed, with the most superficial furrows, returns everywhere in this district abundant produce. The same traveller observed, in his journey from Tehrân to Tabríz, several spots where, by the aid of water, the country was one carpet of verdure. Water in Persia is so essential to vegetation, that almost the only species of improvement which is carried on is the construction of subterranean canals, for the purpose of conveying water to lands which are destitute of any natural supply. These canals, when they are finished, are often let at high rents. Fraser mentions one small stream which brought an annual rent of 4000 rupees, equal (the Persian rupee being valued at 1s. 4½d.) to L.375; and another canal, opened by the governor of Kázárún, and employed in irrigating a fruit-garden, was rented at five or six times that sum. The products of Persia are,—wheat of the finest quality, barley, and other grains. Rice might easily be produced in the southern provinces, were it not for the deficiency of water, of which this grain requires so large a supply. The vine flourishes in several provinces; and the wine of Shíráz has often been highly celebrated, as well as the wines produced from grapes raised upon the side of the Caucasian Mountains. The vines of Shíráz are trained as standard bushes, without any support, and are set, with some attention to regularity, from eight to ten feet asunder. The mulberry is produced in great abundance in the northern provinces of Mazandarún and Gílân, of which silk is one of the great staples, and also in other parts; and the rich and well-watered plains of Gílân and Mazandarún yield in abundance the sugar-cane, though the art of refining is not understood in this rude and semi-barbarous country. Amongst the other products of Persia which, being useful, are articles of trade, are,—gum tragacanth; assafœtida, the plant of which grows in abundance on the plains and hills near Turshíz[1] and all round the city of Hírát; yellow berries; saffron; henna, but not so fine as that of Egypt; madder roots, which grow wild upon the mountains, and are brought down for sale by the Iláts and other wandering tribes. Gazanjubín[2] ("manna") abounds in the province of Karmânshâh. It is a deposit by a green fly on the back of the leaf of the dwarf oak. The Persians mix it with flour and sugar, and make it into cakes, which are exported to all parts of Asia. In the district of Turbat Ishâk Khân, S.W. of Mahmúdâbâd in Khurâsân, opium and tobacco are produced.[3] Indigo is cultivated in Láristân, but is not so fine as the indigo of India, which is largely imported into Persia. The leaf is used for dyeing the beard, a curious fashion in Persia, as in other parts of the East. Cotton is produced to supply the internal consumption; also hemp and hops. Fruits are produced in the garden-grounds in great abundance and perfection. The date is one of the most important products, being used here, where the climate is extremely hot, as an article of food, in the same manner as in other parts of the East. Those produced at Dáláki, four stages N.E. of Abúshahr, in the province of Fárs, are celebrated over the country for richness and flavour. The other fruits are,—pomegranates, a luscious fruit here, and much superior to those which are produced in Turkey, some that Morier saw being twelve inches in circumference; sweet and water melons; the shaddock; limes; oranges, for which the climate of the high table-lands is too cold, although they grow to perfection on the plains and on the banks of the Caspian Sea; apples; pears; apricots; pistachio-nuts; walnuts; and some others. The melons of Isfahân are the finest in the world.[4] The species called Gurgâb is so large that two melons are a load for a donkey. The quinces also are very fine. Timber is scarce on the arid plains, but in more favourable situations the soil seems well adapted for the growth of wood, and indeed of trees of every description. The mountains of Gílân, Mazandarún, and Azarbíján are clothed with the finest woods, amongst which are the oak, the beech, the elm, the alder, boxwood, with thickets of wild cherry and thorns, and luxuriant vines climbing up the trunks of the trees, and hanging in wild festoons from the one to the other. These form a striking contrast to the long ranges of naked and barren mountains in the central and southern provinces. In several provinces grows the poppy, from which is made opium of a very fine quality. The liquorice-plant covers the plains of Merdasht, and the neighbourhood of Shíráz. The tamarind, which flourished near the water-courses, and several of the thorny plants that sprinkled the same districts, had been superseded, when Fraser visited these parts, by various aromatic herbs, amongst which a species of fragrant rice was abundant. The most interesting of all the plants is that which yields the gum-ammoniac. It resembles hemlock, and rises to the height of from 3 to 6 feet. It is remarkable in its season for its rich dark-green verdure; and it is then so full of juice, that on the least scratch it flows in streams to the ground, and congeals on the stalk. It is thus gathered for sale. Such vegetables as carrots, turnips, cabbages, spinach, beet-root, and the like, are common. In the more fertile parts of Persia flowers grow

[1] Fraser, Appendix B, p. 25.
[2] Ferrier, p. 26.
[3] Ferrier, p. 137.
[4] Binning, vol. ii., p. 332.

Persia.

to great perfection and luxuriance; the rose, and every variety of the crocus species, primroses, violets, lilies, hyacinths, and others no less lovely than unknown.[1] Aromatic and thorny plants, and beautiful mountain shrubs, also abound, and clothe the ground in all the rich attire of luxuriant vegetation.

Mineral productions.

Notwithstanding the numerous ranges of mountains which intersect the country of Persia, its mineral resources are scantily developed, partly from ignorance of the art of mining, and partly from the general indolence of the inhabitants, owing to the discouragement of tyrannical and rapacious rulers. There are several mines in the vicinity of Yezd.[2] One of lead at Báft, on the road to Karmán, is remarkably rich, and supplies the greater part of Persia with that metal. There are also some mines of fine rock-salt, and one of green marble. According to Mr Binning,[3] "excellent coal is found in the Alburj Mountains, and is commonly used in preference to charcoal by the blacksmiths in Tehrán and in the arsenal." There are also copper, lead, and iron mines in the mountains; and copper is extracted in such quantities as to render it an article of exportation. There is little doubt that gold and silver would be obtained if proper means were applied. In fact, M. Ferrier (p. 117) expressly says that it is owing to the want of science, and of fuel and water-power, that the gold and silver mines at Davind, close to Mashhad ("Sepulchre of the Ghâzís"), are not worked to advantage. About twenty years ago a party of Scotch miners brought by Sir A. Bethune Lindsay, were employed by the Persian government in working mines in the Káradagh Mountains, which contain most extensive veins, but the short-sighted authorities put a stop to their operations when most promising. The mineral production most common in Persia is salt, which, as has been already mentioned, covers vast tracts, and occurs everywhere in great abundance. All the lakes are salt, and every considerable collection of water is impregnated with this mineral. Salt mines are also found in different parts. At Naishápúr, in the north, there is a salt mine consisting of three excavations, in each of which a vein of salt is found from 6 to 18 inches in thickness. The salt is beautifully white, and the crystals so clear that Mr Fraser could see distinctly through a mass 2 inches in thickness, as through a pane of glass. This mine pays a small rent; and the salt is highly esteemed throughout the country. One of the most remarkable productions of Persia is naphtha or bitumen, which is burned by the natives in lamps instead of oil, and also answers all the purposes of pitch, being used in covering the bottoms of the vessels which navigate the Euphrates. It is found in pits 3 feet in diameter, and from 10 to 12 feet in depth, which are gradually filled from springs. There is also another species of white naphtha, different from the other, which is found floating like a crust on the surface of the water, and affords a more agreeable light than the black naphtha. A black and liquid petroleum of an agreeable odour flows in small quantity from a mountain in Karmán; it is reserved for the use of the king, and is given away in presents. The mines are carefully sealed and guarded. The northern mountains of Persia contain considerable varieties of valuable marble; and the turquoise stone, which is peculiar to the country, is found in the rocks near the village of Mádan, 32 miles W. of Naishápúr in Khurásán. The mines which produce this stone were visited by Fraser in January 1822, who (pp. 409–420) gives a detailed account of their produce, as well as of the very rude manner in which they are worked. The hills in which these stones are found consist of a very red and brown rock. The whole range is deeply tinged with iron. The substances of which the rock is composed are a dead gray earth, heavy, hard, brown rock, soft yellow stone, and a rock which is pervaded with specular iron-ore. There are five principal mines or pits from which the gem is taken. The mode of management in these mines, which from time immemorial have furnished these highly-valued gems, is the most wretched that can be conceived.

Climate.

The climate of Persia, in which, according to its latitude, heat should predominate, is considerably modified by the height of the ground; so that, according to Kinneir, the traveller may pass in a few hours from the air of Montpellier to the cold of Siberia.[4] It is intensely cold during the winter; indeed, the highest ranges of mountains are covered with snow during a part of the year, and some of the highest peaks throughout the whole year. Demawend, in the Alburj Mountains, was seen by Morier buried in deep snow in May; and in 1810, Kinneir mentions that the mountains were covered with snow in July. Severe storms also prevail. To the N. of Shíráz, especially, cold predominates, insomuch that in the vicinity of Tehrán and Tabríz all communication is frequently cut off for several weeks between these cities and the adjoining villages. The cold commences in October, and the winter is ushered in with severe storms of snow. Fraser, after leaving Shíráz, suffered severely from cold in this month. The thermometer fell to 28°, and on the next morning, the 27th of October, to 20°; and in the following month he arrived at Tehrán, after encountering so severe a storm of snow that a traveller was carried to a caravanserai frozen to death on his horse. In January, when Fraser was at Naishápúr, which is in the N. of Persia, in about Lat. 36 25., the thermometer fell during the night to 16°, 19°, and 20°, and rose during the day to 40° in the shade; and in many parts the temperature varies between the night and the day from 64° to 25° and 26°. The cold, especially to the N. of Shíráz, continues, with short intervals of warmer weather, till March or April. At Tehrán, which is in the N. of Persia, near the Alburj Mountains, Morier describes the progress of the seasons and the vicissitudes of the temperature. On the 10th of March there was a fall of snow, followed by an intense frost. On the 23d, the mildness of spring was experienced. On the 19th of April the thermometer rose to 82° in the shade. At Shíráz, Morier mentions that after the middle of June the thermometer was scarcely ever under 100°. It then rose to 105°, 108°, and 110°. "When spring commences," says Sir J. Malcolm, "there is perhaps no spot in the world where nature assumes a more lovely garb than at Isfahán; the clearness of its streams, the shade of its lofty avenues, the fragrant luxuriance of gardens, and the verdant beauty of wide-spreading fields, combine with the finest climate to render it delightful."[5] The regularity of the seasons in this part of Persia is extraordinary, and affords a remarkable contrast to the sudden changes which take place in the northern provinces. In Abúshahr, to the S. of Shíráz, Fraser states the range of the thermometer in July to be from 103° to 109°; but during the night it remained at 90°. About the end of August the weather became cooler, and the thermometer fell to 86° and 87°, and gradually during the day to 75° and 70°. In these southern regions, which include the provinces of Karmán, Láristán, Fárs, and Khuzistán, situated between the mountains and the shores of the Persian Gulf, the heat is increased by the barren and sandy plains with which this tract abounds. The hot winds known under the name of the simoom or sirocco prevail occasionally, but are not attended with danger, owing to the narrowness of the space between the sea and the mountains. In winter and spring the climate is delightful. It is never very cold; and snow seldom falls on the southern face of

[1] Fraser, chap. xxiii.
[2] Fraser, Appendix B, p 24.
[3] *Two Years' Travel in Persia*, vol. ii., p. 227.
[4] *Geographical Memoir of the Persian Empire*, p. 21.
[5] *History of Persia*, vol. ii., chap xxiv.

Persia.

the mountains by which these provinces are divided from the N. of Persia.[1] Upon the whole, however, the climate of this country, notwithstanding the sudden transitions from heat to cold in some of the provinces, is very healthy; the air is dry, and the atmosphere always clear, so that the brightest polished metal may be exposed to it without being rusted. Nor are the dews insalubrious; whilst at night the planets shine with a lustre unknown in the cloudy skies of the N. It seldom rains, and there are consequently none of those damp and pestiferous exhalations so common in the woody parts of Hindústán. The fertile provinces of Gílân and Mazandarún, and the district of Astarábâd, which are subjected to the periodical visitation of disease, form the only exceptions to this general character. The heavy rains which fall in these mountainous regions, stagnating in the deep forests, turn them into impassable marshes, which, becoming putrid from the quantity of vegetable matter that they receive, exhale during the heats of summer and autumn a most pestilential vapour; so that the wandering tribes of these countries fly from its influence, and prefer living on the verge of the burning sand, and carrying their water from the distant river, to the least exposure to these noxious effluvia. Those who are forced to remain suffer severely from fevers, putrid as well as intermittent, from dropsies arising from cold, rheumatic affections, palsies, and other maladies. The appearance of the people, however, Fraser remarked, did not indicate either weakness or disease, for they were remarkably stout and athletic.

Animals.

The domestic animals of Persia are the camel, the horse, the mule, the ass, the goat, sheep, cow, &c. The Persians are expert and fearless horsemen; and they have different breeds of horses peculiar to the country. The native horse of Persia has been improved, both in strength and bottom, by an admixture of Arabian blood. But the original breed, which is now restored, is a tall, lank, ill-formed, and generally vicious animal, which often vents its rage upon its neighbours or its riders by kicking or biting them. It is useful, indeed, for hard work; but is not to be compared, for the purposes of riding, with the action and docility of the Arab. There is another race of horses, reared by the Turkamân hordes, not so much distinguished by grace or beauty as by its hardiness and patience of fatigue, for which it is celebrated all over Asia. It is said to have been crossed with an Arabian breed imported by Nâdir Shâh. The native horses are noted for size and bone, which appear to be indigenous; but figure and blood they owe to their Arab progenitors. "They have," says Fraser, "large and powerful quarters, resembling those of the English horse; the shoulders are often fine; their legs clean and strong; though generally spare of flesh, what they have is firm and good;" and not being burdened with a load of fat, they support the weight of the rider for an astonishing length of time. Their powers of endurance are almost incredible. They will carry their riders for seven or eight days together at the rate of 80 or a 100 miles a day. There is also a breed of ponies, fully as remarkable, if not superior to the large horses in their powers of enduring fatigue. Such horses cost a sum of money equal in value to from L.150 to L.200 sterling, and those of the best quality from L.350 to L.400. These horses are used in plundering expeditions; and they are chiefly prized on this account for their hardy qualities. In the parched and sandy tracts of Persia exposed to great heats, camels are preferred, for carrying burdens, to other animals, and they constitute the chief wealth of the inhabitants; but in almost all the other parts of the kingdom mules are more generally used for transport, on account of their extraordinary strength and activity, and their power of enduring fatigue. Sheep are very abundant in Persia, and constitute the wealth of the wandering tribes; but the latter pay no attention to improve the breed. The dog, though esteemed an unclean animal by the Muhammadans, is yet found so useful that every prejudice has given way; and a very fierce breed is maintained by the wandering tribes, for guarding their flocks and tents, and aiding in their field sports. The desolate parts of Persia abound in wild animals, amongst which may be numbered the lion (which is seen along the woody banks of the rivers), the tiger, the wolf, the jackal, the hyæna, the fox (found in great numbers, of a white colour), the porcupine, the wild sheep, the mountain goat, the wild ass, the wild boar, the antelope, and deer in great variety. Tigers are seldom seen, but it is certain that they are to be found, as it is mentioned that the skin of a royal tiger, which was killed in the neighbourhood of Tabríz, was exhibited, and was in possession of Mr Campbell. A tiger was also seen by the shepherds at the time that he was at Tabríz; and one of the Persian princes had gone out to hunt, with a large retinue, in the hope of meeting it. The wild ass is common in Persia, but is extremely shy, and not easily caught. Morier mentions that one morning, in the desert, they gave chase to two wild asses; but these distanced the horses at such a rate that they stood still and looked behind at them, "snorting with their noses in the air, as if in contempt of our endeavours to catch them." The hunters sometimes succeed in killing them, but it requires great dexterity and knowledge of their haunts; and then it is only by relays of horses and dogs upon the track which they are known to pursue. The same traveller also observed large herds of antelopes, to which he gave chase, but could never come up except with one big with young; so great is the speed of this beautiful animal. The wild hog abounds in Persia, and is exceedingly fierce. Fraser, along with a party of well-mounted Turkamâns, joined in chasing a herd of them; and one being singled out, was assailed with swords and spears, which made no impression on his tough hide; and though wounded by a pistol-shot, he continued his flight until an old man, mounted on a powerful Turkamân horse, rode up, and wheeled rapidly round, when the steed, trained to the work, struck the hog on the head with its heels, and tumbled it over dead on the spot. The wild sheep is a very fine animal, bold, portly, and very strong; thick like a lion about the neck and shoulders, and small in the loins; covered with short reddish hair curled loosely about the neck and fore quarters, and bearing an immense pair of crooked and twisted horns.

Territorial divisions.

The northern division of Persia, or the ancient *Hyrcania*, comprehends three provinces,—Gílân, Mazandarún, and Astarábâd, which are here named as situated from W. to E. On the W. are four provinces, which, naming them from N. to S., are,—Azarbíján (the ancient *Atropatene*), Ardalân or Kurdistân, Lúristân, and Khuzistân. Of these, Lúristân is divided into the Greater and Less. On the S. are Fârs, Lúristân, and Karmân (the ancient *Caramania*); on the E. is Khurâsân, corresponding to the ancient *Aria* and *Bactria*, and including the provinces of Yezd, Tabbas, Kâen and Bírjún, Turshíz, Mashhad, Damghân, and Semnún, and the Great Salt Desert. Central Persia is named 'Irák-i-'Ajmí, and comprises on the N., Khamsah, Kasvín, and Tehrân; and S. of these, Hamâdân, Kúm, and Isfahân.

Cities and towns.

If the face of the country in Persia disappoint the European traveller, his expectations will be still less gratified by the aspect of the towns, which present to him one mass of misery, filth, and ruins; for which, forming his ideas of the eastern towns from what he has read of Isfahân, Baghdád, Shíráz, Basrá, and other famous cities, he can scarcely be prepared. He looks in vain for the hum of a crowded population and the bustle of business which ani-

[1] *History of Persia*, vol. ii., chap. xxiv.

Persia.

mate the cities of Europe. Instead of the road crowded with passengers, vehicles, and an active traffic, bordered with hedge-rows and green inclosures, and with gay habitations, he has to thread his way through narrow and dirty lanes, amidst ruins of mud walls and old buildings, amongst heights and hollows, and clay-pits that produce bricks, and high inclosures that conceal the only trees the place can boast; till at last he reaches the dilapidated walls of the city, and, entering the gateway, watched by a few squalid guards, he finds himself in a mean bázár, or more probably in a confusion of mere rubbish. There are no streets, and scarcely a house; for it is only the dwellings of the poor which are seen, the houses of the rich being carefully shrouded from the view by high walls of mud or of raw bricks; and outside of these are clustered, with the utmost contempt of order, the houses of the poor. There is scarcely room for a loaded ass to pass between the narrow passages that give access to these dwellings; and as no attempt is made to level the paths, the passenger has to make his way over all impediments, diving into hollows, scrambling amongst ruins, stumbling over grave-stones, or falling into holes, especially at night, as the only street lighted in Persia is that which leads past the prime minister's house to the palace at Tehrán.[1] The bázárs are the only thoroughfares which deserve the name of streets; and these have received merited praise from many travellers,—namely, those of Shíráz; the continuous bázárs of Isfahán, which extend for miles; some of those at Tehrán, Tabríz, &c., all of which are comparatively spacious, lofty, and built of materials more or less solid; though the majority of Persian bázárs are as wretched as the towns. These bázárs are generally arched over with well-constructed brick-work or clay, or, as in the inferior constructions, with branches of trees. Here, as in India, are collected all the different trades, the smiths, the braziers, the shoemakers, the saddlers, the cloth and chintz sellers, in their own quarter; but confectioners', cooks', apothecaries', bakers', and fruiterers' shops are dispersed in various quarters. Few houses in a Persian town exceed one storey; and the general *coup d'œil* presents a succession of flat roofs and long walls of mud, diversified, however, by gardens, with which the towns and villages are often surrounded and intermingled, and in which are seen the poplar, the cypress, and the oriental plane. Almost all the towns of Persia have some defence, consisting generally of a high mud wall, which is flanked by turrets, and sometimes protected by a deep dry ditch or a rude glacis. Caravanserais are built in every town for the accommodation of travellers, and are also found at every stage on the principal roads of the kingdom. These edifices are generally constructed of stone or brick, of a square form, and divided in the interior into separate apartments. They are surrounded with high walls and towers, as a defence against the attacks of robbers. The houses are generally built of mud, with terraced roofs; and their inner apartments are usually better than might be expected from their outward appearance. The villages are in general very rudely constructed. The common huts have often, instead of a terrace, a dome roof, in order to avoid the necessity of using wood, which is a very scarce article all over Persia, there being few trees on the arid plains.

Trades and manufactures.

Persia, though it has made no great or general progress in the mechanical arts, has nevertheless been distinguished for those finer manufactures which minister to the luxury of an eastern court. Raw silk is one of the most important staples of Persia, and it is produced more or less all over the country, but chiefly in the provinces of Gílán and Mazandarún. In the former alone the annual produce amounts to about 900,000 lb. Silk goods of a very fine quality are manufactured at Yezd; and those of Isfahán, Káshán, and Tabríz are held in great estimation, as are the velvets of these places and of Mashhad. Silk stuffs are also manufactured in Resht, Laháján, and other cities of Gílán, but, according to Sheil (p. 376), of inferior quality. Satins also are manufactured, but, as Fraser thinks, of an inferior quality; and those which are imported from China are preferred. The city of Shíráz is celebrated for its gold embroideries, though these are now surpassed in other places. Its damasked steel knives and daggers are still esteemed; and it manufactures a good deal of coarse glass-ware. The chintzes and prints which are manufactured in many places are coarse both in texture and pattern, and are only used for inferior purposes. They are nearly superseded by the printed cottons of India and Europe, particularly the latter. Calamkáns are distinguished by a pattern of wreathed flowers in gay colours, sparsely strewn upon a white, blue, red, or fawn-colour ground; they are used for inner waistcoats, linings of robes, &c., and are often of very high price. Wool is produced in great abundance all over Persia and the neighbouring countries in which pastoral habits prevail. The best wool is that of the province of Karmán, the mountains of which, hot and arid in summer, and intensely cold in winter, sustain large flocks of sheep and goats, which yield the finest wool. The wool of the sheep is of an excellent quality; and the goats produce a down which grows in winter at the roots of the hair, in the same manner as that of the Thibet or shawl goats, and nearly of as good a quality. This is spun into various fabrics, which almost vie with the celebrated shawls of Káshmír in warmth and softness, as well as in fineness and beauty of manufacture. This fine wool is found not only in Karmán, but more or less over all Khurásán and the countries to the eastward, the mountains of which are favourable to the animals which produce it. The other woollen goods of Persia consist chiefly of carpets, namads, felted goods, and a variety of fabrics of smaller importance used by the inhabitants as clothing.

Trade.

Persia carries on a trade with Turkey, Baghdád, Arabia, and the countries situated on the Persian Gulf. Of the raw silk of Gílán, amounting, as already stated, to 900,000 lb., about one-fifth part is exported to Constantinople, Aleppo, and the other cities of Asia Minor; about one-fifth is manufactured in the cities of Isfahán, Yezd, Káshán, and other towns of Persia celebrated for their silk manufactures; and the remainder is partly purchased by the Russians, and partly sent to Baghdád. Persia exports to India specie, dried fruits, dates, tobacco, wine, drugs, assafœtida, sulphur, raw silk, carpets, Karmán shawls, swords, combs, copper, saffron, &c. Horses form a considerable article of export to India. They are sent by sea from Abúshahr, where they are collected from the breeding districts in the southern provinces of Persia, and from Khurásán and the north-eastern districts by land through Afghánistán and the Panjáb; and they serve for mounting the Indian cavalry, and supplying the great private demand for riding horses by the British in India. The imports from India are cotton goods, chintzes, and muslins; though these have now been in a great measure superseded by the English, French, and German stuffs, introduced from the ports of the Levant, from India, and by way of Russia. Persia receives from India indigo, which comes chiefly by sea, by the way of Abúshahr (*Bushire*), on the Persian Gulf, or by land through the country of Afghánistán, or Balkh, to Bukhária, and thence by Hírát to Persia. Spices are also amongst the Indian imports, as well as sugar and sugar-candy, the import of which forms one of the most valuable branches of trade between the two countries. The province of Mazandarún yields a coarse sugar; and there

[1] Binning, vol. ii., p. 216.

Persia.

are many parts of Persia fitted for the growth of this article; yet the country depends chiefly on India for its supply. Gold and silver stuffs from Banâras, precious stones, Káshmír shawls, iron, lead, and copper, make up the remaining list of imports. Persia exports to Turkey grain, raw silk, tobacco, paper, cotton, lamb and fox skins, carpets, silk and cotton manufactures, Karmán shawls, and salt; and receives in return specie and European manufactures, brought from the ports on the Levant. From Europe, woollen, cotton, and silk goods are imported; also imitation shawls, gold lace, metal buttons, cutlery, watches, spectacles, spy-glasses, leather, earthenware, iron, copper, tin, quicksilver, and other articles. Iron is made in several parts of Persia; but the foreign iron is preferred, and it is imported from Russia, though it is but little used in these countries. Copper in sheets is much used, and is partly imported from Europe through Russia, and partly from India. There is a considerable demand for European silk goods, which are chiefly supplied by the French. Brocades and embroidery are also supplied from France; and Fraser mentions that of these he saw some magnificent samples at Teflis. In chintzes and printed cottons the French and German manufacturers have been more successful than the English in suiting the Persian taste. The European trade with Persia, as it is conducted at present, lies under the great disadvantage of an expensive land carriage. There are various channels through which goods may reach the Persian market. First, they may be sent through Russia, and thence be transported down the river Volga to Astracan, and across the Caspian to the Persian towns of Resht or Astarâbâd. Accordingly, the countries around Astracan are supplied with the produce and manufactures of Europe by means of this great stream; and the manufactures of Russia itself have greatly superseded ours.[1] The Russian trade across the Caspian Sea is carried on by a number of small vessels, which bring to Astracan the sturgeon cured on the coasts of Gílán and Mazandarún, besides returns of other Persian produce; and convey Russian or European goods to Resht, Lahajan, and Astarâbâd. Secondly, goods may be sent by the Mediterranean to the ports of Trebizond and Redoubt Kaleh, situated at the western extremity of the Black Sea, or to Constantinople; and a considerable quantity of European goods reach Persia by this channel; but in the course of a long route of 1200 miles to Erivân, 200 more to Tabríz, and other 360 to Tehrân,—in all 1760 miles,—they are subjected to an expensive land carriage, to arbitrary imposts in their transit through the territories of rapacious chiefs, and to occasional attacks from banditti, and are consequently brought to Tehrân at an expense of sixty-five per cent. The distance from Trebizond to Erivân is only about 140 miles, the road lying across very rugged mountains, though not worse than the roads over which much of the Persian traffic is carried on. The route from Redoubt Kaleh to Teflis, the capital of Georgia, is but 230 miles, and is through a safe country, free from imposts. Teflis, under the government of Russia, has already, like Odessa, risen to be a great mart of trade; and caravans regularly travel to Tabríz in eighteen or twenty days. European goods are now sent to this place in considerable quantities,—namely, woollen cloths, cotton, printed and plain goods, some hardware articles, some refined sugar from Great Britain, silk and cotton manufactures from Lyons, and embroideries, cloths, &c., from other parts of France. There is another more direct channel through which a supply of European goods may be sent into Persia, namely, by way of Abúshahr; and, in point of fact, British manufactures to a considerable amount, especially cottons, are imported into this place, and thence conveyed to all the southern cities of Persia.

Government and laws.

The government of Persia is a pure despotism, which is subject to no control from the influence of laws or manners, and under which every man's life and liberty are at the mercy of the sovereign. He may exalt the lowest subject to the highest rank, or he may degrade, fine, imprison, maim, or put him to death, according to his will or caprice. He is taught from his infancy to consider his subjects as created for his pleasure; he is initiated in the grossest sensuality; and, as if to train him to habits of cruelty, his preceptors are in the practice of taking him to witness executions, which in Persia are conducted with extreme cruelty, as if to steel his mind against humane feelings, and to habituate him to scenes at which other men would shudder. In general, the kings of Persia profit by these early lessons; few of them are considerate or merciful; whilst with many, according to Sir J. Malcolm, "the habit of shedding blood becomes a passion, by a brutal indulgence in which human beings appear to lose that rank and character which belong to their species."[2] Throughout the different provinces of the Persian empire chiefs and governors are everywhere seen improving upon the example of the sovereign,—beating, maiming, and rending their property from the unfortunate cultivators who are placed at their mercy. There is no such thing as any protection for life and property in any part of this country; and the officers of government everywhere rob the people, and further insult and maltreat them if they dare to complain. A monarch of Persia acknowledges no obligations but the ritual observances of his religion; and a blind superstition is thus substituted for the moral qualities of mercy, generosity, and justice. Every look being watched by parasites and flatterers, he becomes as impatient of the least opposition as he is insensible to the most devoted service. Distrust and terror reign amongst his courtiers, amongst whom falsehood, dissimulation, and specious show supply the place of truth and loyalty. They have no means of preserving the royal favour but by flattery and fawning; and hence their whole object is to deceive and pillage, and, if they can with safety and advantage to themselves, to betray their tyrant. The effects of this system may be traced through all ranks about the court, even to the lowest menial. Such is the character given of those who are attached to the various courts, and live in service with great men, including the military and other functionaries. The other classes into which the population of Persia is divided are,—those who live in towns, namely, merchants, shopkeepers, mechanics, and others; those who are engaged in agriculture; and, lastly, the clans or *íls*. The inhabitants of towns are less exposed than others to the tyranny of their superiors, and they are more industrious; and, though far from strict in their morals, they are not so actively vicious. They are, however, cunning, deceitful, false, eager after gain, and cautious and penurious. The clans are *Táts* or *Takhtah Kâpa*, "dwellers in houses,"—*i.e.*, stationary; or dwellers in tents. According to race, they are divided into Arab, Turk, Lek, and Kurd. An enumeration of these will be found in Sheil's *Persia*, p. 393. They are supposed to form half the population of the whole kingdom.

There is no class in Persia subjected to such tyranny and oppression as the farmers and cultivators of the soil. They are exposed to almost continual extortion and injustice; there is no definite limit to the amount of the demands made upon them. When the king demands money from his ministers, they have recourse to the heads of districts, who in their turn apply to the heads of villages, and these last wring it from the cultivators and farmers. Every

[1] Binning, vol. ii., p. 298.

[2] *History of Persia,* vol. ii., chap. xxvi.

tax, present, fine, or bribe, from whomsoever demanded in the first instance, ultimately falls upon them; so that the only measure of these demands is the ability to pay on the one hand, and the power to extort on the other. Yet there are exceptions to this uniform system of oppression; and when travellers have been admitted to view the Persian farmers in their houses and with their families, a degree of comfort and comparative plenty have been discovered, not quite compatible with the general tale of misery that was told. Land[1] belonging to the cultivator pays nominally one-fifth, but really one-third of the value of its produce. The crown lands are rented at one-half their produce. Landed property is hereditary; but the tax must be paid whether cultivation is carried on or not, and, in case of non-payment, the land is liable to seizure and transference to other parties. The tax is paid partly in cash and partly in kind. Though the Persian peasantry are poor, their general condition would contrast favourably with that of many of the same class in Europe. Famine is unknown; and in so thinly peopled a country the small supply of food required for the wants of the inhabitants is easily raised. The Persian peasants are civil, obliging, and intelligent.[2] The politeness of the Persians, for which they have been so much famed, seems to consist more in the observance of a troublesome routine of ceremonies, and the use of complimentary language in all the forms of eastern hyperbole, than in any real courtesy. A Persian will say to a stranger that he is his slave; that his house and all that it contains,—his horses, equipage, &c.,—all are at his service; but no one understands this in any other sense than an unmeaning form, which encumbers the intercourse of society without refining it. In their persons the Persians are handsome, active, and robust; lively in their imaginations, and of quick apprehension; but without any moral quality to attract esteem. The effects of the cruel despotism under which Persia groans, in thus degrading the character of the people, and also in checking the progress of science and of every useful art, are truly melancholy. The insecurity of life and property is the dead-weight which oppresses the country. It represses the efforts of industry; it paralyses the powers of invention, and every ingenious improvement; for no man will sow where he is not sure of reaping, or will task his ingenuity to produce what he may be deprived of the next hour. It is a common practice to kidnap the best workmen in all trades for the use of the court and great men of the provinces, who never pay the workmen they employ. Hence every one avoids the reputation of excellence, except in the commonest trades; and thus, under the benumbing influence of this frightful despotism, improvement is nipt in the bud, and every useful invention is discouraged. There is no outlay of labour or of capital in expectation of any profitable return. No speculation is hazarded which promises any future advantage. Before closing this sketch of Persian character, one marked feature must be especially noticed. The Persians are the only Asiatics who are real sportsmen. They love the chase for itself; and will ride as hard, and with as much enjoyment, as an English fox-hunter.[3]

The king of Persia has a great variety of personal duties to perform. He gives audience at an early hour of the morning to his principal ministers and secretaries, who make reports of all state transactions, and receive his commands. He holds a public levee, which is attended by the princes, ministers, and officers of his court, at which rewards are distributed and punishments awarded. He then gives one or two hours to his personal favourites, or to his ministers. After the morning is past, he retires to his inner apartments, where he is shrouded from observation. In the evening he holds a levee, and transacts business with his ministers and principal officers of state. This, however, is rather a sketch of what his employments ought to be, than of what they are. The prime minister, exclusive of emoluments, which treble the income, receives 42,000 tumâns, or L.21,000 a year; and when the Shâh is a weak and indolent prince, has paramount influence, and transacts the affairs of state as he pleases. But he is ever exposed, like the meanest subject, to degrading punishments and a cruel death. Thus Fath Ali Shâh strangled his faithful minister Hâjí Ibrâhím; and Muhammad Shâh, the late king, destroyed Mírza Takí, his brother-in-law, as well as minister, causing his veins to be opened, and leaving him to perish by loss of blood. Besides the chief ministers, the secretaries of state preside over the different offices or chambers of accounts; and regular accounts are kept of the receipts and disbursements of the whole kingdom.

Laws, and administration of justice.

The law of Persia, as in all other Muhammadan countries, is founded upon religion as contained in the Kurân, and also upon tradition. Its rules are accordingly extremely vague and imperfect, and are administered by the priesthood, who often pronounce the most corrupt decisions. Many cases are also decided by the law of custom or tradition, which, having reference to local as well as to common usages, varies in different parts of the empire, and is, if possible, a still more vague and imperfect code than the written law of the Kurân. The ecclesiastical order in Persia, as in all other countries, eagerly grasping after power, insist that the law which they administer, being divine, should take cognisance of all cases. But the ordinary courts of common law, supported by the state, have succeeded in limiting their jurisdiction to cases of religious ceremonies, cases of inheritance, marriage, divorce, contracts, sales, and all civil matters; reserving to the ordinary courts the decision of criminal cases, such as murder, theft, fraud, breaches of the peace, and other offences. The order of priests have great influence in Persia. Before the reign of Nâdir Shâh, the whole power centred in the chief pontiff, who was deemed the vicar of the Imâm, and engrossed vast wealth and influence. At the death of this high priest no successor was appointed by Nâdir Shâh, who besides seized the treasures of the priesthood in order to pay his troops. His grandson and successor appointed two persons to this high dignity, with a view of diminishing by dividing their power and influence. These priests are called Mushtâhids; and there are now usually three or four of this high dignity in Persia. They fill no office, receive no appointment, and have no specific duties, but are called by the voice of the public, from their superior learning, piety, and virtue, to be their guides in religion, and their protectors against oppression; and Sir John Malcolm observes, that they receive from the people a degree of respect and reverence to which the proudest kings would in vain lay claim. Their conduct generally agrees with the sacred character to which they owe all their importance, as they know that in deviating from the strictest purity they would lose all their influence. This order of priests exercise an important influence on the administration of the written law. Cases are constantly submitted to their superior knowledge; and there is no appeal from their sentence except to a priest acknowledged to be superior in sanctity and in learning. The sacred character of these priests gives an authority to the decrees of the tribunals over which they preside which the monarch is forced to respect. They are often effectual intercessors for mercy to the guilty; their habitations are considered as the sanctuaries of the oppressed; and "the hand of despotic power," says Sir John Malcolm, "is sometimes taken off a city because the monarch will not offend a mushtâhid, who has chosen it for his residence, but who refuses to dwell amidst violence and

[1] Binning, vol. i., p. 345.
[2] Ibid., vol. ii., p. 361.
[3] Ibid., vol. ii., p. 367.

Persia. injustice." Next in rank to these high priests there is the Shaikhu'l-Islâm, literally the "elder or chief of the faith," who acts as a supreme judge in the court of written law. One of this class resides in all the principal cities; and under him is the kâzí, who has a council of múlás or learned men as his assessors. In the lesser towns there is only a kâzí, from whom there lies an appeal, in cases of intricacy, to the kâzí of the larger towns, and finally to the supreme judge of the provincial capital. But, as in all countries such as Persia, where there is no enlightened morality, and no control of public opinion, justice is venal and corrupt; the administration of the written law by the priests is extremely imperfect and inadequate to its ends, insomuch that the suitor is deprived of every hope of justice; and it is only the administration of the customary law that offers any security, however imperfect, for justice between man and man. Even here, however, the administration of justice varies with the character of the reigning despot; and the judges, in all their various gradations, are active and just, or corrupt and cruel, as the monarch happens to be vigilant or virtuous, avaricious or tyrannical. The European ideas of honour are scarcely known amongst any class. They are all venal and corrupt; and the iniquities which they themselves practise they but feebly condemn in others. Justice is often interrupted by the clashing authorities of the different courts,—an evil which neither the sovereign nor his ministers are anxious to remedy, seeing that it adds both to their power and profit. A suit is very soon brought to a termination, and not at great cost; but considerable sums are often paid for a favourable decision. The most barbarous rules are still followed in the administration of the criminal law. In cases of murder the heir-at-law demands vengeance for blood; and when the guilt of the criminal is established, he is delivered into the hands of the injured person or his relations, to deal with him as they think fit. The punishment of crimes in Persia is fixed by the written law, or when the king interferes by his arbitrary will. Fines, flogging, and the bastinado are the common punishments of lesser offences. The disclosure of hidden treasures is enforced by tortures; and the inhuman punishment of putting out the eyes has long been practised in Persia, as in other countries of the East, on the relations of the reigning family who may aspire to the throne, or on the chiefs of tribes whom it is desirable to deprive of power, though not of life, and sometimes on the male inhabitants of a rebellious town. Criminals are put to death by strangling, decapitation, or stabbing; but in aggravated cases the most inventive cruelty is practised in devising modes of torture. In Persia, women are seldom publicly executed, but they suffer dreadful violence in the recesses of domestic tyranny. When they are of high rank, the comprehensive injustice of the East often includes them in the punishment of their husbands or fathers; and they are given away as slaves to the lowest and most infamous classes of the community, such as mule-drivers. They are also sometimes tortured, in order to force from them a disclosure of wealth which they know to be concealed.

Revenue. The collection of the revenue is intimately connected with the administration of justice, the same officer presiding over both; and this union is unfavourable to the inhabitants, as it enables the collector to prostitute the judicial power for the gratification of his avarice. Sir John Malcolm estimates, though not on any sure data, the revenue of Persia at three millions. According to Fraser,[1] the amount varies with each successive sovereign; but Sheil, who had the best opportunities of learning the truth, states it at 3,177,000 tumâns, or L.1,747,350. The public income of Persia arises chiefly from the produce of crown lands, and from a tax on land. Landed property in Persia may be comprised under the following heads:—1*st*, Crown lands; 2*d*, Those of individuals: 3*d*, Those belonging to charitable or religious foundations; 4*th*, Those granted by the king for military service. The uncultivated tracts, which form so large a portion of Persia, are not claimed as property; but every individual who constructs one of the subterraneous canals called *kanáts*, or who contrives to bring water to the surface, obtains a title to the land which he cultivates. The other titles are, inheritance, purchase, or a gift from the crown; and these rights are held sacred under all circumstances. There is, however, this peculiarity in the state of landed property in Persia, as in other eastern countries, that the cultivator shares with the proprietor in a common right to a certain portion of the soil, of which he cannot be deprived as long as he pays the customary rent. The proprietor has a title to one-tenth of the produce, ascertained by measurement, either of the surface before sowing, or of the standing crop. When the proprietor obtains an artificial supply of water, he has, besides, a right to all that he can procure by its sale. In cases where the proprietor furnishes seed, labour, or cattle to the cultivator, he receives, in addition to his tenth share, a portion of the farmer's profits. The government tax amounted at one time to one-tenth of the produce, but with the increasing expenses of the state other irregular taxes were imposed, till they were at last converted into an additional tenth; the less fertile lands being, however, subjected to a smaller impost. But other irregular and arbitrary imposts continued to be heaped upon the additional tenth by the bad faith of the government, and now form one of the cultivator's heaviest grievances. The other taxes are those on cattle, capitation taxes, transit and town duties, and various irregular impositions. Lands held in fief, or in lieu of military or other service, pay no tax to government; the assignee being entitled to three-tenths, which includes both the proprietor's rights and the government dues. When the assignment is given on the estate of another, the government dues alone are granted. Gardens near villages pay one-fifth of their produce in kind, whilst melon-grounds, tobacco, cotton, and such like fields, pay in money according to a valuation of their produce. Horses, asses, cows, sheep, and goats, are all taxed, at the rate of one real, or 1s. 4d. for each horse, four-fifths for asses and cows, one-third for sheep and goats, and one-sixth on the hive of bees. There is a capitation tax, which sometimes presses heavily upon Armenians, Jews, and Gabars, the ancient fire-worshippers. The rate was in some cases four reals, or 5s. 4d. for a family, and sometimes eight reals. Shops and bâzârs pay a duty of from two to twenty reals a year; and the tenant also pays in the proportion of from ten to fifty tumâns a year, the value of the tumân being 11s.[2] All merchandise is subject to a duty of 5 per cent. on entering the first Persian town, whether by land or sea, and to a variety of inland duties, which are levied at the different custom-houses, without any system, every governor endeavouring to extort all he can. Smuggling is very common. No estimate can be formed of the *saadrát*, or the irregular duties, which include every extraordinary expense of government, the expenses of all travellers and strangers, of members of the royal family, or government messengers, of transporting baggage, royal equipage, or presents, of repairing roads and bridges, of furnishing troops, and the like; for all which it is understood, though the practice is often different, that the village or province shall obtain credit on the annual settlement of their accounts; so that these heavy exactions, resembling those of the king's purveyors in ancient Europe for the maintenance of his court and retinue when they were travelling, fall without redress on the poor ryots. The Persian king's order

[1] *Narrative of a Journey into Khorassan*, chap. x.

[2] Ibid., p. 74, note.

Persia.

is, in like manner, grievously abused to the oppression and vexation of his subjects. Presents, fines, and confiscations, form a considerable item of Persian revenue. At stated times, such as the new year, the courtiers are expected to accompany their respects to the king with a large present of money, which amounts in some cases to L.30,000, L.40,000, and even L.55,000. Every one in any degree dependent upon the court endeavours to make up a purse on this occasion; and in lieu of money, goods, such as shawls, horses, jewels, and merchandise, are brought. The produce of this new year impost is estimated at L.660,000. But there are various other lesser occasions for making presents, no suitor being expected to approach the throne empty-handed; so that about L.275,000 may be received in addition to the presents of the new year. The produce of the crown lands Fraser estimates, though, he admits, on uncertain data, at L.493,950.

According to Sheil (p. 388), the total expenditure from the revenue is as follows:—

General expenditure, including presents, building, post-office, &c.	L.184,536
Amalaját, or salaries at the capital	443,292
Total military expenses	672,520
Provincial expenses	160,782
	L.1,461,130

Army.

The Persian army at present comprises 6000 artillery, about one-half of whom are natives of Azarbíján. The men are active, efficient soldiers, and carry their guns over any ground. There is one marked peculiarity in this arm of the service. The artillerymen are all mounted, and there are more than thirty with each gun; the guns in Persia being to defend the infantry, rather than, as with us, the infantry to defend the guns. For the foundation of an ordnance department on a modern footing, Persia is indebted to England. A foundry under Englishmen was first established at Tabríz, as well as a powder manufactory outside the town. These have since been transferred to Tehrân. The regular infantry is rated at 100,000 men, but does not actually exceed 70,000. Of these, more than a third come from Azarbíján. Internal discipline is said by Sheil to have no existence, and knowledge of evolution to be limited to movement from column into line, and *vice versâ*, and to the clumsy formation of squares.[1] In the recent engagements, however, with the British forces, the Persian infantry did not appear to be so deficient in these points. The arms of the infantry are flint muskets, and bayonets, many of them out of order. The men wear blue linen jackets, with white cotton trousers and leather buskins; and in cold weather they often put on their own clothes under the jackets and trousers which are supplied by the state. Turks wear the lambskin cap, and Leks felt caps. Instead of knapsacks, thirty asses are allowed to each company for the carriage of the men's kit. The infantry is divided into regiments, each of which, called a *fauj*,[2] consists of 1000 men, of whom 800 are *sarbáz* or privates, 41 bandsmen, and 159 officers. The *fauj*, again, is divided into 10 *dastah* or companies, and in each there are 1 sultán, or captain; 2 *náibs*, or lieutenants; 2 *begzádahs*, who ride in the rear; 4 *vakíls*, or serjeants; and 4 *sarjaukas*, or corporals. The regiment is commanded by a *sarhang*, or lieutenant-colonel, who gets 500 tumâns (L.275) a year; and 2 *yávars*, or majors; and over two regiments is a *sartíp*, or colonel, with 1000 tumâns a year. The *yávar* receives from 150 to 250 tumâns a year; *sultín*, 60 tumâns; the *náib*, from 30 to 40; the *begzádah*, 20; the *vakíl*, from 10 to 12; and the *sarjauka*, 8 tumâns annually. The private receives 7 tumâns a year, and has, besides, a *jírah*, or ration of 3¼ lb. of bread daily. Each regiment has, besides, a *mushrif*, or head accountant, who gets 50 tumâns (L.27, 10s.); and four clerks, whose pay is from 30 to 40 tumâns each. Each member of the band gets from 8 to 15 tumâns. The regular cavalry is limited to 500 men; according to Sheil, "an absurd, useless body." The Shah's bodyguard consists of 2500 irregular cavalry, well mounted and armed, and excellent horsemen. Their pay is 60 tumâns each yearly, with 1½ *mans* of bread, 4½ of barley, and 9 of straw for the horses, per diem. Over every 10 men is a *dehbáshí*, or decurion; and over 100, a *yuzbáshí*, or centurion, who gets 500 tumâns annually. Besides these, there are from 30,000 to 50,000 irregular horse, called *ghúlám-i-suwár*, to distinguish them from *ghulám-i-rikábí*, the bodyguard. Sheil considers them fully equal to the Cossacks. Six thousand of them come from Azarbíján. The pay of a private is from 10 to 15 tumâns, with half a *man*[3] of bread, 1½ of barley, and 3 of straw, daily. A *sultán*, or captain of 50, gets 50 tumâns; a *náib*, or lieutenant, 30; *vakils* and *sarjaukas*, 15 tumâns; and a *sarkardah*, or colonel of horse, 1000 tumâns per annum.

The regular Persian army owes its origin to the French, and dates from the mission of General Gardanne in 1808. The first levies were raised in Karmânshâh and Azarbíján. Shortly afterwards, Major Christie and Lieutenant Lindsay, of the Company's army, who accompanied Sir J. Malcolm's mission in 1808, undertook the charge of the new levies. Major Christie was killed in 1812, in the battle of Aslanduz against the Russians, in which he distinguished himself so much that the victors raised a monument to his memory. He was succeeded by Major Hart of the royal army, who, under Abbás Mírzá, brought the infantry of Azarbíján to great efficiency. Lieutenant Lindsay, afterwards Sir H. Lindsay Bethune, did even more for the artillery; and the remains of the vigour he infused may still be traced. After the last war between Russia and Persia, several officers and serjeants of the Indian army were sent to carry on the work. Among the most distinguished was Sir H. Rawlinson. They aided in placing Muhammad Shâh on the throne; but that prince became jealous of them; and finally, on his marching against Hírát, they were recalled. After them came some French officers, who entirely failed; and they in turn were succeeded by a party of Italian, Hungarian, and German refugees.

Religion.

The ancient religion of Persia was the worship of Hormazd, the Good Principle, or God. Fire, and especially the sun, being considered the fittest emblem of the deity, was the visible medium selected to receive adoration, but that this emblem was itself worshipped, is a vulgar error. This religion was subverted by the Arabs in A.D. 651, when that of Muhammad was propagated in Persia by the victorious Muslims. But the Persians are of the Shíah sect, who consider 'Alí, the nephew and son-in-law of Muhammad, as his lawful successor in the khalífat, to which he was appointed by the Prophet; and Abúbakr, 'Umr, and 'Uthmán, his actual successors, and reverenced as the khalífs by the Sunnís as nothing better than usurpers. It was this disputed succession which gave rise to these two hostile sects of Muhammadans. The doctrines of the former,—namely, the Shi'ahs,—have been for more than three centuries warmly espoused by the Persians, who vowed eternal hatred and war against all who profess the Sunní creed. The religion of Muhammad, amongst its other evils, is hostile to all improvement. It enjoins the destruction of infidels as an act of piety; and hence the blind zeal and persecuting spirit which prevails in all Muhammadan states, and which breaks out into reproach, outrage, and often into extreme violence, against their Christian visitors. All knowledge is, according to this system, rejected, beyond what is found in the Kurân;

[1] Sheil, p. 383.

[2] Binning, vol. ii., p. 202.

[3] Binning, vol. i., p. 177, note, reckons the *man* at 7 lb.

Persia.

and the debasing influence of polygamy on the morals and manners of both sexes is calculated completely to poison all the remaining sources of social happiness. The baneful consequences of this false system have been as deeply felt in Persia as in any of the surrounding states. The fanatical influence of the Muhammadan religion has of late years, however, been modified in Persia by the progress of a free-thinking and irreligious spirit, chiefly amongst the nobility, the merchants, and those who have resided much in foreign countries, and even amongst the priesthood, who frequently and openly, before their particular friends, deride the superstitious observances of the Muhammadan creed. The zeal of the early Muhammadans has also been cooled by many causes. The work of conquest, and the extinction or conversion of infidel nations by the sword, is at an end. The enthusiasm of the modern followers of the Prophet is no longer influenced by the practice of persecution; and the whole system has declined into a set of useless forms and ceremonies, which, mingling with all the common affairs of life, have degenerated into a customary routine, without any appearance of reverence, and being in reality a mere mockery of religion.

Literature, science, &c.

In a state of society such as that which prevails in Persia we can scarcely look for any great progress in literature, science, or the arts. With the Muhammadan religion was introduced all the Arabian learning of the seventh century. But the Persians have not improved this original stock; on the contrary, it has gone to waste in their hands; the light of science is nearly extinct, and their literature consists chiefly in poetry and tales. They delight in tales, fables, and apophthegms, which Sir John Malcolm considers as the consequence of their despotic government, where knowledge must be veiled in order to be useful, as the direct truth would wound a despot's ear. The merits of Persian poetry have been very differently estimated. Sir John Malcolm, admitting its extravagance and hyperbole, still praises its tenderness and beauty; and many passages breathe all the sweetness of pastoral poetry. Firdausí is their greatest epic poet, whose poem (the *Sháh-námah*) is a history of the ancient Persian kings. In it, according to Sir John Malcolm, "the most fastidious reader will meet with numerous passages of exquisite beauty. The narrative," he adds, "of this great work is generally very perspicuous; and some of the finest scenes in it are described with simplicity and elegance of diction." In the opinion of Persians, this poet excels in descriptions of the combats of heroes; but to those whose taste is offended with hyperbole, the tender parts of his work will have most beauty, as they are freest from this characteristic defect of eastern writers. Nizámí, who celebrates the exploits of Alexander the Great, is considered as ranking next to Firdausí; and the subject affords ample scope to his genius and powerful imagination. Amongst the didactic poets, Sir John Malcolm assigns the next rank to S'adí, who is a moralist as well as poet, his works abounding in lessons of prudence and morality, and exhibiting a rare union of fancy, learning, urbanity, and virtue. The Masnaví of Jalálu'd-Dín, the poems of Jámí, and the odes of Háfiz, are amongst the most popular effusions of the Persian muse; but the names of Rudikí and others are nearly of equal rank; and some modern writers also have attained to great eminence. "Many of these poems," says Sir John Malcolm, in his excellent History of Persia, "are remarkable for harmony of numbers and luxuriance of imagination, but they all abound with the most extravagant and hyperbolical passages; and the enraptured dreams of their visionary authors can only be esteemed beauties by men whose imaginations keep pace with that of the poet, whom they deem inspired, and whose most obscene lay is often considered by their enthusiastic admirers as the gleaming of a sublime knowledge, which is far beyond the comprehension of the profane and unenlightened. Many discussions have arisen regarding the real and mystical meaning of the writers of this class, and particularly of Háfiz, whose odes are chanted as songs, to excite the young and dissipated to pleasure, and recited as hymns, to remind the old and devout of the rapture of divine love." The Persian poets excel in songs and odes, which are tender and passionate. Satirical effusions are not so common; though the verses of Firdausí on Mahmud of Ghazni are remarkably bitter. There is a satirical poem, by an unknown author, on the passion of avarice, which is extremely humorous. The Persians are enthusiastic in their taste for poetry; and the meanest artisans can read or repeat the finest passages of their most admired writers. Sir John Malcolm mentions that his servants were familiar with Persian poetry; and when at Isfahán, he was surprised to hear a common tailor, who was repairing one of his tents, entertaining his companions with some of the finest mystical odes of Háfiz. Even the rude soldier will leave his tent to listen to songs of love or to a tale of war. The art of printing is unknown in Persia; and beautiful writing, which is carefully taught in the schools, is considered a high accomplishment, those who excel in it ranking with the literary class. They are employed in copying the works of authors; and a few lines written by a celebrated penman are often sold for a considerable sum. Almost all the tradesmen, and many of the mechanics in Persia, have received some education. Schools are established in every town and city, at which the poorest children are instructed, at fees sufficiently reasonable, in the rudiments of the Persian and Arabic languages. The pupil after he has learned the alphabet, reads, as a religious duty, the Kurán in Arabic; next some fables in Persian; and, lastly, is taught to write a legible hand, which completes his education. Unless amongst those who follow a studious life, and thus put in practice what they have learned, these lessons are in many cases forgotten. Yet this course of study, superficial as it appears, improves the habits, and introduces a refinement of manners amongst the scholars, which is unknown to their ruder countrymen. No proper encouragement, however, is given to schools; nor can it be expected that a grasping, despotic, and rapacious government, like that of Persia, should be any way anxious for the education of its subjects. The literary men are numerous. They pursue their studies till they are entitled to the name of Múllá, and to all the honours of a Persian college, though they are not classed with the priesthood. They follow various occupations. To the studious and literary classes a very high rank is assigned. An eminent historian, astronomer, or poet is highly honoured, and has a place of distinction assigned him in every company which he honours with his presence; and this as much for his social qualities as for his supposed talents as an author. The conversation of these persons, replete with anecdotes and information, amuses and instructs; and even the pretenders of this class, who are numerous, possess agreeable manners and a ready wit. A swarm of students is thus produced, who pass their useless lives in indolence and poverty. Isfahán in particular abounds with these literary mendicants; and from its colleges, and those of Shíráz, issue a crowd of vagrant poets, who lie in wait for men of rank and wealth, or for any stranger from whom they expect a reward.

In music and painting the Persians have made little progress. They have a gamut and notes, and a melody that is adapted to various strains; and they sing to the accompaniment of warlike instruments, of which they have a number. Their strains are often pleasing, but they are always monotonous. They are equally backward in the art of painting, in which they have advanced but little within the last three centuries. They use the most bril-

Persia.

liant colours; and in portrait-painting they usually succeed in taking likenesses; and in some of their lesser drawings, which are highly glazed, and painted on wood, they also display industry and taste. But they are entirely unacquainted with the rules of perspective or of just proportions. The despotic and unsettled government arrests all improvement; and in the fine arts the existing race have not advanced one step beyond their forefathers, as appears from the figures in the palaces at Isfahán, executed in the reign of Sháh 'Abbás, and equal to any of their modern productions.

Mathematics, astronomy, and geography.

In science the Persians have advanced no farther than in the arts. Their knowledge of mathematics or astronomy is very limited; and the latter science is chiefly studied for the sake of judicial astrology, in which the whole nation, from the king to the peasant, evince the greatest faith. Their notions of the forms and motions of the heavenly bodies, and the shape and surface of the earth, are borrowed from Ptolemy; and though some efforts have been made to instruct them in the Copernican system and Newton's demonstrations, prejudices are too firmly rooted to be dispelled, except by time. Of geography they do not understand the first principles; for, independently of their error regarding the figure of the earth, they know little of its surface, even of that which lies within their view; nor could their knowledge of surveying enable them to lay down any portion of it with exactness. There cannot be a stronger proof of the ignorance which prevails than the eagerness with which all classes seek the aid of astrology. Any one who can take an altitude with an astrolabe, or knows the names of the planets, with a few technical phrases, and understands the astrological almanacs, considers himself as quite adequate to offer his services to all who consult him; and nothing of consequence is transacted, especially by the great, without consulting stars. A new dress must be put on, or a journey must be commenced, at the lucky or unlucky moment.

As the science of astronomy is thus rendered subservient to astrology, so chemistry is followed for the sake of alchemy, a favourite pursuit of the learned, whose avarice is stimulated by the hope of discovering the philosopher's stone. The alchemists make their experiments in the profoundest secrecy, that they may themselves engross the whole benefits of the wonderful discovery which they expect to make; and whether they may be themselves deceived, certain it is they deceive others, and practise the most serious frauds on the credulous and the wealthy. Of medicine and surgery the Persians are thoroughly ignorant, and, when they are ill, become the prey of quacks, who rob them of their money, and often of their health. They are entirely ignorant of anatomy and the circulation of the blood. They have an arbitrary theory, by which they classify all diseases under four heads,—viz., hot, cold, moist, or dry; and the great principle on which they proceed is, that the remedy must be of an opposite quality to the disease; dry remedies being applied to an illness occasioned by moisture, and cooling medicines to hot diseases. To this practice they are so bigoted, that, with all their respect for European physicians, they dislike any prescriptions that contradict this paradox. Inoculation for the small-pox, though it is known, is seldom practised, though whole towns are often threatened with depopulation by the ravages of that dreadful disease. Mr Jukes, who accompanied Mr Fraser into Persia, was remarkably anxious to introduce the practice of vaccination; for several years his efforts were unremitted; but they were defeated, fully as much from the cruel indifference of the government to the good of their subjects, as from their prejudices. The practice of physic in Persia is mere quackery, for which all the knowledge necessary is that of the qualities and effects of a few simples; and hence a grave air, and a few lucky cures, often brought about by the temperate habits of the patient, complete the fame of a physician. The gains of the physician are, however, trifling. The priests and astrologers succeed better; their art is more suited to the taste of the inhabitants; and it is only in cities and towns that there are regular physicians. Those who dwell in tents are generally attended by an old man or woman, who rely more on superstitious charms than on medical remedies. One of these charms consists in laying a few pieces of bread covered with oil upon a rock, as an offering to a saint.

The Persians are remarkably ceremonious in their intercourse. They receive the visit of a superior by rising hastily and meeting him at the door of the apartment; of an equal, by rising and standing erect; of an inferior, by only making the motion of rising. The apartments are not so luxuriously furnished as in Turkey. The sofas and easy pillows of the latter country are not known in Persia, where the seat is on a carpet or mat, without any soft support on either side, or anything except the hands, or the accidental support of a wall, to relieve the galling posture of the legs. The fashion in presence of a superior is to sit upon your heels, as they are tucked up under your hams, after the manner of a camel. The length of time during which a Persian sits untired upon his heels is to an Englishman quite extraordinary. He will remain half a day, and sometimes he will even sleep, in this posture. They never think of changing their positions; and are as much surprised by the locomotive dispositions of the Europeans as we are by their habits of rest.

It is a singular trait of Asiatic manners that so great a proportion of the people still retain the vagrant habits of the pastoral life. For this purpose the wide wastes of Khurásán, varied with spots of fertility, are well adapted; and the pastoral tribes are accordingly found chiefly to border on this district, which has long been the debateable ground between several great monarchies, where their rival chiefs contended for victory in fierce and bloody wars; and on these occasions the wandering tribes are enlisted on one side or the other. Thus they are inured to blood and to pillage, and contract habits which have been strengthened by time, and have at last become interwoven with their whole pursuits and character. They often attack surrounding states, carry off the people, and sell them for slaves; and most of the wandering tribes of Turkamáns being Sunnís, who have sworn eternal hatred to the Persians, who are Shi'ahs, thus add religious hatred to all their other incentives to murder and pillage; so that their character is described as ferocious and blood-thirsty in the extreme. To the north of Khurásán there are various tribes of Turkamáns, who, occupying the country behind the Alburj and the steppe of Khárazm, pour from their deserts upon the surrounding and cultivated districts, plundering villages and caravans, with every circumstance of atrocious outrage. The old, the feeble, and the helpless are murdered on the spot; those who are fit for labour are carried into slavery; and whole districts of country are left desolate. From the east other tribes equally barbarous make inroads into Persia, and carry away their captives to the slave-markets of Khíva and Bukhára; and on the south and east are found the wild Bilúchís, who formerly murdered and plundered, but now, preferring their avarice to their cruelty, carry their prisoners to the slave merchants who frequent the great northern markets. The Afghán, also, though not naturally cruel, "assumes," says Fraser, "in this ominous neighbourhood a fierce character, and adds to robbery and plunder the crime of murder." By these dreadful inroads a considerable portion of the country to the north and east is laid waste; the terror of these tribes is spread far and wide; and their depredations have become more formidable in proportion to the corruption and increasing weakness of the Persian monarchy

Persia.

These tribes vary considerably in their physiognomy. The Goklán,[1] Yámút, and Takeh Turkamâns, who occupy the country behind the Alburj Mountains, bordering on the Caspian Sea, are tall, stout, and well made, and have all the Tátâr features,—namely, the scanty beard, the small eye drawn up at the corners, the high cheek-bones, and the small flat nose. Some, on the other hand, have handsome features, rather resembling those of the Asiatics than of the Europeans. The arms used by these tribes are chiefly the sword and the spear. They are dexterous in the use of the sword, which is curved in the Persian fashion, and very sharp. Several of the tribes use bows and arrows. They have very few fire-arms; only such as they have taken from travellers whom they have plundered.

Persia, the seat of learning, of wealth, and of improvement, whilst the greater part of the world had scarcely emerged from barbarism, might naturally be expected to abound in the precious relics of ancient art; and although many such memorials have perished amidst the ruthless devastations of war to which this and other Asiatic countries have been exposed, yet numerous monuments of taste still remain. Of these, the ruins of Persepolis belong to the earliest era of Persian history. It was in this city, which they took a delight in improving and embellishing, as the great metropolis of the East, that Cyrus and his immediate successors resided. It has for centuries presented only a scene of decay and ruin. The most remarkable remains in Persepolis, or, as it is called by the natives, *Istakhar*,[2] *Takht-i-Jamshíd* ("The Throne of Jamshíd"), are the Chihalminar, or forty "minarets or pillars," which are situated about 35 miles N.E. of Shíráz. Sir R. K. Porter recognised in these ruins, *en masse* as well as in detail, a strong resemblance to the architectural taste of Egypt; and he conjectures that some of the architectural ornaments may have been partly brought from that country by the Persian monarchs, as trophies of their victories. These magnificent remains appear to be part of the great castellated palace of Darius, which was set on fire by Alexander whilst he was under the influence of intemperance. They are placed as if in an amphitheatre, on a fine plain, inclosed by semicircular mountains. The terrace on which the ruins of this immense royal citadel or palace are is at the foot of a steep rock called the *Kúh-i-Rahmat*, or "Hill of Mercy," and overlooks the wide plain of Mervdasht. It is nearly 500 yards in length (according to Binning, vol. ii., p. 4), 312 in breadth, and from 10 to 20 high. Its form is irregular, and it faces to the west. "The strength and beauty of its construction," says Sir R. K. Porter, "cannot be exceeded. The steep faces of the rocky terrace are formed of dark-gray marble, cut into gigantic square blocks exquisitely polished, and, without the aid of mortar, fitted to each other with such closeness and precision, that when first completed, the perfected platform must have appeared as part of the solid mountain itself."[3] The exterior wall is built of black stones, much harder than marble, finely polished, and of such a prodigious size, that it is difficult to conceive how the workmen, without the aid of machinery, were able to move them. The only access to the summit of the platform is by a double flight of stairs of a very gentle ascent, on its western side. There are fifty-five steps, each step being 3½ inches in height, formed of blocks of marble so large that each of them is cut into ten or fourteen steps. The first flight of steps leads to an irregular landing-place of 37 feet by 44, from which springs a second double flight of forty-eight steps, which terminate on the ground level of the platform in a second landing-place, occupying 64 feet. On reaching the platform, the first objects that arrest the attention of the traveller are the lofty walls of an enormous portal, the interior faces of which are sculptured into the colossal forms of two immense quadrupeds resembling bulls, which are elevated on a pedestal 5 feet in height. The heads of the animals are entirely mutilated, so that Fraser says it is impossible to determine what species they were intended to represent. Round their necks collars of roses are executed with critical nicety; and over the chest back, and ribs, short curling hair, cut with that peculiar correctness and delicacy of chiselling which Sir R. K. Porter states to be a distinguishing characteristic of the ancient Persian sculpture. The wall that forms one side of this magnificent portal is 5 feet in breadth, 21 feet in length, and 30 feet in height. The one wall is distant from the other about 12 feet, and the space between is flagged with beautifully-polished slabs from the neighbouring rock.

Persia.

Eastward, at the distance of 24 feet in a direct line from the portal, once stood four magnificent columns, of which only two now remain. Their capitals are singularly beautiful. At the distance of 24 feet is a second portal, exactly resembling the former, only that it is 18 feet instead of 21 in length. Its inner sides are adorned with similar sculptures. But the animals here represented are of a gigantic size, and of a monstrous formation; the body and legs of a bull, with similar trappings to those already described, and enormous wings, the feathers of which are exquisitely cut. The heads of the animals, though greatly defaced, show the faces of men; the countenance has a cast of deep gravity, and a long and carefully-curled beard adds to the general majesty. The head is adorned with a diadem, on both sides of which horns are represented winding from the brow upwards towards the front of the crown; the whole being surmounted by a sort of coronet, formed of a range of leaves like the lotus, and bound with a fillet beautifully carved in roses.

Between the right of this portal and the magnificent terrace that supports the range of columns from which it takes its name, there is an area of 162 feet, in which is a cistern hewn out of the solid rock, in dimensions 18 feet by 16. The approach to the terrace is superb, consisting of a double staircase covered with the most beautiful decorations, and projecting considerably before the northern face of the terrace, which is 212 feet in length. At each extremity E. and W. rises another range of steps; and about the middle, projecting from it 18 feet, appear two smaller flights, rising from the same points. The extent of the whole range, including a landing-place of 20 feet, amounts to 86 feet. The ascent is extremely gradual, each flight consisting of some 30 low steps, 4 inches in height, 14 feet in breadth, and 16 in length. The whole front is covered with sculptures so thickly that the eye is bewildered amid the various groups. They consist chiefly of figures and emblematical devices. These sculptures are executed with a nicety of detail which gives them historical interest, as they mark with accuracy the costume of the time and the people, and the form and variety of the armour used at different periods.

But the most splendid division of the ruins is the magnificent colonnade, which occupies the terrace, and which, having survived the devastations of war and the wreck of empires, remains on the desolate plain a most impressive image of departed grandeur. The terrace upon which these pillars stand stretches N. and S. 350 feet, and from E. to W. 380 feet; the greater part of the intervening space being covered with broken capitals, shafts of pillars, and numerous fragments exquisitely sculptured. There were formerly four divisions of columns, namely, a central group of thirty-six pillars, with two rows of six each on

1 Fraser's *Narrative of a Journey into Khorassan*, pp. 256, 267.
2 Gulistán of S'adí, ch. iv., story 12. The word in its first sense means "pool," but it is now obsolete (Binning, vol. ii., p. ii., note).
3 *Travels in Persia, Georgia*, &c., vol. i., p. 583.

either side, as well as in front; in all seventy-two columns. Of the division in advance only one was standing in 1818 when Sir R. Porter visited the spot.[1] About 38 feet from the western edge of the terrace appears the second double range of columns, of which only five remained in 1818. The distance is 268 feet to the corresponding eastern rows, of which only four columns remained in the above year. At a distance of 60 feet from the eastern and western colonnades stood the central range of columns, to the number of thirty-six; but of these no more than five remained at the said period entire. The three exterior double rows of columns are of uniform architecture, and described by Sir R. K. Porter as being perfectly beautiful. "The total height of each column is 60 feet, the circumference of the shaft 16 feet, and its length from the capital to the top 44 feet. The shaft is finely fluted in fifty-two divisions: at its lower extremity begins a cincture and a torus; the former 2 inches, the latter 1 foot in depth. From thence devolves a pedestal, in form of the cup and leaves of a pendant lotus. It rests upon a plinth of 8 inches, and measures in circumference 24 feet 6 inches; the whole, from the cincture to the plinth, comprising a height of 5 feet 10 inches. The capitals which remain, though much injured, suffice to show that they were also surmounted with a double demi-bull. The heads of the bull forming the capitals take the directions of the faces of the respective fronts of the terrace; and I think there can be no doubt that the wide hollow between the necks received a beam, meant to support and connect an entablature, over which has been placed the roof." The dimensions of the central pillars are the same as those of the others, only that they are 55 feet in height, whilst the others are 60 feet. The capitals, however, which surmount them are of quite a different character, being of the same description with that in the great portal where the crowned and winged bull is so conspicuous an object. The two lower divisions of the capital (it being of a triad form) are evidently constructed of the hollowed lotus. The upper compartment has only two volutes. The middle compartment which is one division of lotus, appears to have had some extraneous body introduced into the opening between it and the lower compartment of the flower; and the angular and unfinished state of that side of the capital seems to testify the same. "Here then," says Sir R. K. Porter, "the connecting-line must have been whence the roof could spring."

The nearest building to the palace of the forty pillars occupies a space of 170 feet by 95, and it is approached by a double flight of stairs, which are almost in complete ruin; but from the fragments it appears to have been adorned with sculptures resembling the royal guards and other figures. The side to the E. is so choked up with ruins that no corresponding trace of stairs can be found. To the S. the whole face of the terrace which supports this building is occupied with another superb flight of steps, which terminates in a landing-place 48 feet by 10. Its front is divided by a tablet bearing an arrow-headed inscription, on each side of which are seen spearmen of a gigantic stature. There appear to have been also other apartments with lofty entrances, composed of four solid upright blocks of marble of a colour nearly black, within the portals of which are bas-relief figures of two guards sculptured on the sides of the walls, besides various other figures, one of a monarch clad in royal robes; whilst in other parts there are representations of single combats between a man and a lion, a griffin, or some other imaginary creature. In another division of the same building may be seen a variety of inscriptions, cuneiform, Kúfic, Arabic, and Persian. Still farther to the southward appear other elevations or terraces covered with vast masses of ruin, under which scarcely any traces of the original structure can be discovered; but here may be seen the remains of colonnades of elaborate sculpture. From the extremity of the eastern colonnade on the terrace of Chihal Minár is an expanse of 315 feet, the plain of which is interrupted by an immense pile of ruins, which has the appearance of having been heaped up for centuries, and which Sir R. K. Porter conjectures to cover a division of the palace answerable to that immediately to the S., and containing, as he supposes, the banqueting-chambers and other apartments; and this conjecture he supports by many special reasons and learned authorities. South of this is another terrace, on which he supposes that there stood those portions of the palace in which the monarch resided. Here are the bases and plinths of pillars, and fragments of beautiful sculpture, scattered about. The ponderous doorways and huge marble frames are yet in their places; they are of the finest workmanship, and are adorned with sculptures and figures such as those which have been already noticed, and of which our limits do not admit of a more detailed description. A considerable way N. from the columns stands a structure which is next in extent to the *Chihal Minár*, or the "Palace of the Forty Pillars." It is a perfect square of 210 feet on each side, and is entered by two doorways on each side, and by a grand portal 13 feet in width, whilst the others are only 7. These are all richly adorned with sculptures, representing scenes of state or of royal parade, or emblematical figures of lions and imaginary animals.

Among other remarkable antiquities of Persia, the tombs, supposed to be those of her ancient kings,—namely, Cyrus and his posterity,—have attracted the particular attention of travellers. These excavations or tombs are generally cut out of the solid rock. About 500 yards eastward from the Hall of Columns, in the face of the mountain, is found a niche 72 feet in breadth by 130 feet in height, divided into two compartments, and covered, as usual, with sculptures of nondescript animals, royal personages, and symbolical figures. Three quarters of a mile southward from Takht-i-Jamshíd, a tomb was discovered by Niebuhr, and visited by Morier, which seemed to have no entrance, from which he supposes that those receptacles for the dead were entered by subterranean passages. The sepulchres of Naksh-i-Rustam, which have been visited by various European travellers, are also very curious. There are four excavations cut out of the perpendicular cliff, at the height, according to Sir R. K. Porter, of 60 feet from the ground. The one he examined, and to which he was drawn up by ropes, consists of an excavation in the solid rock of about 14 feet, in the form of something like a Greek cross. The length of the cave, which forms the whole tomb, is 34 feet, and the height 9. It is adorned, like all the other ancient monuments, with a variety of richly-sculptured figures of men and animals, and emblematical devices. There are likewise numerous remains of antiquity in the plains of Murghâb, 49 miles N.N.E. of the ruins of Persepolis, and probably belonging to the same era, which are fully described by Morier and Porter. The most remarkable of these is the supposed tomb of Cyrus; an interesting monument, of which the latter writer gives an account with his usual accuracy. It is surrounded by other ruins, which bear traces of the same antiquity, as they contain numerous inscriptions in the ancient arrow-headed character.

The very curious sculptures on the mountain called Bí-Sitún have already been noticed. Some have thought the words mean "without pillars;" but it is probably a corrup-

[1] Pietro della Vallé was the first European who visited Istakhar. This was in 1621, and 25 pillars were then standing. In 1809 Morier found but 16.

Persia.

tion of a more ancient designation. Just over the fountain-head of a beautifully clear stream, which bursts from the mountain about 50 yards from this rocky platform, are seen the remains of an immense piece of sculpture, so greatly defaced that no continued outline can now be made out; but by close examination the rude forms of several colossal figures may be traced. The principal cause of the mutilation seems to be, that additions have been made to the original. In one place a Greek inscription has been introduced, and has, in its turn, been erased to make way for one in Arabic. These rude sculptures are generally supposed to be of high antiquity, some referring them to the age of Semiramis. Above these appears an interesting piece of sculpture, containing fourteen figures, one of a king trampling on a prostrate body, probably of some of his captives. He has a diadem and all the other badges of sovereignty; and a row of nine persons, having their hands bound behind them, and being themselves bound together by a cord round their necks, are seen approaching him in a suppliant posture, and with a dejected expression. Sir R. K. Porter supposes that these ten persons, including the one under the feet of the monarch, represent the ten tribes which were carried into captivity; and the design of the sculpture, which is executed in a style not inferior to any at Persepolis, is to commemorate the final conquest of Israel by Salmanaser, King of Assyria and the Medes. Above the head of each individual is a compartment with an inscription in the arrow-headed writing, full translations of which will be found in Rawlinson's *Herodotus*, vol. ii., p. 590.

There are other monuments of antiquity, as at Táki Bústán, already noticed, and at Sháhpúr, which belong to the era of the Sassanian kings, and which afford important and curious illustrations of these times. Fifteen miles north of Kázarún are the ruins of Sháhpúr, once the capital of Persia. At the entrance of the valley where it is situated stands an insulated hill, which exhibits portions of its ancient walls and towers; and the precipitous cliffs are carved with sculptures. On the southern side of the river which waters the plains, a much-mutilated bas-relief is carved on the surface of the rock, consisting of two colossal equestrian figures. Their height appears to be about 15 feet. A tablet, divided into three compartments, contains the second sculpture. In the central compartment is an equestrian figure, with the usual badges of Sassanian sovereignty. A suppliant is on his knees before the horse's head, his hands extended, and his face expressive of entreaty; whilst another figure with Egyptian features stands, likewise in the attitude of a suppliant, to the right of this compartment. The right-hand section contains three figures in attitudes of supplication. A greater number of tablets are still to be seen on the opposite side of the river. They contain various figures and designs, one of which is an elaborate representation of the triumph of a Persian over a Roman army. Colossal horsemen are pictured on others, with the royal emblems of Persia. In the Sháhpúr valley is a mountain, which is crowned by a perpendicular precipice of limestone 700 feet in height. Here is a cavern of enormous extent, its communication intricate and endless, with every form and variety of stalactites diversifying the different chambers, some of which are wonderfully lofty and spacious, and, when entered by torch-light, present the most brilliant reflection of all sorts of fantastic shapes. The entrance to the cave is about 140 feet above the base of the precipice; and here, in a spacious archway 150 feet broad, and nearly 40 feet in height, within which is a sort of natural ante-chamber, stands the pedestal of a statue, which lies mutilated and prostrate, with the head downwards. Both have been cut out of the solid rock. The figure, which, when erect, must have been from 15 to 20 feet in height, represents some one of the Sassanian kings — Sháhpúr, as is supposed. There are various other Sassanian relics in the vicinity of Persepolis,—namely, the tombs of the kings, where the sculptures, by the natives called Naksh-i-Rustam, are to be found; also the sculptures named Naksh-i-Rajib. The sculptures of Naksh-i-Rustam are contained in six tablets cut on the perpendicular rock, and containing many bas-reliefs of the triumphs or victories of the Persian arms under the Sassanian kings, with figures of the sovereign in various attitudes, and of horsemen engaged in hostile collision. The sculptures at Naksh-i-Rajib consist of three tablets containing seven colossal and two diminutive figures. One of the sovereigns is on horseback in his greatest pomp; and underneath is a Greek inscription, which has been restored and translated by M. de Sacy. It runs thus:—"This is the resemblance of the servant of Ormazd, the divine Sháhpúr, king of kings, of Irán and An-Irán, of the race of the gods, son of the servant of Ormazd, the divine Artaxares, king of kings, of Irán and An-Irán, of the race of the gods, grandson of the divine Babek the king." The remaining tablet contains but a repetition of the two horsemen holding a ring. There are other ancient monuments in different parts of Persia, consisting of sculptured rocks and other remains resembling Druidical erections.

History.

The early history of Persia is lost in remote antiquity, and for authentic accounts, the uncertain gleanings of oral tradition, or the fictions of poets, have been substituted. The *Sháhnámah* of Firdausí, the Homer of Persia, a legendary history of the Persian kings, composed of such materials, comprises all the information possessed by the Asiatic writers prior to the Muhammadan conquest. From this poem, and similar authorities, Sir J. Malcolm has compiled the early annals of Persia, and to it we refer our readers for some account of that dim era.

It will be sufficient here to mention that, according to the *Dábistán*, there were four dynasties before Kaiúmars, whom the Muhammadan histories, such as the *Zínatu-t-tawárikh* declare to have been the grandson of Noah, or Noah himself. These four dynasties, viz.,—1. That of Máhábád; 2. The Jaianian; 3. That of Sháh Kalív; and 4. That of Yessán,—are purely fabulous. The dynasty founded by Kaiúmars is called the Píshdádyan, and must be regarded as legendary and pre-historic, though doubtless there is a basis of truth in what is said regarding it in the *Sháhnámah*, of which it forms the sole subject. The kings were—1. Kaiúmars; 2. Húsbang, the discoverer of fire, and inventor of useful arts; 3. Tahmúras, the legendary founder of Babylon, Nineveh, and Isfahán; 4. Jamshíd, the founder of Istakhar or Persepolis, and inventor of wine; 5. Zahhák, the Syrian or Arabian, whom some take to be Nimrod; 6. Farídún; 7. Minúchihr; 8. Nauzar; 9. Afrásiáb; 10. Zú; 11. Karshasp; 12. Afrásiáb II., who was defeated by Rustam, and the victor placed Kai Kubád, a descendant of Minúchihr, on the throne, and with this prince commenced the Kaianian, or second dynasty, the monarchs belonging to which bore the following names:—1. Kai Kubád; 2. Kai Káús; 3. Kai Khusrau; 4. Luhrásp; 5. Gashtásp, in whose reign Zartasht or Zoroaster introduced the fire-worship; 6. Bahman, or Ardashír Dirázdast; 7. Dárá I.; 8. Dárá II., or Darius Codomanus of the Greeks.

From the evidence of the cuneiform inscriptions, and other monuments,[1] the true history of the rise of the Persian power appears to be as follows:—At a very remote period, during the existence of a powerful Assyrian monarchy, there took place a great migration of the Arian nation westward from beyond the Indus towards Persia and Media. In 880 B.C., the migration being still incomplete, that part of the Arian nation which was subsequently called the Medes encountered a great Assyrian king named Shal-Manuhara, whose history is recorded in the cuneiform character on a black obelisk, and has been deciphered. From this period, a struggle continued between the Medes and Assyrians till B.C. 710, when Sargon, the third king of the Lower Assyrian empire, completely subdued the newly-arrived tribe, and planted a number of cities in their territory, some of which were filled with Israelites, whom Sargon had carried off from Samaria. The Medes, however, constantly endeavoured to assert their independence; and in B.C. 633 Cyaxares shook off the Assyrian yoke, and, having taken Nineveh in B.C. 625, laid the foundation of the Arian empire, which, sixty-

[1] Rawlinson's *Herodotus*, vol. i., p. 406.

Persia.

seven years afterwards, was fully established by Cyrus. It has been shown by Mr Grote, in his History of Greece, vol iii., pp 307, 308, that the account given us by Herodotus of Deioces is foreign to the oriental character, and savours far more of the Greek; and Colonel Rawlinson remarks that the very name of Deioces is a mere repetition of that of Astyages, the one being a corruption of *Dahák*, "biting," and the other *Aj-dahák*, "the biting snake."[1] Further, it does not seem [illegible] Cyaxares would have been so universally regarded as [illegible] of the Median empire, had he been preceded by Phraortes. On the whole, therefore, it seems reasonable to consider what is said of the two first-named kings as mere fiction, and to look upon Cyaxares as the first leader of the Arian hordes, who founded a kingdom after their migration westward from the Indus, and the same as the Kai Kubád of the Persian writers. Kai Káús, then, would be Darius the Mede of the book of Daniel, that is, Cyaxares, grandson of the first Cyaxares, and son of Astyages by Ariene, the daughter of Alyattis, King of Lydia; and Kai Khusrau is Cyrus. Luhurasp, who is called in the inscriptions Kabaijiya, and Gashtásp, or Kishtásp, must be regarded as the same as Cambyses and Darius Hystaspes, and the Pseudo-Smerdis is called in the Bisitún inscriptions Gaumáta Gomates. It is very remarkable that there is no mention of Xerxes, or of his famous expedition to Greece, to be found in the Persian writers or the legends of that country. Instead of Xerxes, a Queen Homai is mentioned as having reigned thirty years in succession to Bahman or Ardishir Dirázdast, the Artaxerxes Longimanus of the Greeks. A further examination of the inscriptions is required to unravel these difficulties, and also to reconcile the Persian account of Alexander the Great with that which has been adopted from the Greek writers. According to the former, Alexander was the elder brother of Dárá or Darius II., being the son of Dárá I. by the daughter of Philip of Macedon. In the meantime, enough has been discovered to show that there is much fiction in the accounts of this Persian dynasty furnished by the Greeks. With these preliminary remarks, we proceed briefly to notice the chief circumstances mentioned by those writers.

Arbaces, according to Prideaux, who makes this prince the Tiglath-Pileser of Scripture, was the first sovereign of Media. He flourished B.C. 747, and conspired with Belesis, governor of Babylon, and other nobles, against Sardanapalus, with whose death terminated the Assyrian monarchy. Without attempting to reconcile this view with that which makes Deioces the first, or that which, regarding Deioces as a fabulous character, substitutes Cyaxares for him, we proceed to note the statements of the Greek historians. Cyrus, according to them, was the chief of a pastoral horde, who, quitting their own comparatively barren and unproductive country, subdued the territories of their wealthy and luxurious neighbours. He was the conqueror of Babylon, and on the ruins of that great kingdom founded that of Persia, which was gradually extended by conquest from the Mediterranean to the Indus and the Oxus. Cyrus was succeeded, in the year 529 before Christ, by Cambyses, the Ahasuerus of the Scriptures, who gave himself up to sensuality and cruelty. Still he extended his empire, having reduced Egypt to the state of a colony, and also conquered a great part of Northern Africa. Pseudo-Smerdis, feigning himself to be the brother of Cambyses, who had been murdered, was by a faction of the Magi raised to the throne B.C. 522. Otanes, a Persian nobleman, finding out the deceit, conspired with six other chiefs, who agreed to assassinate him, which they effected, after he had reigned eight months. Along with him they put to death a number of the Magi; and having decided on a monarchical form of government, they resolved to assemble next morning at sunrise without the city, on horseback; and it was agreed that he whose horse should neigh first should be chosen king. The well-known trick of Æbares, the groom of Darius Hystaspes, secured the throne to his master, 521. He brought his master's horse the evening before, with a mare, to the appointed spot; and the horse, as soon as he arrived next morning, recollecting the mare, neighed, and he was immediately saluted king. The Greek character and fabrication of these tales is self-evident. Darius Hystaspes reigned over Persia thirty-six years, and was distinguished as a legislator as well as a conqueror. He divided the country into nineteen satrapies or provinces, each liable for the payment of a fixed tribute. Over these provinces satraps were sent to preside, with the delegated authority of the king. Their duties were, to collect the revenue, to improve agriculture, and to perform all the royal commands. They were afterwards invested with military commands; and securities were devised against their usurpation of independent authority. An establishment of couriers was at the same time instituted, for expediting orders through every part of the empire. A regular and efficient military force was also organized by this monarch, and maintained at the expense of the different provinces. In process of time, Grecian mercenaries were taken into pay; and, when the country was engaged in war, the army was recruited from the people.

Persia.

The reign of Darius was distinguished by several important warlike expeditions. Crossing the Thracian Bosphorus, he invaded Europe with 700,000 troops. But the Scythian tribes between the Danube and the Don successfully resisted his attack, and forced him to retreat with loss. He then overran the territories of Thrace and Macedonia, and left Megabyzus to complete the subjection of those provinces. He next invaded the countries to the east of Persia with a powerful army, and conquered some of the countries bordering on the Indus, which he formed into a twentieth satrapy, under the name of India; and his vast armies were also sent to overwhelm the rising communities of Greece. But his troops, though they far outnumbered their enemies, were completely overthrown on the plains of Marathon by the forces of the Greeks. Amidst these disasters the reign of this monarch terminated; and he was succeeded by his son Xerxes B.C. 486.

Xerxes carried on a successful war against the Egyptians, whom he gave over to the vengeance of his brother Achæmenes; and he resolved to avenge himself on the Greeks. With this view, he fitted out a mighty armament, in which he embarked an army amounting to 3,000,000 of troops, or, with all the camp followers, to above 5,000,000;[2] and with this vast force he resolved to annihilate the independence and liberties of Greece at a single blow. But he was met by the devoted bands of Grecian patriots, and experienced a severe check at the celebrated pass of Thermopylæ, which was defended by 300 Spartans against his whole army, and which he only carried by an immense sacrifice of men; and his fleet and army were finally overthrown at Salamis, Platæa, and Mycale, he himself escaping from the scene of action in a miserable fishing-boat. He was assassinated, after a reign of twenty-one years.

He was succeeded, in 464, by his grandson Artaxerxes Longimanus, the Ardishír Dirázdast, or Longhands of the Persian historians. He is celebrated for the internal regulation of his empire, and for the intelligence which he acquired relative to all the concerns of the kingdom, by means of the agents whom he employed. He is represented by some as the Ahasuerus of the Scriptures, because he is said to have treated the Jews with lenity and kindness, and to have married one of that nation. The two succeeding sovereigns were Xerxes II. and Darius II. whose reigns were short. The latter was succeeded in 605 by Artaxerxes Mnemon, his eldest son, who had to contend for the crown with his younger brother Cyrus. It was in his reign that the famous retreat of the Ten Thousand took place under Xenophon, who has given a narrative of the expedition. His reign, which continued twenty years, was a scene of intrigue, in which favourites bore the chief sway, and during which those symptoms of decay became visible which terminated at last in the overthrow of the kingdom. He was succeeded by Darius or Dárá I., who reigned only twelve years. In the year 336 B.C., Darius Codomanus, or Dárá II. of the Persian historians, assumed the sceptre. It was in his reign that Alexander of Macedonia, having subdued the different principalities of Greece, and consolidated their power into one, invaded Persia. He crossed the Hellespont in the year 334 B.C., with a well-disciplined and veteran force of 35,000 men, and encountered and defeated the Persian host on the banks of the Granicus. The hasty levies of Persia were again routed in the fatal battle of Issus, in which 100,000 were slain; and the family of Darius fell into the victor's hands. The battle of Arbela, which succeeded, completed the triumph of Alexander. The Persian armies were routed and dispersed, and the unfortunate Darius, flying from the field of battle, was seized by his nobles, at the head of whom was Bessus, who bound him in golden chains, and were carrying him to Bactriana in a car covered with skins; but being overtaken by the conqueror, they stabbed their victim to the heart, and left him in the chariot weltering in his blood. With Darius terminated the dynasty of Cyrus, which had subsisted 206 years, according to the Greek writers.

After the death of Alexander, Asia continued for a long period a scene of war and commotion, owing to the contests which arose amongst his successors for the dominion of the country. But about the year 307 B.C. Seleucus Nicator by his success had acquired the dominion of all the countries which lie between the Euphrates, the Indus, and the Oxus, and had even carried his victorious arms to the Ganges, and established a friendly alliance with Sandrocottus, or Chandra Gupta, King of Pataliputra, who reigned on the Ganges, near Alláhábád. In B.C. 279 Seleucus was succeeded by Antiochus Soter, who again, in 261, was succeeded by Antiochus

[1] Rawlinson's *Herodotus*, vol. i., p. 408, note.

[2] The absurdity of these numbers needs no comment.

Persia.

Theus. In the eleventh year of his reign, or, according to Thomas,[1] in 255, the Parthians revolted under Arsaces, who founded the third Persian dynasty, the Arsacidæ or Ashkanians,—Ashk being the name given to Arsaces by the Persians. Arsaces, enraged at an affront offered to Tiridates his brother, put the governor of Parthia, Agathocles, to death, and declared himself independent.

The following, as given by Thomas, vol. ii, p. 299, is the list of the Ashkanian kings, of whose authentic history little is known :—

	B.C.		A.D.
1. Ashk, or Arsaces I.	255	19. Artabanus III	13
2. Tiridates I., or Ashk II.	253	Tiridates III	
3. Artabanus I., or Shahpúr.	216	Cinnamus	
4. Phraapatius	196	Artabanus III.	
5 Phrahates I.	181	20. Bardanes	42
6 Mithradates I.	173	21. Gotarzes, or Bahram Gudarz	45
7. Phrahates II.	136	22. Meherdates	50
8. Artabanus II.	126	23. Vonones II.	51
9. Mithradates II.	123	24. Vologeses I., or Volas	51
10. Mnaskires	80	25. Artabanus IV., or Hormúz	62
11. Sinatroces	77	26. Pacorus or Firúz	77
12. Phrahates III.	70	27. Chosroes or Khusrau	108
13. Mithradates III	60	28. Parthamaspates	115
14. Orodes I.	54	29. Chosroes restored	116
15. Phrahates IV.	37	30. Vologeses II., or Volas	121
	A.D.	31 Vologeses III., or Volasin	148
16. Phrahataces	4	32. Vologeses IV.	192
17. Orodes II.	5	33. Vologeses V.	209
18. Vonones I.	5	ArtabanusV., or Arduan	
34. Artaxerxes, King of Persia, first of the Sassanidæ			235

The alternative appellations are those given by the Persian historians, who, it will be seen, omit the majority of these princes altogether. They are also silent as to the wars between this dynasty and the Romans. We learn, however, from the historians of the West that Pacorus, the 26th king, sent an embassy to Sylla in A.D. 90; and that in A.D. 53, Crassus, having passed the Euphrates a second time to carry on a war he had commenced against the Parthians, was defeated and slain, with 20,000 of his men, and 10,000 were made prisoners. Next year Cassius, his quæstor, who had carried off the remains of the army, repelled from Syria an invading Parthian army; and in 51, on their returning and besieging Antioch, he defeated them again with great slaughter. In the years 41 and 40, however, they returned and conquered all Syria, and took Jerusalem, slew Phasael, made Hyrcanus prisoner, and settled Antigonus on the throne of Judea. In 39 Ventidius defeated the Parthians in a great battle, and drove them out of Syria; and in 36, Antony having invaded Parthia, was repulsed with the loss of the larger portion of his army. In 20 B.C. the Parthian king sent an embassy to Augustus to seek his friendship, and restored the standards taken from Crassus and Antony, and all the surviving prisoners.

In 165 A.D. the generals of the Emperor Marcus took Seleucia, which had become the Parthian capital, and put 300,000 of the inhabitants to death. They at the same time pillaged and destroyed Ctesiphon; but this latter city, in 198, had become so populous and strong, that it maintained an obstinate defence against the Emperor Severus, and, when stormed, supplied him with 100,000 captives. Even after this, Ctesiphon recovered, and became the winter residence of the Parthian monarchs. About the year 217, the Emperor Macrinus purchased a disgraceful peace for Parthia by the payment of a sum equivalent to three millions of our money. This is all that is known of a period which is justly declared by D'Herbelot to be the most obscure in Persian history.

The Sassanian dynasty of kings forms a new era in the history of Persia. These monarchs were engaged in long and bloody wars with the Roman emperors; and hence we are enabled to correct the imperfect records of the East by the authentic narrative of the Roman historians. The first of these, Artaxerxes, or Ardishír, as he is called by the Persian historians, began his reign A.D. 226, and, having pacified the province of Fárs, made himself master of 'Irák. Having defeated and slain Aravan or Artabanus, who ruled over the mountainous country about Hamadán and Karmánsháh, he was hailed in the field with the title of *Sháhansháh*, or "King of Kings,"—a name which has ever since been assumed by the sovereigns of Persia. In the course of his reign he extended and consolidated his newly-acquired dominions, and waged, with various success, a war with the Roman emperor Alexander. He laboured to restore the religion of Zoroaster, and the authority of the Magi, which he enforced by the most sanguinary decrees. He was succeeded by his son Sháhpúr or Sapor, A.D. 238, who carried on a successful war against the Romans, whose emperor, Valerian, in an attempt to relieve Edessa, was defeated and taken prisoner. Sháhpúr gained many victories over the Roman armies; but towards the latter part of his reign he suffered reverses. His army was attacked by Odenathus, prince of Palmyra; and his country was afterwards invaded by Aurelian, the warlike Emperor of Rome Hurmuzd his son, the Hormisdas of Greek authors, reigned only one year, and was succeeded by Bahrám or Varanes I in 271, who evinced his zeal for the ancient religion of Persia by the execution of Mani, founder of the sect of Manicheans. He reigned three years and three months, and was succeeded by Bahrám or Varanes II., a weak prince He engaged in a war with the Emperor Carus, who conquered Mesopotamia, carried his arms across the Tigris, and made himself master of Ctesiphon. Bahrám or Varanes III. reigned only three months. His brother Nársi (the Narses of the Greeks) reigned nine years, and abdicated in favour of his son Hurmuzd or Hormisdas II. He subdued Armenia, and signally defeated the Emperor Galerius on the same fatal field on which Crassus had been slain. The Romans invaded Persia next year, and defeated Narses, who fled, leaving his tents and family in possession of the conquerors. An inglorious peace followed, by which Mesopotamia and five districts to the eastward of the Tigris were ceded to the Romans No events of any consequence occurred during the succeeding reign of Hurmuzd II. He was succeeded in 308 by Sháhpúr or Sapor II., who was crowned king from his birth, and during a reign of seventy-one years maintained the integrity of his kingdom. His first operations were directed against the Arab tribes, on whom he took a severe vengeance for having invaded his territories. He was involved in bloody wars with the Romans, in the course of which he experienced serious reverses. Constantine advanced into Persia with a formidable army, and was joined by the Arab forces. A dreadful conflict took place, in which the Persian army was routed with great slaughter; and the king himself narrowly escaped, with a few followers, from the fatal field. But having recruited his army, he again took the field; and in a night attack he recovered some of the advantages which he had lost. He was also successful in repelling the invasion of Julian, who was killed by an arrow; and his successor Jovian was fain to purchase a peace by the loss of all the provinces east of the Tigris, which had been ceded in the former reign. He was succeeded by Ardishír or Artaxerxes II, who was deposed by Sháhpúr, the son of the late monarch, after a reign of four years. He reigned only five years, when he was killed by the fall of a tent, which was blown down by one of those whirlwinds which sometimes occur in Persia. Bahrám or Varanes IV., who succeeded, reigned eleven years, and was at length killed in 399 by an arrow, in endeavouring to quell a tumult in his army. The throne of Persia was next filled by Yezdijird, the Greek Isdegerde. He is very differently represented by the Persians and Greeks; by the former as cruel and abandoned to luxury, and by the latter as wise and virtuous. He was killed by a kick of his horse, after a reign of twenty years. Bahrám Gúr, or Varanes V., succeeded, and became celebrated for his munificence and generosity His dominions were invaded, and partly overrun, by the Tátárs, who, being flushed with their conquest, gave themselves over to a false security, and were one night surprised and defeated with great slaughter by Bahrám. The only fruit which he sought from this victory was peace with all his neighbours, after which he returned to his capital. He was engaged in wars with the Romans under Theodosius, in which neither party had any cause to boast. His ruling passion was the chase, and he was fond of hunting the wild ass; and it was in pursuit of one of these animals that he lost his life in a deep pool near Ausepas, about three marches from Shíráz, on the road to Isfahán.[2] According to the *Sháhnámah*, however, and other authorities, he died a natural death. He was succeeded in 440 by his son Yezdijird II., who followed his father's footsteps, and during his reign of eighteen years was only once engaged in war with the Romans. The succession to the throne was now disputed between Hurmuzd or Hormisdas III., the younger son of Yezdijird, who was appointed heir by his father, and Fírúz or Perose the Elder, who, being supported by an army of Tátárs, to whose king he fled for support, and by the chief nobles, succeeded in wresting the sceptre from his brother's hand, and in putting him to death, after reigning a year. He lost his life in an expedition which he undertook against the Tátár prince, by whom he had been treated with so much generosity. Ballas or Palash, the son of Fírúz, now ascended the throne (485), and was succeeded by Kubád or Cavades, who, though he was dethroned by his discontented subjects, re-conquered his lost dignity. He carried on a successful war with Anastasius the Roman emperor, and died, after a long and troublous reign, in 531.

His son and successor Khusrau Núshírván, or Chosroes, is celebrated by the Persian historians as a model of justice, generosity, and sound policy. He is said to have been the fruit of a casual amour of Kubád, who, flying from his brother Fírúz, then established on the throne, halted for a night with a beautiful girl at

[1] *Indian Antiquities*, vol. ii., p. 299.

[2] Binning, vol. ii., p. 357.

Naishápúr. Four years afterwards, on his return to that city, his fair mistress presented him with a boy, who was one day to reign so gloriously on the Persian throne. His first care after his accession to the sovereignty was to extirpate the pernicious sect of Mazdak, encouraged by his father, one of whose leading tenets was a community of property and of women. The founder of the sect and many of his followers were put to death; and the women and property which they had appropriated were restored to those to whom they belonged. He was indefatigable in promoting the prosperity of his dominions, in building and repairing bridges, in restoring and re-peopling decayed towns and villages, in founding schools and colleges, and in giving every degree of encouragement to learned men and even to the Greek philosophers who resorted to his court. His empire was divided into four great governments—namely, 1st, Khurásán, Sístán, and Karmán; 2d, The lands dependent on the cities of Isfahán and Kum, the provinces of Gilán, Azirbiján, and Armenia; 3d, The provinces of Fárs and Ahwáz, and 4th, 'Irák, which extended to the frontier of the Roman empire. A well-digested system of provincial government was introduced into those provinces, and every check adopted that could prevent the abuse of power. He imposed a fixed and moderate land-tax all over his dominions, and a capitation-tax on the Jews and Christians; and the strictest regulations were adopted for preserving the discipline of his army. The reign of Núshírván was illustrated as well by his conquests abroad as by his wise policy at home. He compelled Justinian to conclude a disgraceful peace at the price of 30,000 pieces of gold; and the reduction of Syria, the capture of Antioch, and the advance of the Persian armies to the shores of the Mediterranean, attest his triumphant reign. Though he was checked in his career of conquest towards the west, yet his sway was finally extended over the countries beyond the Oxus, some provinces of India, and the finest districts of Arabia. He reached the advanced age of more than eighty years.

Hurmuzd or Hormisdas IV., the son of Núshírván, ascended the throne in 579. His administration was wise and prosperous for a time, whilst he acted under the advice of his preceptor; but on the death of the latter, he fell into every excess, and, after a short and disastrous reign, was dethroned and put to death by one of his generals, Bahrám Chúbín, who usurped the supreme authority. But Khusrau Parvíz, or Chosroes II., the son of the late king, flying to the Roman emperor Maurice, his adopted father, was, by his assistance, re-instated in the throne (591), and Bahrám was forced to seek refuge amongst the Tátárs, whose armies he had formerly defeated, and amongst whom he died. The new monarch showed his gratitude to the Roman emperor by scrupulously fulfilling all the engagements he had contracted with him. He surrendered Dárá and several other strong places on the frontier, and, besides, sent him costly presents. But no sooner did he hear of the death of Maurice, than he invaded the Roman territories with a large army; pillaged and destroyed Dárá, Mardin, Edessa, and Amida; laid waste Syria; took the holy city of Jerusalem; and set on fire the magnificent churches of St Helena and Constantine. The true cross, which had been inclosed in a golden case, and buried deep in the earth, was discovered, and borne in triumph to Persia; and a crowd of captive priests and bishops swelled the train of the conqueror. Egypt was added to his other conquests; his troops entered Alexandria in triumph; and, after carrying his victorious arms westward to Carthage and Tripoli, and finally extirpating the Greek colonies of Cyrene, he returned in triumph through the sands of the Libyan desert. In the same campaign another army advanced from the Euphrates to the Thracian Bosphorus; and, after taking Chalcedon, his victorious troops remained encamped for twelve years in the vicinity of Constantinople. But, whilst his generals and his armies were thus gaining laurels in the field, Khusrau was indulging at home in the most unheard-of luxury. Every season a splendid palace was raised; and his thrones were made of the most exquisite materials, one being formed to represent the twelve signs of the zodiac and the hours of the day. His treasures; his wives, amounting to 12,000, besides the incomparable Shírín, or Irene the daughter of Maurice; his horses, amounting to 50,000; his Arabian charger of surpassing fleetness; and his musician Barbud,—furnish inexhaustible topics for the pen of the historian, and for the hyperbolical praises of his countrymen. But his reign, hitherto glorious, was, towards its termination, closed with misfortunes. Herodius, the Roman emperor, alike remarkable for luxury and indulgence in the palace, and for valour and military skill in the field, was roused to a sense of the public danger by the victories of Khusrau, and with a powerful army suddenly invaded Persia. In the course of six years he succeeded in stripping the Persian king of all his foreign conquests; he defeated his armies in every encounter; marched without opposition into the heart of his country; destroyed his splendid palaces, and plundered his hoarded treasures. His subjects, headed by his own son, at last rebelled against him, and put him to death, after a reign of thirty-eight years. Persia, after the death of this prince until the accession of Yezdijird III. in 632, was a scene of confusion and misery, from the combined evils of famine, the contentions of the nobles, a succession of weak sovereigns, or rather, as Sir J. Malcolm terms them, pageants of power, and from the threatened attack of the Arabian tribes, who, under the standard of the Muhammadan faith, had now become very formidable to all surrounding states. In their first attacks on the Persians, the Muslim armies were repulsed, and their leader Abú Obaid was slain. The Arabs, reinforced, were again defeated by Mehrán the Persian general. But in another action the Persians were defeated, and their general slain. Yezdijird, who was now elevated to the throne, was the last hope of the sinking state. An ambassador was sent to him from the Arabian tribes, proffering peace on condition that he should accept of their religion, and pay the taxes which all believers are bound to pay. These terms were rejected with disdain. Great armies were now assembled on both sides; they met on the plains of Náhávand, A.D. 641, where the Muhammadans gained a remarkable victory that for ever decided the fate of Persia. The Persians brought 150,000 men into the field,[1] of whom 30,000 perished on the field, and many more were drowned in a deep trench which surrounded the camp. Persia, from this date, fell under the dominion of the Arabian khalifs. Yezdijird, the last monarch of the Sassanian line, fled from the field of battle to Sístán, to Khurásán, and lastly to Marv, from which being also forced to fly, he concealed himself in a mill eight miles distant. But the miller, tempted by his rich robes and armour, murdered him whilst he slept, and thus ended, A.D. 651, the dynasty of the Sassanides, and the Magian religion, which had existed in Persia for 1200 years.

After the flight of Yezdijird, the armies of Persia, scattered and discouraged, were able to oppose only a feeble resistance to the hardy children of the desert, skilfully commanded, and, besides, inflamed by a fanatic enthusiasm: and in a short time, accordingly, they overran and laid waste the whole country with a bigoted fury that had no parallel, sparing neither sex nor age, and subverting in one common ruin the laws, manners, and most sacred institutions of the country. Many were contented to purchase life by embracing the new faith; and others fled to the mountains and fastnesses of the country, or to a distant land. "The progress of the conquerors," says Sir John Malcolm, "was rapid and wonderful; colonies from the burning deserts of Arabia were extended over the cold countries of Khorassan and Balkh; and they flourished on the soil to which they were transplanted."[2] The conquest of the country being completed, it was divided into different provinces, over which lieutenants were appointed; and it was thus held for more than two centuries under the dominion of the khalifs. Towards the year 868 A.D. the dominion of the khalifs began to totter to its fall. In that year an adventurer expelled the governor of the khalifs from Persia. He was Yákúb-bin-Lais (or *Suffár*, whence this dynasty was called the Suffarides), the son of a pewterer of the name of Lais, in Sístán. He worked, when young, at his father's trade; but he was prodigal of his money; and, tempted by his necessities, he became the leader of a desperate band, which gradually increased with the success of his enterprises. He soon attained power and consideration; and his aid was solicited by Sálah-ibn-i-Násir, the ruler of Sístán, against his fellow-ruler of Khurásán. He was afterwards raised to be commander of Sálah's army; and the first use he made of his power was to seize on the chief who had conferred it on him, and to send him to Baghdád,—a service for which he claimed and received the government of his native province, as the servant and lieutenant of the Faithful. He afterwards took the important fortress of Hírát, reduced the province of Karmán, marched thence to Shíráz, and finally made himself master of the greater part of Persia. The khalíf, secretly dreading his power, sent him a formal investiture of certain territories as governor, which he rejected with disdain. In A.D. 873 the Khalíf Muhammad declared Yákúb a rebel, upon which that ambitious chief marched against Baghdád, but was obliged to retire with the loss of the greater part of his army. In 877 he marched again to the attack, but was overtaken by disease, and died, leaving almost the whole kingdom of Persia to his brother 'Amrú, who reigned twenty-three years, but was defeated and taken prisoner by Isma'íl-bin-Ahmad, a Tátár chief with whom he was at war, and, being sent to Baghdád, was there executed. With Amrú fell the fortunes of his family; and though two more princes maintained a precarious authority, the empire of Persia was divided between two families, Sámání and Dilamí. The power of the first extended over Khurásán, Sístán, Balkh, Transoxiana, including the cities of Bukhára and Samarkand. The Dilamí princes exercised sovereign power over the greater part of 'Irák, Fárs, Karmán, Khuzistán, and Láris-

[1] Ouseley's *Travels*, vol. iii., p. 3.

[2] *History of Persia*, vol. i., chap. viii.

tán. The following is the list of the Sámánides and Dilamites. Their names are as follows:—

Samanian or Samaní Dynasty.

	A.D.
1. Nasr-bin-Ahmad	874–5
2. Ism'aíl-bin-Ahmad	892
3. Ahmad-bin-Ism'aíl	907
4. Nasr-bin-Ahmad	914
5. Núh-bin-Nasr	943
6. A'bd-ul-Malik-bin-Núh	954
7. Al-Mansur-bin-Núh	961
8. Núh-bin-Al-Mansúr	976
9. Al-Mansúr-bin-Núh, deposed and blinded	997
10. A'bd-ul-Malik-bin-Núh	[illegible]99
11. Ism'aíl-bin-Nuh, killed	1005

Dilamites.

	A.D.
1. 'Ali [illegible]	[illegible]
2. Rukun'd-[illegible]	[illegible]
3. 'Izzu'd-daulah, who, after a short time is deposed by Azadu'd-daulah, who constructed the Band-amir, or famous dam near Persepolis	977
4. Samaniu'd-daulah	982
5. Majidu'd-daulah, taken prisoner by Mahmúd of Ghazni	1007
6. Malik Rahim, made prisoner by Togral Bey Seljuki	1055
7. The last of the race dies in the service of Alp Aslan.	1094

Of the Sámánian dynasty, Ism'aíl was the most celebrated. His grandfather was a Tátár chief named Samán, who claimed descent from Bahrám Chúbín, the Sassanian. He extended his conquests both eastward and westward, and died in 907, at the age of sixty. In the reign of Amir Núh, the fifth Sámánian king, Alptagín, his viceroy in Khurásán, purchased a Turkish slave named Sabuktigín, and, finding him to possess great qualities, gave him the highest offices, and at last bequeathed to him all his estate. Sabuktigín was thereupon chosen to succeed to the viceroyalty of Khurásán; and in A.D. 367 made war upon Hindústán with such success that Núh recognised him as an independent prince, and, as such, called him to his succour against the King of Turkistán. Sabuktigín died in A.D. 387, and left his son Mahmud to succeed him. This prince was the celebrated Mahmud of Ghazni, whose Indian wars are so celebrated. He died in 1208; and his successor Masa'úd was defeated by the Seljuk Turks; and in the next reign the House of Ghazni lost the whole of their Persian possessions. These Tátár tribes were numerous and powerful; they were a nation of shepherds, inured to fatigue, to long marches, and to every kind of hardy exercise, and trained from their infancy to the use of arms. Their numbers and discipline enabled them to overpower the civilized inhabitants of more fertile countries. Accordingly, in the year 1042, the Tatár tribes subdued Khurásán; and their sovereign, Togral Beg, chief of the tribe of Seljuk, assumed the state of a sovereign at Naishápúr. In the succeeding twenty years Togral overran all Persia, made himself master of Baghdád, and took prisoner the sovereign pontiff, the commander of the Faithful. He approached him, however, with every outward mark of reverence, and was constituted the temporal lieutenant of the eastern and western divisions of the empire. This alliance was further cemented by a marriage with the daughter of the khalif. But Togral Beg, who had by this time attained to his seventieth year, died a few months after the marriage. He was succeeded in 1068 by his nephew Alp-Arslan, the "Valiant Lion," who has been praised by all historians for his justice, valour, and generosity. He successfully defended his dominions against an invasion by the Romans, defeated their armies, and, having made their emperor prisoner, generously set him at liberty for a fair ransom. He was killed by a rebellious chieftain whom he had ordered to be put to death, but who, having shaken off his guards, assailed him on the throne with all the fury of despair. Alp-Arslan, an unerring archer, seized his bow, and commanded his guards to stand aloof: but for the first time his arrow missed its mark, and he fell under the assassin's stroke.

The celebrated Malik Sháh, his son, succeeded to the throne in 1072; and his reign rivalled, and even surpassed, in glory that of his father. Syria and Egypt were subdued by his victorious generals; Bukhára, Samarkand, and Khárazm yielded to his sway; and he received homage and tribute from the tribes beyond the Jaxartes, and from the distant country of Kashgár. Including the territories of all those princes whom he had conquered, and obliged to do him homage and to pay tribute, his dominion extended from the Mediterranean to the wall of China. The country was greatly improved during his reign; many colleges and mosques were built; and agriculture was promoted by the construction of canals and water-courses. Learning was also encouraged; and an assembly of astronomers from every part of Malik Sháh's wide dominions were employed for several years in reforming the calendar; and their labours, which established the *Jalalean*, or "Glorious Era," is a proof of the attention which was given at this period to the noblest of all sciences. For thirty years after the death of Malik Sháh, Persia was distracted by the wars of his four sons, who contended for the supreme power; but Sanjar having at length triumphed over his competitors, was elevated to the throne. His reign was for a time successful and prosperous. He resided in Khurásán; and from this spot, as from a centre, his dominion extended in one direction beyond the Indus, and in another to the Jaxartes. Towards the latter end of his reign, he experienced the most signal reverses of fortune. Advancing into Tátary, he was completely defeated by the monarch of Kára Kathai, his family were made prisoners, and all his baggage was plundered. He afterwards marched against the Turkamán tribe of Ghaz, who had refused their royal tribute, and in a decisive action which ensued he was defeated and taken prisoner. After being long detained and cruelly treated, he made his escape, and returned to his own country, where the spectacle of his wasted dominions, ravaged and destroyed by barbarous invaders, so preyed upon his spirits, that he died of melancholy in 1175, at the age of seventy-three. After his death, Persia continued during forty years distracted by the wars between different branches of the Seljukian dynasty. The last who exercised sovereign power was Togral III., who was slain by the monarch of Khárazm, as he went into battle flushed with wine.

From the decline of this dynasty to the conquest of Persia by Húlákú Khán, son of the great conqueror Jangiz or Genghis, the country was distracted by the contests of these rival chiefs, who are known under the name of Atábaks. They were petty princes, who, taking advantage of the weakness and anarchy which prevailed, extended their authority over some of the finest provinces of the country. A detailed account of the progress and decay of these various dynasties would exceed our limits; nor would it contain either amusement or instruction. But there is one chief who requires to be noticed, who, by means of assassins devoted to his purposes, caused the most powerful sovereigns to tremble, and spread far and wide the terror of his mysterious power. His followers were reckoned at 50,000; they were called mysterious and devoted; and each was bound, under the most dreadful sanctions, to sacrifice, at the command of their chief, either his own life or that of another. Hasan Sabáh was the first of these chiefs. He had been mace-bearer of Alp-Arslan; but being displeased with his minister Nizámu-'l-Mulk, he retired to Rhe, and afterwards to Syria, where he entered into the service of a chief of the family of Ism'aíl, and adopted their views concerning the right of the descendants of Ism'aíl to the holy dignity of Imám, instead of the younger brother of Ism'aíl. He afterwards returned to Rhe, his native place, where, leaguing himself with other malcontents, he succeeded in gaining possession of the mountain fort of Alláhamaut, whence he commenced a series of depredations on the surrounding country. Malik Sháh Seljukí sent a force against him, which was repulsed. He was soon afterwards exposed to a more serious attack from the Sultán Sanjar, who resolved to extirpate a race whose murders and depredations spread terror over his kingdom. But he was warned to desist from his fatal project by secret threats of assassination. He had made some marches in the direction of Alláhamaut, when one morning as he awoke he discovered a poniard stuck in the ground close to his bed-side, and read with surprise, written on the handle, "Sultán Sanjar, beware. Had not thy character been respected, the hand that stuck this dagger into the hard ground could with more ease have plunged it into thy soft bosom." The warrior who had often faced death in the field of battle trembled at this mysterious threat; and it is certain that he desisted from his meditated attack. Hasan Sabáh brought several other hill-forts under his sway; and was styled Shaikhu'l-Jabal, "Chief of the Mountain," or, as his Arabic title has been erroneously translated, "The Old Man of the Mountain," the name by which he and his descendants are distinguished in the European histories. Khalífs, princes, and nobles fell under the blows of these assassins; and the power and dominions of Hasan Sabáh were handed down through a series of sovereigns who ruled for 170 years, the terror and disgrace of Asia, and who, in 1256, were finally extirpated by the overwhelming and victorious armies of Hulaku Khán, who rivalled his sire in the rapidity of his conquests. His first design was to turn his arms against the declining empire of the Greeks; but he was diverted from this object by an astrologer, who directed his hostility against Baghdád, the seat of the khalíf's authority. This place was speedily stormed by the Tátár armies, and its inhabitants were put to the sword; the Khalíf Mustasim, with his only surviving son, was slain; and thus was for ever extinguished the celebrated empire of the Arabian khalifs. The conquest of Persia, Mesopotamia, and all Syria, was achieved by Húlákú in the same year, who meditated other ambitious schemes of conquest in the East. But the defeat of his army in Syria by the prince of the Mamelukes in Egypt compelled him to abandon his design; and having restored his affairs in Syria, he fixed his residence at Marágha, a beautiful town of Azarbíján, where he spent his declining years in the cultivation of letters and philosophy. He built an observatory on the summit of a mountain, the foundation of which still remains, "and where," says Sir John Malcolm, "his favourite, Násíru-'d-Dín, formed those astronomical tables which have become so celebrated under the name of the Tables

of Il-Khání," and are still referred to for the latitude and longitude of such places as are not fixed by European observations. He was succeeded by Abáká Khán in the year 1264, who was anxious, by cultivating the arts of peace, to repair the ravages of war, and to heal the still bleeding wounds of his wasted empire. He was assailed from the E. by the powerful armies of the Tátár chiefs; but he succeeded in repelling all their attacks, and in maintaining the integrity of his empire. He died, it is supposed by poison, in the year 1281. The Mughul lords having held a council, raised to the throne his brother Nikudár Oglan, seventh son of Húlákú, who, though he was baptized in his youth, afterwards renounced the Christian faith, which he persecuted with all the violence of a renegade, and assumed the name of Ahmad Khán. But his persecution of the Christians was so obnoxious to his own subjects, that they conspired against him, and deprived him both of his crown and of his life. Arghún, son of Abáká, whom he had thrown into prison, was raised to the throne by the Mughul nobles, but did not assume the name until he received the investiture from the emperor of Tátary, by whom he was hailed as sovereign of Persia, Arabia, and Syria. His reign was marked by no event of any consequence; and on his death, which occurred in 1291, his brother Kai Khatú was raised to the throne by the majority of the amírs. The latter was indolent, sensual, and extravagant: and his short and inglorious reign would hardly merit notice, were it not for an attempt by an officer of the revenue department, of known talent, to introduce a paper-currency, in order to supply the means of royal extravagance. But credit, the foundation of paper-currency, cannot exist under a despotism which affords no security either for life or for property. The scheme was therefore altogether vain, and appears to have been the device of a tyrant for cheating or plundering his defenceless subjects. From this period until the conquest of the country by Tímúr Lang or Tamerlane ("Tímúr the Lame"), the history of Persia presents one continued scene of intestine commotion. Tímúr was descended from Korachar Nevian, who had been vazír to Chaghtai the son of Jangíz, and also claimed kindred with that great conqueror. He was counsellor and general to the Tátár prince, Ouleaus Khajah, who ruled over the territories between the Oxus and the Jaxartes. But having soon thrown off his allegiance to this prince, he led a wandering life, with only a few faithful followers, enduring great hardships and peril. He had formed a close alliance with Amír Husain, one of the most powerful nobles of Transoxiana. Their joint object was, to expel the enemies of their country; and Ouleaus, though he had conquered in the field, having been forced to retire with disgrace from the siege of Samarkand, the countries between the Jaxartes and the Oxus were freed from the foreign enemy. A war for the possession of Transoxiana now ensued between Tímúr and Husain, and was only interrupted by a short and hollow peace, which terminated in the overthrow of Husain, who was taken prisoner, and, as is generally believed, put to death, with the secret sanction or by the orders of his rival. Eleven years elapsed before Tímúr had fully reduced to tranquillity his newly-acquired dominions, and had extended his power over Kashgár and Khárazm; after which his whole reign was one unvaried course of the most triumphant success. He subdued Khurásán, Kandahár, and Kábul, and laid the two latter cities under heavy contributions. He invaded Persia, which, being now ruled by the degenerate descendants of Húlákú, was entirely barren and wasted. He extended the limits of his empire to the farthest bounds of Tátary; and whilst one body of his troops spread dismay to the wall of China, another army penetrated to the banks of the Irtisch, and a third to the Volga. Tímúr next marched against Baghdád, which he stormed, and also took the remarkably strong fortress of Takrít; after which his vast armies were dispersed over Asia Minor, Mesopotamia, Kurdistán, and Georgia. He afterwards invaded Russia, and, advancing to Moskow, took and plundered that city. Returning to his own country, he prepared for the invasion of India. His war with Baiazíd or Bajazet, and his defeat and capture of that warlike chief, were amongst the latest exploits of his active reign; and he had embarked on the arduous enterprise of the conquest of China, when he was arrested by an enemy which he could not conquer. He was seized with a violent illness at the city of Otrar, where he expired in 1405, declaring Pír Muhammad Jahángír his successor. The latter, however, had a competitor for the crown in Khalíl Sultán, his cousin, by whom he was deposed and murdered; and, in his turn, Khalíl, infatuated by his attachment to the beautiful Shádu l Mulk, on whom he squandered the vast treasures of Tímúr, was deposed by the nobles. He was attached to the arts of peace, a philosopher, a man of science, and a poet; and his whole care was to heal the wounds inflicted on his country by the wars of the former reign. He rebuilt Hírát and Marv, and drew around him from all quarters men of literature and science. Sultán Sháh Rukh, uncle of Khalíl Sultán, hearing of the misfortunes of his nephew, marched from Khurásán, and his authority was acknowledged over all Transoxiana. Kalíl Sultán was succeeded by Ulugh Beg, who also followed the arts of peace, and neglected those of war. He was deposed and put to death in the year 1449, by his son 'Abdu'l Latíf, who was slain by his own soldiers within the short period of six months. The Mughul dynasty in Persia was now fast verging to decay, and its final extinction was preceded as usual by scenes of confusion and civil war. The kingdom was at length divided amongst three sovereigns,—viz., Sháh Rukh Mírzá, a descendant of Tímúr, who kept a splendid court at Hírát, and governed Khurásán; Kara Yúsuf, the Turkamán chief of the Black Sheep (the tribes of the Black and White Sheep being so called from their carrying the figures of those animals on their respective standards), ruled over Azarbíján, 'Irák, Fárs, and Karmán; and Azan Hasoun, chief of the Turkamáns of the White Sheep, who finally acquired possession of all Western Persia, and attacked the Emperor Muhammad II., from whom he sustained a severe defeat. After his death the country was distracted by the contentions of his sons, grandsons, and nephews, for the supreme authority, and their dissensions, whilst they accelerated their own ruin, prepared the way for a native dynasty, which was gladly hailed by the people as the auspicious omen of domestic peace.

Sháh Ism'aíl was the first monarch of the Safávean line. He traced his descent from Musa Kázim, the seventh imám. The first of the family who attained to any celebrity was Shaikh Safíu-'l-Dín, who resided in the town of Ardebíl, and from whom the dynasty takes its name of Safávean. His son Sadru-'d-Dín inherited all the sanctity of his sire. The great conqueror Tímúr even condescended to visit him in his cell, that he might receive his blessing; and on his asking whether he, Tímúr, could do aught for his comfort, "Give up," replied the saint, "those Turks whom thou hast carried off as captives." The disinterested request was granted, the saint was dismissed with presents, and the descendants of these captives ever afterwards acknowledged their gratitude by their ardent support of the Safávean dynasty. The immediate descendants of Sadru-'d-Dín, Khwájah 'Alí, Junaid, and Haidar, acquired also a great reputation for sanctity. The first, after making the pilgrimage to Makka, visited Jerusalem, where he died. His grandson Junaid assumed the sacred mantle or patched garment worn by the Súfí teachers, after his father's death; and so numerous were his disciples, that Kára Koinlu, who at that time ruled in Azarbíján, took the alarm, and banished him from Ardebíl. He returned to Shírwán, where he was killed by an arrow in a conflict with the troops of that province. He was married to a sister of Azan Hasoun, chief of the Turkamáns of the White Sheep; and this lady was the mother of Sultán Haidar, who succeeded him, and became a warrior as well as a saint. His uncle Azan Hasoun gave him his daughter in marriage, by whom he had three sons, Sultán 'Alí, Ibráhím Mírzá, and Sultán Sháh Ism'aíl. Haidar was defeated and slain in an attack which he made on the province of Shírwán in order to revenge his father's death. Sultán 'Alí succeeded; but he and his brothers were seized at Ardebíl, by Yákúb, one of the descendants of their grandfather Azan Hasoun, who had become jealous of their influence, and confined in a fort, where they remained prisoners for four years. They afterwards made their escape, and were soon joined by numerous adherents. But in the meantime they were attacked, Sultán 'Alí was slain, and his brothers fled in disgrace to Gílán, where Ibráhím Mírzá died. These events occurred during the infancy of Ism'aíl, the third son of Haidar, of whom we know little till he attained the age of fourteen, when he collected his adherents, and marched against the great enemy of his family, the ruler of Shírwán, whom he defeated. Alwand-Beg, a prince of the dynasty of the White Sheep, hastening with his troops to crush the young warrior, shared the same fate; and the triumphant prince having made himself master of the province of Azarbíján, fixed his residence at Tabríz. Next year he vanquished Sultán Murád, one of the military competitors for supreme dominion in Persia; and in less than four years from his leaving Gílán he was acknowledged the sovereign of Persia.

Sháh Ism'aíl, not being born the chief of a tribe, had no hereditary feuds to avenge; his family were objects of hostility to no one; and he united in his person the reverence and affection of all his subjects. He was a firm adherent of the Shí'ahs. The Turkish tribes to whom he owed his elevation were highly honoured. They were distinguished by a red cap, from which they received the name of Kazilbásh, or "red heads," which has descended to their posterity. Persia, Khurásán, Baghdád, and Balkh, submitted to his arms. His territories were afterwards invaded by Sultán Salím about the year 1514, with a numerous and well-disciplined army. In the action which took place, the Persian monarch, after performing prodigies of valour, was entirely defeated, which affected him so deeply that he was never afterwards seen to smile. After the death of Salím he crossed the Araxes, wrested Georgia from the possession of Turkey, and died at Ardebíl in the year 1523. He was succeeded by his son Támásp, who ascended the throne when

he was only ten years of age. His reign, which continued fifty-three years, proved prosperous. He repelled the invasions of the Uzbaks on the east, and of the Turks on the west. It was from him that Humáyún, emperor of India, when he fled from his rebellious subjects, received the aid which enabled him to regain his throne. It was to him also that Elizabeth sent her envoy, Anthony Jenkinson. But the intolerance of the Muhammadan monarch could not brook the presence of a Christian. His family was numerous; and after several years of disputed succession, and of brief and troubled reigns, 'Abbás, his grandson, was proclaimed king in 1582, when a minor. During the earlier years of this monarch's reign, the country was alternately alarmed by internal disturbance and foreign aggression, each party in their turn using the name of the sovereign. But as he advanced to manhood he vindicated his rights, and in the course of three years he reigned the undisputed sovereign of the country. His reign, which lasted forty-three years, was highly successful and glorious. He was engaged in wars with the Turks and with the Uzbaks, whose armies he defeated in several actions; and it was during his time that an amicable intercourse commenced between Persia and Europe.

Sir Anthony Shirley, a gentleman of family, was persuaded by the Earl of Essex to repair to the court of Persia; and, with twenty-six followers, gallantly mounted and richly attired, he presented himself to the king, who received him with every mark of distinction. The military skill of these foreigners enabled him to discipline his army and to improve his artillery, so that with an army of 60,000 warriors he obtained a decisive victory over 100,000 Turks. In this battle, which was fought on the 24th of August 1605, Sir Anthony Shirley was thrice wounded. This victory gave a decided check to the Turks, who were driven from Azarbíján, Georgia, Kurdistán, Baghdád, Mosul, and Diarbekir, all of which were re-annexed to the Persian empire. This monarch also entered into an alliance with the English for the destruction of the flourishing Portuguese settlement of Hurmaz, which unhappily proved but too successful; and this place, long renowned as the seat of wealth and a great commercial emporium, was plundered and left to decay.

'Abbás expended his revenues in the improvement of his dominions, and erecting caravanserais, bridges, aqueducts, bázárs, mosques, and colleges; he embellished Isfahán, his capital, built splendid palaces, the ruins of which still attest his taste and magnificence. He was also distinguished by his toleration, especially to Christians; and he was liberal in his foreign policy. To his family he proved a sanguinary tyrant. He had four sons, whom he caressed, whilst in infancy, with parental fondness, but who, as they arrived at manhood, were viewed with jealousy and hatred. The oldest son was assassinated, and the eyes of his other children were put out, by his orders. One of these, Khudábandah, had a daughter, Fátimah, innocent and lovely, and the delight of her grandfather, who could not endure that she should be out of his sight. The prince, learning the fondness of his father for this his child, seized her one day with all the fury of a maniac, and deprived her of life. The rage and despair into which 'Abbás was thrown by the death of his grand-daughter gave a momentary joy to the son, who concluded this bloody tragedy by swallowing poison. 'Abbás died soon afterwards, in 1628, at the age of seventy, worn out with affliction of mind.

By the desire of the expiring prince, Sám Mírzá, one of the sons of Sáfi, who had been murdered, was placed on the throne, which he occupied fourteen years. His son 'Abbás II. succeeded him at the age of ten, and reigned prosperously twenty-five years, though his habits were licentious and intemperate. He was succeeded by his eldest son 'Abbás in the year 1641, who, under the title of Sháh Sulaimán, reigned twenty-nine years. He was, like his father, the slave of dissolute habits; and his drunken orgies were often stained with blood. He was succeeded by Husain Mírzá, a weak prince, who was ruled by eunuchs and priests, and whose measures tended to destroy the little spirit which yet lingered amongst the nobles and chiefs. The first twenty years of his reign passed over in tranquillity, but it was only the prelude to a political storm. The Afghán tribes who inhabit the mountainous tract between Khurásán and the Indus had long been subject to Persia, and having often suffered great oppression, at length broke out into rebellion, irritated by the tyranny of Gurjin Khán. The insurgents were headed by Mír Váiz, an Afghán chief. They invited the obnoxious governor Gurjín Khán to a feast, where he was suddenly attacked and put to death; and Mír Váiz, collecting his followers, surprised and stormed the fortress of Kandahár. He then proceeded to strengthen himself in his newly-usurped power. Whilst the weak monarch endeavoured by negotiation to pacify this formidable insurgent, Mír Váiz imprisoned his ambassabor, and set his power at defiance; and a second ambassador met with no better treatment. The court of Persia now assembled an army under the command of Khusrau Khán, who advanced against Mír Váiz, defeated his army, and laid siege to Kandahár. The insurgent chief having assembled another army, compelled the Persian general to raise the siege of that place, and afterwards defeated him in a decisive action, in which he was slain. In the midst of his successes Mír Váiz died, and was succeeded by his brother Mír Abdu'lláh, who was assassinated by Mahmúd, son of Mír Váiz. The troubles which now afflicted Persia on every side gave ample leisure to Mahmúd to mature his plans, and to consolidate his power. The Uzbaks were ravaging Khurásán; the tribes of Kurdistán were almost at the gates of Isfahán; the Abdali Afgháns had taken Hírát, and afterwards Mashhad; the islands in the Persian Gulf had been subdued by the Arabian governor of Maskat; and the rude tribes of Georgia had attacked Shírwán. A prediction by an astrologer, of the total destruction of the capital by an earthquake, completed the public dismay, when intelligence was received that Mahmúd Ghilzy had entered the country at the head of 25,000 Afgháns. He was met by the royal army of 50,000 troops; and an action took place, which ended entirely in favour of the Afgháns. The consequence was, the siege or blockade of Isfahán, which, after enduring all the miseries of famine, surrendered on the 21st of October 1722, after a siege of seven months. The following day the fallen monarch of Persia, Husain, took a solemn leave of his subjects, and signed a capitulation, by which he resigned the crown to Mahmúd. Husain, with his nobles, after doing homage to the Afghán sovereign, was confined for seven years in a small palace, when his enemies, threatened with a reverse of fortune, caused him to be assassinated; and in his person may be said to have terminated the Safávean dynasty, as his son, Támásp, though he assumed the title of king, never possessed any real power, and only struggled a few years against his inevitable fate.

Mahmúd having thus succeeded in acquiring the sovereignty of Persia, now endeavoured to conciliate the people whom he had subdued. But the Persians hated the Afghán yoke; and, as they recovered from their first dismay, they began to attack and cut off scattered parties of the invaders. At the same time Persia was invaded both by Russian and Turkish armies. The Russian army advanced into the country and took possession of Darband, and the Turkish army was already on its march to Hamadán, when the inhabitants of Kazvín rose in insurrection, and expelled the Afghán garrison from the place. Mahmúd was now seriously alarmed. The probable revolt of the capital seemed to be the most immediate danger; and his gloomy mind, alarmed and enraged by these signs of vengeance, conceived the horrible design of exterminating the conquered people. He commenced with the massacre of three hundred nobles and their children, who were treacherously invited to a feast. He afterwards put to death three thousand of the late king's guards, whom he had taken into his pay; and at length every person who had been in the service of Sháh Husain was included in one bloody proscription, and put to death without mercy.

After this, Mahmúd, being aided by the Kurdish tribes, succeeded in making himself master of some of the principal cities of 'Irák and Fárs. But his affairs appeared to be on the decline; his kingdom was threatened from various points, and his mind proved at last unequal to the difficulties with which he was assailed. In this extremity he resorted for relief to the most abject and degrading superstitions; he shut himself up in a vault for fourteen days and nights, fasting and enduring the severest penances; and, under the influence of this gloomy fanaticism, he lost his reason, and fell into the most furious paroxysms of madness. In this melancholy situation his mother, out of compassion to him, directed him to be smothered. But this event did not take place till, under his fatal orders, thirty-nine princes of the Safávean blood had suffered an untimely death. He was succeeded by Ashráf, the son of Mír Abdu'lláh, and nephew of Mír Váiz. The first period of Ashráf's reign was successful. He gained repeated victories over the Turkish armies, who were compelled to retire; and he concluded the war by compelling the Turkish court to acknowledge his title to the throne. But he was now assailed from another quarter by more serious dangers. Támásp, the son of Sháh Husain, and the representative of the Safávean princes, was in Mazandarún, where he was joined by a distinguished chief, Nádir Kulí, a well-known warrior, who now declared his resolution to expel every Afghán from the soil of Persia. Támásp, from the day of his father's abdication, had assumed royal state, and now that he was supported by Nádir and the nobles of Khurásán and the Mazandarún, he found himself in a condition to exercise the authority of a sovereign. Nádir being invested with the sole command, soon succeeded in reducing Mashhad and Hírát, and at length all Khurásán, under the authority of Támásp. Ashráf now prepared for the defence of his sovereign authority; and having raised an army, he advanced into Khurásán against his enemy, whose followers, he knew, were daily increasing. The Afgháns were defeated in a series of sanguinary actions, and pursued, first to Tehrán, and finally

Persia.

to the gates of Isfahán. It was at first proclaimed in the city that the Afgháns had obtained the victory; but the loud wailings of the women from the citadel soon disclosed the result of the battle. The night was passed in preparations for flight. The old men, women, and children, were mounted on mules and camels, and having packed up all the treasure and spoil which they could carry away, they took the route to Shiráz by break of day; the tyrant Ashráf having in the meantime cruelly murdered Sháh Husain, who was still detained a prisoner, and the pressure of circumstances only preventing a general massacre, which was fully intended. Nádir lost no time in pursuing the discouraged and flying Afgháns. They were overtaken at [illegible], and immediately fled towards Shiráz, where, though they were still 20,000 strong, they were deserted by their leader, who fled homewards with only two hundred followers. The army was dispersed in wandering bands, which were closely pursued and cut down by their exasperated foes; and Ashráf himself, whilst wandering in Sistán, was recognised and slain by Abdulláh Khán, a soldier of Bilúchistán, who sent his head, with a large diamond which he found on his person, to Sháh Támásp. The Afghán invasion was one of the most cruel calamities which ever befel the Persians. Within the short period of seven years they had massacred nearly a million of the inhabitants, laid waste the finest provinces of the country, and levelled the proudest edifices with the dust.

Nádir Kuli, afterwards known as Nádir Sháh, was born in the province of Khurásán, on the 11th of November 1688. His father was in a low condition, earning a livelihood by making coats and caps of sheep-skins. He was taken prisoner by the Uzbaks at the age of seventeen, but made his escape from them after a captivity of four years. He was for a considerable period the chief of a band of robbers; and being a plunderer of known valour and resolution, had collected 3000 followers, by whose aid he laid under contribution the extensive province of Khurásán. His friendship was now courted by his uncle, who was the chief of Kelát. Nádir pretended to listen to his overtures, but treacherously slew him with his own hands, and proceeded to employ the power which he had thus acquired against the Afgháns, the enemies of his country. And so well did he succeed in this popular and patriotic enterprise, that the Afgháns were entirely expelled from the country; whilst, for his services, he received from his sovereign, Támásp, the provinces of Khurásán, Mazandarún, Sístán, and Karmán. He then proceeded to attack the Turks, who still occupied the western provinces of 'Irák and Azarbíján, and having defeated them in various actions, took possession of Tabríz, Ardebíl, and all the principal cities. He returned to quell an alarming insurrection of the Afgháns, who were unable to withstand his victorious armies; and in the meantime the imbecile Támásp commenced a war with the Turks, which ended in a disgraceful peace. He had for some time been a mere pageant in the hands of Nádir; and this unfortunate war, with other complaints against him, furnished a plausible pretence for his dethronement, which took place on the 16th of August 1732. He retired to Khurásán, where he was afterwards put to death by Rizá Kulí, the son of Nádir, with the knowledge, if not by the secret orders, of the father. His son, an infant eight months old, was seated on the throne; but Nádir was now in substance, as he was soon to be in form, the real sovereign. In 1736 the death of this infant removed the only obstacle to his ambition; and in a vast assembly of his nobles and troops, he was, after much pretended reluctance, prevailed on to accept of the crown. This high dignity served only to give a fresh stimulus to his active and enterprising habits. In the course of a new war with the Turks, after having regained the provinces which had been wrested from the imbecile Támásp, and concluded a peace, he turned his arms eastward. Kandahár and Balkh were besieged and taken by his son Rizá Kulí, who passed the Oxus, and defeated the ruler of Bukhára and the Uzbaks. Afghánistan was afterwards subdued; and Nádir finally completed his military glory by the conquest of Delhi. A single battle was sufficient to disperse the Mughul host; and Nádir, with his triumphant legions, entered the capital, which made no resistance. Its treasures were plundered; and its inhabitants, who rose on the Persian soldiery, were, in revenge, given over to an indiscriminate massacre, in which neither age nor sex was spared. Nádir returned in triumph, loaded with the spoils of one of the richest capitals of the East. He continued to prosecute his conquests on every side, and restored the ancient glory of the Persian empire, when it extended from the chain of the Caucasus eastward to the Indus.

But the glory of foreign conquest was tarnished by domestic tyranny. In an expedition against the Lesghís, a mountain tribe upon the western frontier, Nádir was wounded by an assassin, who fired on him from a wood. His suspicion fell on his son Rizá Kulí, or had been instilled into his mind by artful intriguers. Under this impression he commanded his son into his presence, and immediately caused him to be deprived of his eyesight. But so struck was he with remorse after the deed had been done, that he vented his fury upon all around him; and fifty noblemen were put to death by his orders, because they had not come forward to sacrifice their lives for the young prince, the hope of his country. "It is not my eyes," says the prince, 'that you have put out, but those of Persia.' The mind of Nádir was deeply affected; he became gloomy and ferocious; all his future actions were deeds of horror, and he exceeded in barbarity all that has ever been recorded of the most bloody tyrants. The country languished under his extortions; and when he at last raised the people to insurrection, his fury knew no bounds, and he not only murdered individuals, but gave up whole cities to the destroying sword. Several of the principal officers of his court, [illegible] that their names were in a proscribed list, resolved to anticipate the vengeance of the tyrant. The execution of the plot was committed to four chiefs who were employed about the palace, and who, on the pretext of business, rushed past the guards in the inner tents, and found the tyrant asleep. He was awakened by the noise, and had slain two of the conspirators, when he was deprived of life by a blow from Sálah Beg, the captain of the guards.

The sudden death of Nádir Sháh involved the country in the greatest distraction. He was succeeded by his nephew 'Ali, who took the name of Adil Sháh. But his reign was short and inglorious. He was taken prisoner by his brother Ibrahím Khán, and put to death at Mashhad, as his captor himself also was, being slain by the officer who guarded him. Sháh Rukh, the grandson of Nádir, succeeded; but the throne was ere long usurped by Mírzá Saiyíd Muhammad, by whom Sháh Rukh was taken prisoner and deprived of sight. The usurper being defeated and taken prisoner by Yúsuf 'Alí, the principal general of Sháh Rukh's army, was immediately put to death. The blind Sháh Rukh was again raised to the throne; but the measures of his general, Yúsuf 'Alí were opposed by two chiefs, the respective heads of a Kurdish and an Arabian tribe, and, by their joint efforts, the faithful general of Sháh Rukh was defeated and slain, and he himself again sent from a throne to a prison. The two chiefs, however, soon quarrelled; and Mír 'Alam, the Arabian, triumphed, but only to fall before the rising power of the Afgháns under Ahmad Khán 'Abdalí. This leader might at the time have easily accomplished the reduction of Persia. But judging more wisely, he assembled the principal chiefs, and proposed to them that the province which gave birth to Nádir should be given as a principality to his grandson. To this all the chiefs agreed, and Sháh Rukh was again established in the undisturbed possession of Khurásán. At this period Persia was in a complete state of distraction, from the contentions of rival chiefs. Muhammad Husain Khán, chief of the tribe of Kájárs, had established himself at Astarábád, and had brought under his authority the whole province of Mazandarún. The province of Azarbíján was under the rule of Azád Khán, an Afghán leader, who had been one of the generals of Nádir Sháh. Gílán was independent, under one of its own chiefs, Hidáyat Khán. At this time 'Alí Mardán Khán, a chief of the tribe Bakhtiyárí, took possession of Isfahán, and, resolving to elevate a prince of the house of Safí to the throne, he invited the nobles to join his standard. The principal of those chiefs was Karím Khán, of the tribe of Zand, a man distinguished by his sagacity and courage, and between whom and 'Alí Mardán Khán a rivalship for power soon took place. Karím Khán, dreading the enmity of 'Alí Mardán, took the field against him. But his assassination soon afterwards left Karím undisputed master of the south of Persia. He was joined by most of the tribes from that country, and being at war with Azád Khán, he was entirely defeated by him in a general action, and so discouraged by the unpromising state of his affairs that he meditated a retreat into India. But he was dissuaded from so unworthy a course by the remonstrances of his general Rustam Sultán, the chief of Khisht, who attacked the enemy in a narrow pass, and obtaining a complete victory, re-established the power of Karím Khán, who again occupied the city of Shíráz, where he employed his utmost efforts to recruit his army. Azád Khán, throwing himself on the clemency of his conqueror, was received into his service, and became one of his most attached followers. The most powerful enemy of Karím Khán was Muhammad Husain Khán, the chief of the Kájárs, who ruled in Mazandarún. He advanced against Shíráz with a powerful force; but the city being bravely defended, he was compelled to raise the siege, and to retreat to Isfahán. He afterwards engaged Karím in a general action, in which, being deserted by part of his troops, he was defeated and slain. The whole province of Mazandarún then submitted to the conqueror, and this was followed by the submission of Gílán and the greater part of Azarbíján. Khurásán was the only province which he did not subdue; and his forbearance is ascribed to compassion for the blind Sháh Rukh, who still retained this remnant of his extensive dominions.

Karím Khán was distinguished by a love of justice and a moderation not usual amongst eastern princes. He died in the year

1779, in the eightieth year of his age, after a reign of twenty-six years. His administration was generally just and beneficent. He encouraged agriculture and commerce, which greatly revived during the latter years of his reign; and he protected by his justice Christians as well as Muhammadans. He never refused mercy to a fallen foe, though he sometimes punished severely, that he might strike terror into his enemies. The humane disposition of this prince prompted him to acts of mercy; and the generous confidence with which he treated those whom he forgave never failed to attach them to his person.

After the death of Karím Khán, the succession to the crown was, as usual, disputed, and in the course of these contests his four sons either perished under the daggers of assassins, or were sacrificed in the intrigues of ambitious chiefs contending for the crown. Zakí Khán, the moment his father died, assumed the reins of government, whilst Sadak Khán at the same time evacuated Basrah, and advanced towards Shíráz. But he was unable to contend against Zakí, and was soon forced to retire. In the meantime, Aghá Muhammad Khán Kájár, who had been detained prisoner at Shíráz, and who was duly apprised by his sister, an inmate of the royal harem, of the progress of Karím Khán's illness, and at last of his death, contrived to escape to Mazandarún, where he proclaimed himself a competitor for the throne. The cruelties of Zakí, who had treacherously murdered a number of his rebellious nobles, after pledging his faith for their safety, soon provoked revenge, and he himself was put to death at Yezdikhast. Abú'l Fath Khán was proclaimed king of Persia the moment Zakí Khán was put to death. Sadak Khán hastened from Karmán to Shíráz when he heard of the assassination of Zakí and proclaimed himself king, arresting the person of Abú'l Fath Khán, and causing his eyes to be put out. He was besieged in his capital by his nephew 'Alí Murád Khán, his most formidable enemy, and, being obliged to surrender, he was put to death, with most of his sons. 'Alí Murád was, in his turn, put down by another rival; and Jafar Khán, nephew of Karím, and Aghá Muhammad, were at length the only rivals left to contend for the crown. The former having disgusted one of his chief supporters, Hájí 'Alí Kulí, he engaged in a conspiracy against him; and having put poison in his victuals, he and others rushed into his chamber when he was writhing under its effects, and put a period to his existence. He was succeeded by Lutf 'Alí Khán, who was one of the most remarkable characters recorded in the Persian annals. His appearance was greatly in his favour: his fine countenance full of animated expression; his form tall and graceful, and, though slender, active and strong. He was at Karmán when he heard of his father's murder, which took place in the year 1789; and though Saiyíd Murád Khán was at first proclaimed king by the conspirators, yet, by the aid of Hájí Ibráhím, appointed by his father the first magistrate of the province of Fárs, he was soon enabled to assert his claim to the crown. He was bold in counsel and fearless in action, and maintained a long and well-sustained struggle for the sovereignty, in the course of which he performed prodigies of valour. But he wanted prudence and temper, and had no control over his passions. Unbending in his pride, and harsh and unconciliating in his manners, he employed terror as the chief source of his influence. His great error was in quarrelling with and disgusting his faithful minister Hájí Ibráhím, a statesman of consummate prudence and talents, who abandoned his service for that of his rival and enemy, Aghá Muhammad Khán, and was ever afterwards his most formidable enemy.[1] Lutf 'Alí maintained the contest for six years; but he was at length overwhelmed by the superior forces of his enemy. Flying from Persia, he was treacherously seized, after a brave resistance, in which he was seriously wounded, and being delivered into the hands of Aghá Muhammad Khán, was treated with a brutality of insult which is too shocking to be described, and which, Sir John Malcolm adds, disgraced human nature. His eyes were torn out, and he was sent to languish out a miserable existence in Tehrán, where an order was soon afterwards sent for his execution. Lutf 'Alí terminated his extraordinary career in 1795, in the twenty-fifth year of his age. Nor was Aghá Muhammad's cruel treatment of the inhabitants of Karmán less shocking. This place was the last stronghold of Luft 'Alí. It was defended by him with his usual bravery, and being at length taken by treachery, became the scene of the most dreadful atrocities. The place was almost depopulated. Many women and children, to the number of 20,000, were carried into slavery. The men were murdered, and numbers were deprived of sight, many of whom were afterwards seen by Sir John Malcolm begging their bread. Lutf 'Alí was the last of the Zand family of princes, who had ruled over Persia for nearly half a century.

Aghá Muhammad Khán having now firmly established himself upon the throne of Persia, his first care was to restore order throughout his dominions, and to repel foreign aggression. Having tranquillized the southern and central provinces, he invaded Armenia and Kárabág, and, marching straight to Teflis, he defeated Heraclius, prince of Georgia, and having taken the city, he sacked it, and made a dreadful slaughter of the inhabitants, carrying into slavery 20,000 women and children. He then turned his arms eastward, subdued Khurásán, and repressed the incursions of the pillaging Turkamáns in the vicinity of Astarábád, as well as of the Uzbaks in Bukhária. But however rigorous his administration, and however active in the field, all his exploits were stained with cruelties. His avarice was unbounded; and he scrupled at no atrocity to gratify it. He had long thirsted after the jewels of which Nádir Sháh had despoiled India, and these he wrested without remorse from their unfortunate possessors. From the aged and blind Sháh Rukh he extorted, by the severest tortures, several of those which were the most precious, particularly a ruby which had belonged to Aurangzíb, and which was of extraordinary size and value. This precious jewel was retained to the last, until boiling lead had been poured upon the head of the unhappy prince, when, in his intolerable agony, he declared where it was hidden. He was afterwards conveyed to Damghán in Khurásán, were he died in a few days, in the sixty-third year of his age, in consequence of the tortures to which he had been subjected.

Aghá Muhammad Khán succeeded in tranquillizing the country, partly by policy, and still more by terror. He often spared his enemies, and conciliated them, not however from any feelings of humanity, but from a sense of his own interest, for his disposition was stern, cruel, and vindictive, and his reign presents a series of atrocities scarcely equalled in the bloody annals of the East.

'Alí Khán, a chief of the Afshár tribe, had opposed Aghá Muhammad in the field. He was decoyed into his power by the deepest treachery, and being arrested amidst fawning and caresses, his eyes were put out. The brave and generous Jafar Kulí, his own brother, was in like manner seduced, by the kindest assurances, to visit the court of Tehrán, where, after being welcomed with every appearance of cordiality, he was cruelly assassinated. This act stamps upon Aghá Muhammad the character of a remorseless tyrant. In truth, a temper naturally cruel had been still more soured by cruelties he had himself undergone in his youth.

Aghá Muhammad being apprised of the invasion of Persia by Russia, sent his army to defend the frontier; but the death of the Empress Catharine relieved Persia from the serious danger with which it was threatened. Aghá Muhammad then determined to move towards Georgia; and having received a friendly deputation from the inhabitants of Shíshah, he proceeded with some light troops, and took possession of this important fortress. Three days afterwards, a dispute having occurred between a Georgian slave, a personal attendant on the monarch, and another servant, respecting some money that was missing, the king, enraged at the noise which they made, directed that they should both be put to death. Saadak Khán Shekákí, a nobleman of the highest rank, solicited their pardon, which was refused; but as it was the night of Friday, sacred to prayer, their lives were spared till next morning, and, with a singular infatuation, the despot permitted them to perform their usual services about his person. Despair gave them courage; and whilst the monarch was asleep, they entered his tent, accompanied by an associate, and stabbed him with their poniards. He was then in the sixty-third year of his age, and had ruled for upwards of twenty years, though he had enjoyed the undisputed sovereignty of the country for only a small portion of that time.

Aghá Muhammad was in person so slender that he appeared like a youth of fourteen or fifteen. His face was beardless and shrivelled, resembling that of an aged and wrinkled woman; it was at no time pleasant or agreeable, and when clouded with indignation, as it often was, its expression was horrible. He was so sensible of this that he could not bear any one to look at him. He was harsh and abrupt, and often cruel to his ministers and to his domestics. Hájí Ibráhím, however, was uniformly treated with unbounded confidence. "The penetration of the monarch," says Sir J. Malcolm, "discovered at once the talents of that extraordinary man, whose plainness of manner, blunt speech, manly fortitude, and astonishing knowledge of public affairs, led Aghá Muhammad to give him his entire confidence, and no confidence was ever better rewarded. The minister, though he contrived to gratify the avarice of his master, and to promote his ambition, often obtained favour for others through the kindness of his disposition, whenever he could interfere without danger to himself."

By the influence and wise management of Hájí Ibráhím, the

[1] See, in Sir John Malcolm's excellent *History of Persia*, a full account of all the transactions of Lutf 'Alí's reign. Sir John was personally acquainted with Hájí Ibráhím, who informed him that his principal reason for taking part with Muhammad Khán was to save his country from the continual petty wars with which it had been long afflicted. (Vol. ii., chap. xix., p. 183.)

crown was secured to the nephew of the deceased monarch, who assumed the sovereignty under the title of Fath 'Alí Sháh. Saadak Khán made a feeble effort to oppose him, but was attacked and defeated. Two other attempts to usurp the crown, the one made by the king's brother Husain Kulí Khán, and the other by Muhammad Khán, a prince of the Zand family, were subdued; and since this period the internal tranquillity of the country has not been disturbed. The most important events in the reign of Fath 'Alí were connected with the wars which he entered into with Russia, and which generally proved unfavourable to Persia. In 1800 Georgia finally submitted to the dominion of Russia; and in 1803 Mingrelia was subdued. Gunjah was taken; and although the invaders were forced to raise the siege of Eriván, they overran Dághistán and Shirwán; and in 1805 Kárabág yielded to their victorious arms. The interference of Great Britain arrested the progress of Russian conquest; and Persia was saved from further inroads by the treaty of Gulistán, concluded in October 1813, which fixed the relative boundaries so indefinitely, as, after much tedious negotiation, to give rise to a new war. In this war, which commenced in the month of July 1826, 'Abbás Mírzá, the prince royal of Persia, took the field, with 40,000 men, 12,000 of whom were regulars; and at the outset he gained several important advantages. But the superior discipline of the Russian armies, trained in the wars of Europe, triumphed in the end; and in 1828, seeing no prospect of maintaining the war with success, peace was again sought for through the mediation of Great Britain. It was concluded on the 21st of February at Turkamánchai. Besides large cessions of territory,—namely, the Khánat of Eriván, and that of Nakhshiván, and the greater part of Talish, including all the islands which fall within its direction,—Persia agreed to pay 5,000,000 of tumáns, as an indemnification for the expenses of the war. Since this treaty the peace of the two countries has not been disturbed; and the prince royal, turning his attention to the internal concerns of his kingdom, has succeeded in reducing the rebellious chiefs of Khurásán. By the aid of a Polish refugee, equally skilful and brave, he acquired possession of Yeza, took Turshish and Khabushan by storm, and reduced to obedience all the other chiefs in that quarter.

Fath 'Alí Sháh was about forty years old when he succeeded his uncle Aghá Muhammad on the throne. He reigned nearly thirty-eight years, and died in October 1834. With the exception of his wars with Russia, the tranquillity of his long reign was almost undisturbed. By the treaty of Turkamán Chai in 1828, the Russian frontier had been advanced to Mount Ararat, and thence to the left bank of the Aras. This acquisition was regarded by Russia as only a step to further advances, and as soon as Muhammad Sháh, the eldest son of 'Abbás Mízá, had been securely settled on the throne of his grandfather, Fath 'Ali, the Russian minister at Tehrán, commenced a series of intrigues to induce the new sháh to advance against Hírát. As the sháh had been placed on the throne by the aid of English arms and influence, in opposition to the efforts of his numerous uncles and nephews, this movement, so contrary to the interests of the British, was a piece of base ingratitude. The sháh was fully aware how displeasing any attempt upon Hírát would be to the English government; for in 1832 Fath 'Alí had been induced by the English envoy to abandon an expedition against that city, in spite of the encouragement of the Russians, who even sent Baron Ache, an officer of engineers, to accompany it. In the winter of 1835, however, Muhammad Sháh announced his intention to march against Hírát in the spring; and Mr Ellis, the English ambassador, used every effort to dissuade him, and to compose the differences between the sháh and the ruler of Hírát, Prince Kámrán. Nevertheless, the sháh persevered in his intention, and marched, accompanied by the Russian minister, in August 1836; but having attacked the Turkamáns on his way, his army was so much harassed by them as to be obliged to return towards Persia in October of the same year. About this time Sir John M'Neill had replaced Mr Ellis at the court of Tehrán, and continued to remonstrate with the sháh on the subject of Hírát. On the 23d of July 1837, however, the sháh marched again against Hírát; and on the 10th of October Captain Vicovich, a secret agent of the Czar, joined the Persian camp, and proceeded thence to Kandahár and Kábul, announcing that a Russian force had arrived at Astarábád to co-operate with the sháh. This report had such an effect upon the Afgháns, that it was thought requisite to recall the British agents, Major Leech from Kandahár, and Captain A. Burnes from Kábul. Kohandil Khán, the ruler of Kandahár, now bound himself by treaty to become the subject of Persia, and the Russian minister, Count Simonich, took the command of the Persian troops in the trenches before Hírát, and a regiment of Russian deserters were allowed to take part in the assault. The siege of Hírát lasted ten months, and the defence was one of the most memorable in history. The sufferings of the inhabitants were dreadful; and the population was reduced from 70,000[1] to about one-tenth of that number. But every assault was repulsed, chiefly through the courage and skill of Lieutenant Eldred Pottinger, an officer of the East India Company's artillery. At the same time the Anglo-Indian government, to counteract the designs of Persia, despatched an armament to occupy the island of Kharg in the Persian Gulf, and concluded a treaty with Sháh Shujá'a and Ranjít Singh to depose the Bárakzy chiefs, Kohandil and Dost Muhammad, and place Sháh Shujá'a, the ally of the British, on the throne of Kábul. This treaty was signed on the 26th of June 1838; and the whole of Afghánistán was shortly after occupied by British troops. These operations, and the determined defence of Hírát completely overthrew the ambitious designs of the sháh. He returned to Tehrán, and the Russian government hastened to disavow all intentions hostile to the British. In 1839 a Russian army of 15,000 men marched from Orenburg, under General Peroffski, against Khíva. It had been collected in anticipation of the sháh's success at Hírát, but it failed against Khíva no less signally than the sháh had done in the other direction; and the greater part of the troops perished in the snow. In 1841, immediately after the destruction of the English army at Kábul was known, the Russians again commenced their ambitious movements on the side of Persia. They established a naval station at Ashurada, an island in the Gulf of Astarábád, about 12 miles from the coast, and established a complete supremacy in the Caspian, in which sea they are now supposed to have four or five steamers, and several brigs and schooners of war.

Muhammad Sháh died in August 1848 at Tehrán, and was succeeded by his eldest son, Násiru'd-dín, the present sháh. Colonel Farrant, an English officer serving in Persia, was the main instrument in securing the quiet accession of the new king, and held the capital for him till he arrived from Azarbiján, of which province he was governor. Friendly relations had been renewed between the English and Persian governments; but the subject of Hírát had not been lost sight of by the court of Tehrán. Sháh Kámrán had been murdered by his vazír, Yár Muhammad Khán, and this wily chief had long before engrossed the chief power in that principality. His policy was to maintain independence, while he soothed the sháh by courtesies which cost him little. But in 1851 Yár Muhammad died; and his son Saiyíd Muhammad, less confident of his position, sent envoys to Tehrán offering to become the subject of Persia. In response to these offers, a Persian force was prepared under Sultán Murád Mírzá, the governor of Khurásán, nominally against the Turkamáns, but in reality for the occupation of Hírát. Colonel Sheil, the British envoy, at once remonstrated against this expedition, and on August the 7th, 1851, distinctly announced to the Amír Nizám, or prime minister, that a perseverance in the proposed course would bring on a rupture with Great Britain. After a long correspondence, the Persian government, on the 25th of January 1853, signed an agreement not to send troops to Hírát until that place should be attacked by a foreign force. New difficulties, however, soon arose. In 1854 Mr Thomson, in charge of British affairs, appointed Mírzá Háshem to be first Persian secretary of the mission, an appointment so obnoxious to the sháh that the Persian government declined to receive the mírzá, and, on his destination being changed to Shíráz, notified to Mr Murray, who was now the British minister, that should the mírzá set out for his post, he would be seized, and forcibly detained. This notice was given on the 6th of November 1855, and immediately afterwards the mírzá's wife was seized by order of the Persian minister. On the 17th Mr Murray officially intimated, that unless the lady was released, the flag of the mission would be hauled down, and friendly relations would cease; and as this menace produced no effect, the flag was struck on the 20th of November, and on the 5th of December the mission withdrew from Tehrán. The Persian government then published a justification of its conduct, which set forth that Mr Murray was carrying on an intrigue with the wife of Mírzá Háshem, and in an autograph note to his prime minister the sháh indulged in the most intemperate language against Mr Murray, charging him with insolence, and speaking of him as "stupid, ignorant, and insane." In the same month of December Prince Sultán Murád Mírzá put himself at the head of 9000 men intended to act against Hírát. It must be admitted that there was some colour for this expedition, as a tribute had been guaranteed to the sháh from the city, and, further, Prince Muhammad Yúsuf, the son of Kámrán, who, after putting Saiyíd Muhammad to death, had recovered his heritage, had applied to Persia for aid, alleging that he was threatened with an attack by Dost Muhammad of Kábul. On the 27th of February 1856 the Persian government, doubtless encouraged by the Russian successes

[1] Ferrier's *Caravan Journeys*, p. 171.

Persian Gulf.

at Kárs in November of the preceding year, published their reasons for this offensive movement. After futile negotiations between the Persian envoy at Constantinople and Lord Stratford de Redcliffe, instructions were sent out by the mail of the 20th of September 1856, by Lord Clarendon to the governor-general of India, to prepare a force at Bombay for the occupation of Kharg. In the meantime, the Persian army under Sultán Murád had defeated the Hirát forces near Ghorián, taking their general, Ahmad Khán, and several hundred men, prisoners; and having captured and garrisoned Ghorián, after a twenty days' siege, were closely besieging Hirát itself On the 29th of April 1856 Prince Muhammad Yúsuf was sent in as a prisoner into the Persian camp by his vazír, 'Isá Khán. On the 26th of October 1856 Hirát was surrendered to the Persians, and its occupation was publicly notified at Tehrán on the 6th of November. (*Correspondence respecting Relations with Persia*, p. 228) On the 1st of the same month the governor-general of India issued a proclamation declaring war against Persia. On the 11th several ships sailed with troops from Bombay for the Persian Gulf; and on the 13th Sir H. Leeke, commanding the naval forces, embarked for the same destination. On the 26th the whole fleet, consisting of thirty-four sail, assembled at Kíshm; and on the 3d of December the island of Kharg was reoccupied; and on the 7th, the army, consisting of two brigades,—the first under Brigadier Stopford, C.B, and the second under Colonel Honner,—disembarked at Halíla Bay, twelve miles south-east of Abúshahr (*Bushire*), the 20th Bombay native infantry, and the 4th Bombay rifles, being the first regiments on shore. On the 9th the troops advanced to dislodge the enemy from their position near the fort of Rashahr (*Reshire*). A body of Arabs made a most determined resistance at an earthwork, and the action was not gained without loss. Brigadier Stopford, Colonel Malet of the 3d cavalry, and Lieutenants Utterson and Warren of the 20th Bombay native infantry, were killed; and Captain Wood of that regiment was wounded; and thirty-five inferior officers and men were killed or wounded. On the 10th, after a sharp cannonade of three hours, Abúshahr surrendered, and the British flag was hoisted on its walls at 5 P.M. of that day. Fifty-eight guns were taken, and several Persian officers of high rank were made prisoners. In the meantime, a reserve force, consisting of the 14th light dragoons, the 1st Sindh horse, the 4th troop of royal horse artillery, the 1st company of the 2d battalion of foot artillery, the 78th Highlanders, and the 23d and 26th regiments Bombay native infantry, and a light battalion of ten companies drawn from regiments not serving with the force, had been assembled at Bombay under General Outram, to whom the command of the whole army was given. The general and his staff sailed from Bombay on the morning of the 16th of January 1857; and the army was now formed into two divisions, of which General Stalker commanded the first, and Brigadier Havelock the second. The reserve reached Abushahr in the end of January; and on the 3d of February General Outram, with the 2d European light infantry, the 64th and 78th Highlanders, the 3d Bombay cavalry, the Púnah horse, the 4th Bombay rifles, and 20th native infantry, the 2d Bilúch battalion, and some guns, marched to dislodge the enemy from an intrenched camp at Burázjún, 48 miles from Abúshahr. On the 5th this position was occupied, after a slight outpost affair, in which Cornet Spens of the cavalry, and a few troopers, were wounded. A vast quantity of stores and ammunition were taken in the camp. On the night of the 7th General Outram commenced his return, after having first exploded 36,000 pounds of the enemy's powder, to ignite which the rifles, with shell bullets invented by General Jacob, were used. During the darkness of the night the enemy made a sharp attack on the English column while on the march, in which Captain Mackler and Lieutenant Greentree of the 64th were wounded, and a few men killed and wounded. General Outram met with a severe accident, his horse falling with him, and rolling over him. At daylight on the morning of the 8th, the enemy were seen drawn up in order of battle, with their right resting on the village of Khush-áb, numbering 6000 infantry and 2000 cavalry, with about 15 guns, under Shujá'au'l-Mulk, reputed the best officer in the Persian army. After a short but sharp action, this force was completely routed, and fled, leaving 700 men dead on the field, and two guns in the hands of the English. A regiment of Persian infantry was in this battle ridden over and cut to pieces by the 3d Bombay cavalry, whose commanding officer, Captain Forbes, was severely wounded. The English loss was altogether one officer and eighteen men killed, and four officers and sixty men wounded. General Outram regained his quarters at Abúshahr by midnight of the 9th. On the 26th of March, the general having organized a force for the capture of Muhammarah, a town at the confluence of the Kárún with the Shatu l 'Arab, where the Persians had thrown up strong batteries, and had stationed an army of 15,000 men, attacked the place, and captured it, with the loss of but ten men killed, and one officer and thirty men wounded. The loss of the enemy was very severe On the 29th of March General Outram despatched a light force to pursue the enemy to Awáz, a town about 100 miles distant up the Kárún. This force proceeded in the Comet, Planet, and Assyrian steamers, under Commander Rennie. On the 1st of April, the expedition came within sight of the Persian army near Awáz, but on the right bank of the river, the town being on the left. Although the Persians amounted to at least 10,000 men, and the English troops did not exceed 300, such was the terror General Outram's victories had inspired, that the instant the English advanced on Awáz the Persians deserted the place, and not long after, a shell falling near their general's tent, the whole army likewise took to flight. Then was seen the astonishing spectacle of five heavy masses of infantry, well supplied with artillery, and 2000 horse, among which were the picked men of the Bakhtiyárí tribes, reputed the best cavalry in Persia,—a complete army, in short,—retiring before a handful of Englishmen, less numerous than the wing of a single regiment. The vast stores of the Persians were destroyed or thrown open to the plundering Arabs; and the retreating enemy suffered dreadful distress ere they reached Shustar, 100 miles distant, where was their nearest depôt On the 4th of April the expedition returned to Muhammarah; and on the same day General Outram received the news of the treaty which had been concluded at Paris on the 4th of March preceding, between the English government and the Persian, as represented by Farrukh Khán, ambassador of the sháh. On the 9th of May, General Outram issued orders for the breaking up of the force under his command, and their return to India; and on the 15th General Havelock embarked with his staff for the scene of his more arduous labours and glorious death at Lakhnau.

Thus ended the Persian war; and so severe was the lesson taught during General Outram's brief campaign, that not even the disasters of the Indian revolt could induce the sháh to venture once more on a rupture with the English government. It is possible that a movement might have again taken place in the direction of Hírát; but in May 1858 the sháhzádah commanding in that quarter suffered a severe defeat from the Turkamán hordes, the greater part of his army being destroyed, and several of his guns taken. (D. B—N) (E. B. E.)

PERSIAN GULF, a large inland sea in the S. of Asia, forming an inlet of the Indian Ocean, and lying between 24. and 30. N. Lat., and between 48. and 57. E. Long. Its form is that of a curve, having the convex side to the S.W.; the northern and north-eastern shores being bounded by Persia, and the western and southern by Arabia. It is entered from the ocean by the strait of Ormuz; and its greatest length from N.W. to S.E. is about 560 miles; its breadth varies from 40 to 200, but it is on an average about 160; and its entire area is estimated at 70,000 square miles. There are several islands scattered about in this gulf, which have an aggregate area of 1400 square miles. The shores of the Persian Gulf are the most arid and barren that can possibly be imagined. They generally consist of extensive sandy expanses, with hardly a blade of grass to relieve the monotony of the view, and the glare of the sand in the sun. The climate of the gulf for five months of the year is extremely hot, almost intolerable; and the thermometer stands probably higher in these regions than in any other place we are acquainted with. The Persian shores of the gulf are skirted by a range of mountains about 3000 feet high, from 3 to 30 miles distant from the sea; and though there are numerous small indentations on both coasts, the only bay of any size is that of Es-Elwak, on the coast of Arabia. The navigation is dangerous, on account of the shoals and reefs with which it abounds, especially on the Arabian coast, where large vessels can hardly approach near the land. The only rivers of any size that fall into the gulf are the Euphrates and Tigris, which unite to form the Shat-el-Arab, a river which falls into the north-western extremity of the gulf, about 70 miles below Bussorah. The tides in the Persian Gulf are much lower than those in the Red Sea; owing partly probably to the influence of the great rivers Euphrates and Tigris, and partly to the

shape of the gulf. The prevailing wind in the gulf is from the N.W. during the greater part of the year; but in the months of November, December, and January southerly breezes blow with considerable regularity, especially in the strait of Ormuz. The currents on the outside of the strait generally follow the direction of the wind; but in the gulf there is one that sets westward along the Persian shore. The shores of the gulf abound in fish, which, along with dates, almost the only produce of the surrounding country, form the chief articles of food to the inhabitants. These are not, however, sufficient to supply the wants of the people, and food has to be imported. The most of the inhabitants derive their means of sustenance from the fisheries of the pearls, for which this gulf is so famous. On the banks near the island of Bahrein, on the Arabian coast, these are found in the most abundance; but they are obtained in greater or less quantities throughout the whole of the western and southern shores. During the month of June, when the weather is somewhat cool, the fishing is carried on in the shallow water along the coast; but it is only in the intense heat which prevails in July, August, and the beginning of September, that the Bahrein banks, where the water is much deeper, are frequented, the divers being much inconvenienced when the water is cold. In diving, they have their nostrils compressed with a small piece of horn, and their ears stuffed with wax, to keep out the water; and with a net for oysters attached to their waists, a rope which they hold, and a stone to aid their descent, they go down, and remain for about two minutes under the water, shaking the rope when they wish to be drawn up. In favourable weather they sometimes dive twelve or fifteen times in a day; and the work, though exhausting at the time, is not considered to be injurious to the constitution. The annual value of the fisheries at Bahrein alone has been estimated to be from L.200,000 to L.240,000, though some of the merchants state it at a much greater sum; and the value of the whole pearl trade of the gulf is about L.300,000. The number of boats at Bahrein, containing generally ten men each, is about 1500. The larger shells are preserved for the sake of their lining of mother-of-pearl; but the oysters are never used for food, even in a country of such scarcity.

The trade of the Persian Gulf, which seems to have been carried on so early as the time of Alexander, is very considerable; the port of Bussorah, on the Shat-el-Arab, and that of Bushire, on the Persian coast, being the principal inlets for the produce of India and the East into Turkey and Persia respectively. The scheme for the steam navigation of the Euphrates would, if successful, make this the principal route to India; but the route by the Red Sea and Egypt, as in ancient times, presents many advantages over the other. The Arabian shores of this sea were for a long time infested with pirates; but the Jawasimi, the most daring of these, have been reduced to order by two British expeditions from Bombay in 1809 and 1819. The principal islands in the gulf, besides Bahrein, Ormuz, and Kishm, which are described in separate articles, are,—Busheab, near the northern shore, containing about 40 square miles, with a small town and harbour; Kaes or Kenn, off the same shore, also containing a small town and harbour; and Karej or Kharrack, a lofty island, nearly surrounded with reefs. The whole of the shores of the Persian Gulf, though belonging partly to Persia, are inhabited by Arabs; who extend on the N. as far inland as the mountains. Nearly all this country is subject to the Imam of Muscat, who pays an annual rent to the Persian monarch.

PERSIUS FLACCUS, Aulus, a celebrated Roman satirist, was descended from an equestrian family of considerable eminence in the state, and was born at Volaterræ in Etruria, in 34 A.D. The little that we know respecting his personal history is chiefly derived from a slight sketch commonly but erroneously ascribed to Suetonius. He lost his father at an early age; and his mother, Fulvia Sisennia, removed to Rome, that her son might enjoy the best training which the imperial city could furnish. He studied first under the grammarian Rhemmius Palæmon, and the rhetorician Virginius Flavus; and when he reached his sixteenth year he was placed in the school of the Stoic philosopher Annæus Cornutus, to whom he became passionately attached, and from whom he imbibed those tenets by which his writings are characterized. No less indebted was his education to Pætus Thrasea, whose noble character tended to form his mind to virtuous habits. His admiration of the Satires of Lucilius is said to have first turned his attention to the study of poetry. His character was austere, his mode of life pure and blameless, and his affection for his friends strong and unbending. At his death in 62 A.D., he left a considerable property to his mother and sisters; and his books, which are said to have consisted of 700 volumes, he bequeathed to his friend Cornutus. The philosopher recommended to his mother that she should commit to the flames all his manuscripts except his Satires. These were accordingly preserved, and consist of one book, divided, according to some, into five Satires, and according to others, into six. These Satires are intended to expound and illustrate some favourite doctrines of the Stoics. In executing this purpose, the author is not careful to copy his incidents and examples from real life. Describing them according to an exaggerated representation in his own mind, he strains all his faculties, and employs every literary art, to make the picture correspond to his own ideal conception. Accordingly his sentences are condensed into the most pithy and concise forms; his allusions are at once short and suggestive; his passion, in its vehemence, often assumes the rugged and expressive shape of colloquialism; and his frequent use of dialogue throws a spirited and life-like effect over the whole. It would even seem that the edge of his satire, directed against the vices of Nero's reign, sometimes became so keen that it required to be concealed under obscure phrases. From this description of Persius' Satires we can easily see how Lucan, Quintilian, Martial, and others, who knew the history of the author's time, were charmed with their pungency, and how modern students and commentators who have not that knowledge are perplexed by their almost impenetrable obscurity. Persius was first printed at Rome by Ulrich Hahn about 1470. The best editions are that of Isaac Casaubon, 8vo, Paris, 1605, reprinted by Duebner, 8vo, Leipsic, 1839; that of Otto Jahn, 8vo, Leipsic, 1843; and that of Heinrich, 8vo, Leipsic, 1844. There are numerous English translations, both in prose and poetry. The best poetical versions are those of Dryden and Gifford. The latest prose translation is that which forms, along with translations of Juvenal, Sulpicia, and Lucilius, a volume of Bohn's "Classical Library."

PERSON, Personality. The word *person* (Latin *persona*, "a mask," derived, according to Gabius Bassus, in Aulus Gellius, v. 7, from *persono*, "to sound through"), from being originally applied to a player's mask, came to signify the individual wearing it. Again, as one individual is distinguished from another more by the internal character than by the external traits of his nature, the term suffered a further transference of meaning, in being used in a sense synonymous with *man*, who is an intelligent, free, and responsible being. Person in this sense is distinguished from *thing*. Deity, considered as a creative cause and governing intelligence distinct from the universe, is a *person*. *Personality* is the idea of a person carried to its highest degree of generality. The essence of personality is generally supposed by philosophers to reside in the will.

PERSONIFICATION, or Prosopopœia, is, in rhetoric and composition, a species of metaphor, in which the highest degree of energy is produced by representing inanimate objects as endued with life and action.

PERSPECTIVE.

Projection of Points.

Perspective, or *Perspective Drawing*, is the art of representing solid bodies by means of pictures traced upon a surface. This surface is usually, though not necessarily, flat, and is most commonly placed upright.

The principle of the art is very simple, being founded on the fact that light moves in straight lines. If a transparent plate were placed between the eye and the object to be represented, and if the various points at which the light passes through were noticed, these would indicate the form of the picture, and if proper colours were laid on these, would produce upon the eye nearly the same effect which the object did, and would be a perspective picture of that object.

Such a picture, however, though accurately drawn, and though coloured quite in accordance with nature, can never produce on the eye exactly the same effect which the object itself does. The adjustment of the eye to distinct vision is not the same in both; and, in truth, the light which comes from any point in the object is not a mere line, but a conical pencil, having the aperture of the pupil for its base. Hence, however skilfully finished, a picture is always recognised as such.

The various contrivances which were used for enabling the painter to mark off with precision the outlines of his subject, are almost entirely superseded by the new processes of photography. The well-known instrument, misnamed the *camera lucida*, was one of the most ingenious of these; and the most simple of them was to set up an open frame, across which a network of threads was stretched; by placing the eye behind this frame and observing through which mesh each part of the object is seen, an expert draughtsman could readily transfer the outlines to a sheet of paper, on which a similar network had been traced.

The art of drawing in perspective is useful to architects and engineers, by enabling them to make views of intended buildings or machines. The ordinary plans, sections, and elevations, which are needed for carrying out a piece of work, hardly enable us to realise the appearance which the structure will have when completed, and hence the importance, particularly in matters of taste, of having perspective representations.

PROJECTION OF POINTS.

Let PQRS (fig. 1), be the ground plan of an intended building, and suppose that we wish to have its projection upon a vertical plane standing on the line AB, the point of sight being at E. We have only to join E with each point of the structure, and ascertain where the lines cut the picture plane. Thus having joined EP, the point p at which this line cuts the plane on AB, is the representative of P.

When the point of sight can be marked on the same sheet of paper with the plan, the simple joining of P, Q, R, S, &c., with it gives the representative points; but this rarely happens, and some contrivance has to be made for obtaining these points without actually drawing the lines.

Having let fall EC, a normal to the picture plane from the point of sight, C is called the *centre of the picture*, and EC the distance of sight. Produce EC to meet PT drawn parallel to the line BA, then we have the proportion ET : EC : : PT : pC; so that if ET and TP were known, the distance Cp could be very easily found. Now ET and TP are the co-ordinates of the point P referred to axes passing through the point E; hence a very convenient arrangement. Measure off along ET and CB a series of equal parts, and from the points of section draw lines parallel to AB and ET and we have a network, by help of

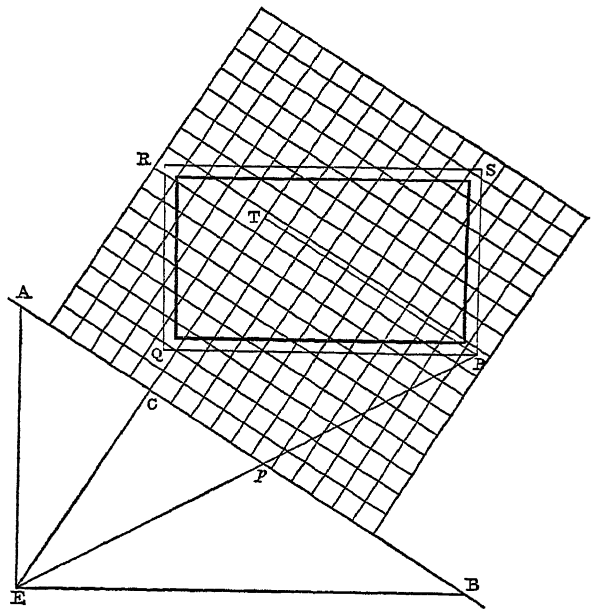

Fig. 1.

which the co-ordinates of the various points on the plan can be found.

This network may be drawn in pencil upon the working plans without injuring them; but, for those who are in the habit of making perspectives, it is convenient to have lines etched upon the surface of a plate of glass which can be laid down upon the plans in any required position.

In fig. 1, the distance of sight EC is ten of the actual divisions; calling it 100 and referring to the figure, we find ET=187, TP=104, whence 187 : 100 : : 104 : 55·6; so that Cp=55·6.

Again, referring to fig. 2, which is the elevation of our

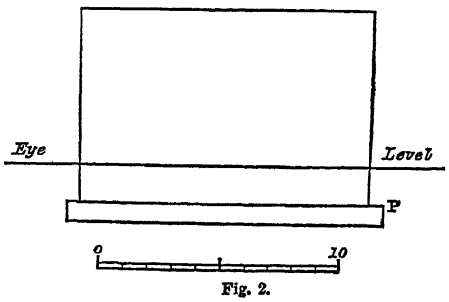

Fig. 2.

supposed building, we find the points P to be below the eye-level 16 and 24, whence the distances of their representatives below the eye-level on the picture must be 8·6 and 12·8, as found by the proportions 187 : 100 : : 16 : 8·6 and 187 : 100 : : 24 : 12·8.

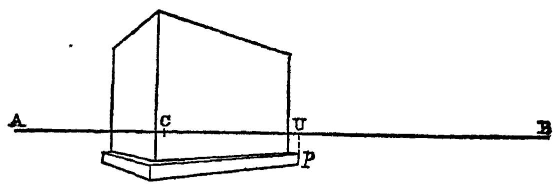

Fig. 3.

Let fig. 3 be the actual picture, C being the centre, and

Projection of Straight Lines.

CU the eye level; then the representation of the corner of the base at P is obtained by laying off CU=55·6 and Up, 8·6 and 12·8 respectively.

These calculations may be readily made by help of a sliding rule or of a circular logarithmic scale. The number 187 on the one slide being brought opposite to 100 on the other, we find opposite to the three numbers 104, 16, and 24, the three results 55·6, 8·6, and 12·8.

Denoting the co-ordinates of the various points of the structure by X, Y, Z; X being in the direction ET, Y in the direction TP, and Z in the vertical direction; and at the same time denoting by y and z the co-ordinates of the projections on the picture plane, reckoning from the point C, we have

$$y=EC\frac{Y}{X};\ z=EC\frac{Z}{X}.$$

Similar operations give the projections of the other points of the structure, and the whole details may be recorded in a tabular form as under:—

Point.	X	Y	Z	y	z
At P Base	187	+104	−16	+55·6	−8·6
			−24		−12·8
Wall	188	+96	−16	+51·1	−8·5
			+64		+34·1
At Q Base	117	−6	−16	−5·1	−13·7
			−24		−20·5
Wall	125	−5	−16	−4·0	−12·8
			+64		+51·2
At R Base	183	−48	−16	−26·2	−8·7
			−24		−13·1
Wall	182	−40	−16	−22.0	−8·8
			+64		+35·2
At S Base	253	+62	−16	+24·5	−6·3
Vanishing point B				+157·1	0·0
Vanishing point A				−63·6	0·0

The positions of the points on the picture are most readily marked by help of a graduated T square and drawing-board; the scale for the y being marked off along the edge AB (fig. 4) of the drawing-board, and that for the z along the edge CD of the square; and pieces with verniers may be fitted to slide on the blade of the square so as to give a great degree of precision. It is to be observed, that the scale used for the drawing need not be the same as that used for the plans and elevation, but may be made larger or smaller, according to the nature of the case—the distance of sight being increased or diminished in the same ratio.

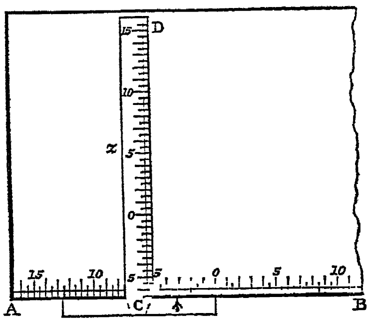

Fig. 4.

PROJECTION OF STRAIGHT LINES.

The projection of a straight line is also straight; for all the lines drawn from the eye to points in a straight line lie in one plane, and the intersection of this plane with the picture is a straight line; wherefore, if the projections of two points in a straight line be found, the projection of that line is known.

If we draw through the point of sight E (fig. 1) a line EB parallel to PQ, and meeting the picture plane in B, this line is in the plane EPQ, and therefore B is in the projection of QP upon the picture. Hence the projection of the line RS, and, in general of any line parallel to QP, must also pass through B. This point B is called the vanishing point for lines parallel to QP. Similarly, the vanishing-point for lines parallel to QR is found by drawing EA parallel to QR. Having then measured off on the actual picture (fig. 3). CB and CA equal to CB, CA, of fig. 1, we perceive that the face and end lines of the structure tend respectively to B and A.

The positions of the vanishing-points can be easily computed, since we have

$$EC : CB :: X_P - X_Q : Y_P - Y_Q \text{ and}$$
$$EC : CA :: X_R - X_Q : Y_R - Y_Q,$$

or in our example

$$70 : 110 :: 100 : 157·1 = CB$$
$$66 : -42 :: 100 : -63·6 = CA,$$

and when the angle PQR is right it is clear that the distance of sight EC is a mean proportional between the distances CB and CA of the two vanishing-points.

The determination of the points A and B facilitates greatly the delineation of the picture, since all the lines of the cornices, doors, and windows tend toward them. In no properly arranged drawing can both of these points be found within the limits of the paper, and therefore we must either support a pin at the proper place by a cumbrous erection, or make use of some instrument for drawing lines to a distant point. The *centrolinead*, contrived by the late Mr David Dick is, perhaps, the most convenient for the

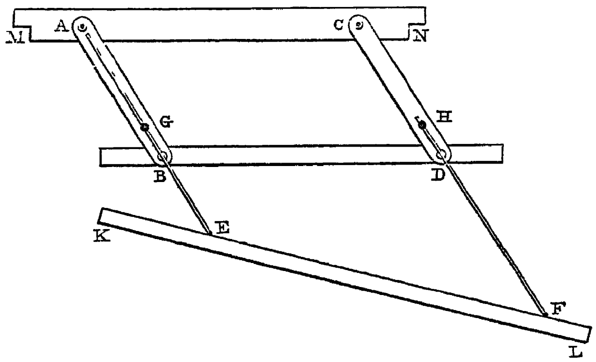

Fig. 5.

perspective draughtsman: it consists of a parallel ruler of the ordinary rhomboidal form, on the cross-ties, AB and CD (fig. 5) of which two pieces, BE and DF, are made to slide; these are retained in their places by pinching-screws at G and H. From the ends of the sliding-pieces two thin angular bits of steel project downwards to the paper, and against these a tracing-rule KL is laid. The edges of the steel at E and F must be accurately in the straight line passing through the pins of the parallel ruler. In order to facilitate the application of this instrument, notches are cut in the principal bar at M and N, exactly in the line of the joints. If, now, MN be applied to one of two converging lines, and the bar MN be secured against moving, by means of weights; and if, while the edge of KL is applied to the second line, the sliding-pieces at E and F be adjusted to bear upon it, the instrument is ready to trace lines tending to the same point.

The vanishing-points for all horizontal lines are found in the eye-level; but for lines which are inclined to the horizon, the vanishing-points are above or below that level. If, for example, there were a pediment on the face PQ of our supposed building, the vanishing-points for the cornices of that pediment would be found in a vertical line drawn through the point B of fig. 3, and at distances equal to the height of a pediment of which EB of fig. 1 is the half-breadth. Thus in Greek buildings the rise is about one-fourth part of the horizontal distance, in which case the positions of the vanishing-points will be found by laying one-fourth part of EB, fig. 1, above and below B of fig. 3.

When a row of equidistant vertical lines is put in perspective, the distances and the lengths of the projections are in harmonic progression; and if any two of these projections be given, all the rest can readily be found.

Let, for example, Pp and Qq (fig. 6) be the perspective representations of two equal vertical lines, and let it be proposed to continue the series either way.

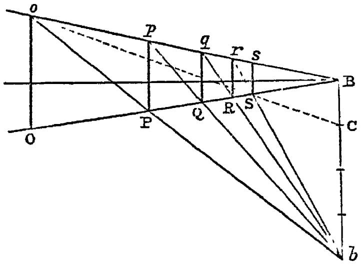

Fig. 6.

Join PQ, pq, and produce the lines till they meet in B; B is the vanishing-point for horizontal lines in the plane of the series, and a horizontal line drawn through B must be the eye-level. Join now pQ, and produce it to meet a vertical line drawn through B; the point of intersection b must be the vanishing-point for all the lines connecting the top of one upright with the bottom of the next; so that the intersection R of qb with BP marks the position of the perspective projection of the next upright, and so that the intersection o of bP with Bp gives the position of the next on the other side.

Again Oo and Ss being the projections of two uprights in a series, let it be proposed to divide the interval between them as into four equal parts. Having found the vanishing-point B as before, draw the vertical line through B, produce oS to meet it in C, and measure off Bb equal to four times BC, then b is the vanishing-point for diagonals of single intervals. The rest of the construction is obvious.

PROJECTION OF CURVED LINES.

Generally speaking, the most convenient method of drawing the perspective representation of a curved line is, to assume a number of points in the curve, to project these separately, and then to trace, by hand, a curve through the several projections. This process is applicable, whether the line to be projected be a fanciful curve sketched merely to please the eye, or a curve of a definite character. In the latter case, however, it is more satisfactory to determine strictly the nature of the projection.

The lines which join the point of sight with the various points in the given curve, trace out a conical or conoidal surface; and the intersection of the picture plane with that surface is the projection sought for; so that this branch of perspective drawing belongs essentially to the doctrine of conic sections.

When the proposed line is a circle, or any other line of the second order, the conoidal surface belongs to a cone proper, right, or oblique, as the case may be. Now the section of such a cone by a plane is also a line of the second order; wherefore the perspective projections of *circles*, *ellipses*, *parabolas*, and *hyperbolas* belong to the same class.

As the circle occurs in all machinery, and very frequently in buildings, the projection of the circle is a matter of special interest, and a ready means of obtaining it is a desideratum.

When five points in a line of the second order are known, the whole line is determined, and can be easily traced out by the method of radiants. If, then, we project five points in a circle, we can obtain its perspective representation. But as this process resolves itself into finding a number of points in the curve, and then tracing, by hand, a line through them, it is not preferable in practice to the simple process of assuming a number of points in the circle, and projecting these directly.

When the circle to be projected lies entirely on one side of a plane passing through the point of sight and parallel to the picture plane, its projection is a closed curve, generally elliptical, and sometimes, though very rarely, circular. Now, we can trace ellipses by help of mechanical contrivances, called *elliptographs*. These instruments can be readily applied when the major and minor axes of the curve are known; and therefore the practical problem becomes this, "To find the major and minor axes of the ellipse."

If the plane of the circle be parallel to the picture plane the projection is circular, and the centre of the projection is the projection of the centre. Otherwise, let the plane of the circle be produced to intersect the picture plane along the line PQ (fig. 7); this line may happen to be vertical, horizontal, or inclined.

From O, the centre of the circle, let fall OR perpendicular to PQ, and circumscribe the circle by the square KLMN, touching at S, U, T, and V.

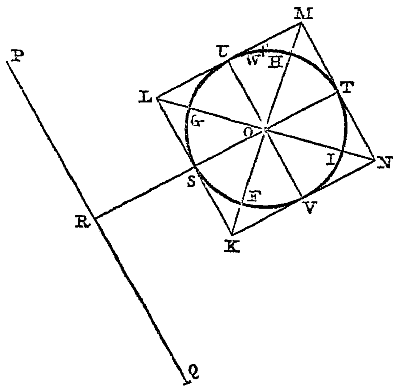

Fig. 7.

From the centre of the picture also draw CQ perpendicular to PQ, and suppose that the inclination of the two planes is represented by i.

Since the two lines LK and MN are parallel to the picture plane, their projections must be parallel to each other, and to the line PQ; let lk, mn (fig. 8) be these projections. The vanishing-point for the parallels LM, RSOT, and KN must be in the continuation of QC as at B. Since O is the intersection of the lines LN and MK, its projection must be at the meeting of the two lines ln and mk on the picture.

Having drawn through B a line parallel to PQ, produce

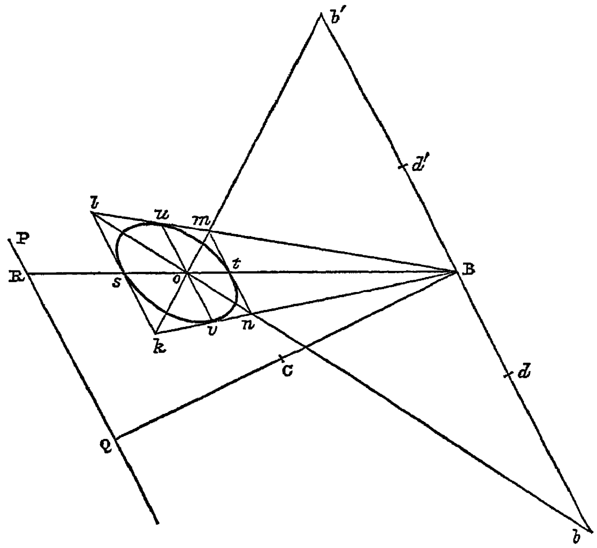

Fig. 8.

ln to meet it in b; b is the vanishing-point for all lines parallel to LN. Now we have, in general, $NK : KL :: EB : Bb$, wherefore, in this case, Bb must be equal to EB; but EB is parallel to the plane of the circle, so that $EB : BC :: R : \cos i$, or $Bb = BC \,.\, \text{ses}\, i$. But $BC = EC \cot i$; wherefore, since $\cot i \,.\, \sec i = \text{cse}\, i$, $Bb = EC \,\text{cse}\, i$. The vanishing-points for lines parallel to KM is at b', as far on the other side of B.

If we join V with F, the middle of the arc VS, the angle KVF is $22\frac{1}{2}°$, and the vanishing-point for lines parallel to

Curved Surfaces.

VF, as SI, GT, UH, is found by making Bd equal to the tangent of $22\frac{1}{2}°$ for Bb as a radius; while, by laying off an equal distance Bd', we obtain the vanishing-point for the lines VI, TF, SH, UG. By help of one of these we readily find the points f, g, h, i, and, by help of the other, we can check the accuracy of the work. (The letters f, g, h, i, are, for the sake of clearness, omitted in the figure.) Observing that the tangents at f and h tend to b, those at g and i to b', we obtain an octagon circumscribing the desired ellipse, after which an ordinarily expert draughtsman can trace it out.

All this supposes that the vanishing-points are within the range of the paper, or implies the use and frequent re-adjustment of the centrolinead. Those who possess an elliptograph would naturally prefer to determine the major and minor axes of the ellipse, so as to be able to apply the instrument. These axes can be obtained by means of the doctrine of conic sections, but the processes, whether geometrical or algebraic, are so tedious that the method of points is to be preferred in practice.

When the circumference of the circle is graduated, as in the case of arches or of toothed wheels, the projection by successive points is unavoidable.

Retaining the ordinates X in their former position, let us, for the sake of convenience, place the Y in the direction QC, the Z in the direction QP, the origin being still at the point of sight. Having assumed any point W in the circumference of the circle, let us denote the angle UOW by a, the radius of the circle being r, then the co-ordinates of the point W are,—

$$X_W = X_O + r \sin i \,.\, \sin a$$
$$Y_W = Y_O + r \cos i \,.\, \sin a$$
$$Z_W = Z_O + r \cos a,$$

so that the co-ordinates of its projection on the picture plane are,—

$$y_W = EC \,.\, \frac{Y_O + r \cos i \,.\, \sin a}{X_O + r \sin i \,.\, \sin a}$$
$$z_W = EC \,.\, \frac{Z_O + r \cos a}{X_O + r \sin i \,.\, \sin a}.$$

By giving to a the values corresponding to the various divisions of the circle, we can compute, by means of these formulæ, their several projections.

When the perspective of any other curve is wanted, the best method is to assume points in the proposed curve, and to find the perspective representations of these separately.

CURVED SURFACES.

The representation of a curved surface in perspective is a matter of considerable difficulty. When the surface is so placed that lines can be drawn from the point of sight to touch it, these lines form the surface of an enveloping conoid, and the intersection of the picture plane with this conoidal surface is the boundary of the perspective representation; but it is also the representation of the line in which the conoid touches the proposed surface, and, without the help of shading or colouring, the eye cannot distinguish whether the trace be meant to represent the line of contact, or the curved surface.

For example, lines drawn from the point of sight to touch a sphere lie in the surface of a right cone touching the sphere along a circle. The intersection of this cone with the picture plane is an ellipse, which is, indifferently, the projection of the sphere, or of the circle of contact. Nay, it might have been intended to represent any other curved surface enveloped by the same cone. The mere line then cannot convey the desired impression to the eye.

If the equation of the curved surface be represented by the symbol U=0, U being a function of the three ordinates X, Y and Z, we must also have $\delta U = 0$, or

Curved Surfaces.

$$\left(\frac{\delta U}{\delta X}\right)\delta X + \left(\frac{\delta U}{\delta Y}\right)\delta Y + \left(\frac{\delta U}{\delta Z}\right)\delta Z = 0;$$

so that the equation of a plane touching the surface at the point of which the ordinates are X′, Y′, Z′, must be

$$\left(\frac{\delta U'}{\delta X}\right)(X - X') + \left(\frac{\delta U'}{\delta Y}\right)(Y - Y') + \left(\frac{\delta U'}{\delta Z}\right)(Z - Z') = 0.$$

If this plane pass through the point of sight, the point at which it touches the curved surface is in the line of contact, so that the character of this line is determined by the two equations

$$U' = 0, \text{ and } \left(\frac{\delta U'}{\delta X}\right)X' + \left(\frac{\delta U'}{\delta Y}\right)Y' + \left(\frac{\delta U'}{\delta Z}\right)Z' = 0.$$

If now x be the distance of sight, y and z the co-ordinates of the perspective limit, we have

$$xY' = X'y\,;\ xZ' = X'z,$$

and on eliminating X′, Y′ and Z′ from these four equations, we obtain an equation in y and z, which determines the form of the perspective outline.

The equation of a sphere, of which the centre is O and the radius r is

$$(X - X_O)^2 + (Y - Y_O)^2 + (Z - Z_O)^2 - r^2 = 0, \quad . \ (1.)$$

which corresponds to the general equation U=0. Treating this by the method of partial differentials, we obtain, on halving,

$$(X - X_O)X + (Y - Y_O)Y + (Z - Z_O)Z = 0, \quad . \ . \ (2.)$$

and this subtracted from the preceding equation, leaves

$$XX_O + YY_O + ZZ_O = X_O^2 + Y_O^2 + Z_O^2 - r^2, \quad . \ . \ (3.)$$

which is the equation of a plane perpendicular to the line joining E with O; the intersection of this plane with the surface of the sphere gives the line of contact. By adding the double of equation (3.) to (1.), we obtain

$$X^2 + Y^2 + Z^2 = X_O^2 + Y_O^2 + Z_O^2 - r^2, \quad . \ (4.)$$

which belongs to a sphere having its centre at the origin, and its radius the side of a right-angled triangle, having the distance EO for its hypothenuse, and r for its other side. The equation of the ellipse may be now found by eliminating from (3.) and (4.), the quantities X, Y, Z, by means of the equations

$$xY = Xy\,;\ xZ = Xz,$$

the result being

$$(x^2 + y^2 + z^2)(X_O^2 + Y_O^2 + Z_O^2 - r^2) = (X_O x + Y_O y + Z_O z)^2,$$

which indicates a line of the second order, the major axis of which passes through the centre of the picture.

From this example of the application of the general method to a very simple case, it will be seen that the strict analytic process is far too laborious to be used in projecting the curved surfaces which are found on buildings or in machinery: a process readier, though perhaps not so satisfactory, is needed by the practical draughtsman.

It is of no use to assume, at random, points upon the proposed surface, since the projections of these would not give the limiting line of the picture. We must endeavour to select points on the line of contact.

A convenient though, in some cases, rather a tedious process, is to make a series of sections of the proposed surface, to project these, and then to draw a line touching and inclosing the projections. In the case of a cylinder or of a truncated cone, it is enough to project the two ends and to draw straight lines touching the two ellipses, while for a pointed cone, tangents drawn from the projection of the

Inverse Problem.

apex to the ellipse which represents the base, are the limits of the picture.

For an annular surface, as that of the torus of a column, it is convenient to take sections made by planes passing along the axis of the solid, as these give equal curves; and it may be remarked in general, that only a small part of each curve need be projected.

INVERSE PROBLEM.

When a drawing, purporting to be the perspective representation of an object is presented to us, we endeavour to realize the form of that object. This we can only do strictly, by resolving the problem "of what object can such a drawing be the true picture?" Shading and colouring aside, the lines of the picture may be the projections of an infinity of diverse solids, the corners and edges of which are in the straight lines joining the eye with the various traces; and these again change with every alteration in the position of the spectator. Hence the inverse problem is incapable of a strict solution.

A correct drawing of any familiar object, though in outline only, at once suggests the idea of the object which it was intended to represent; and though it cannot be demonstrated strictly to be the picture of such and such a thing, the mind, through the force of association, is satisfied of the fact. Adding to the actual delineation the knowledge that the picture is meant to represent, say a house, we may, to a certain degree, thence determine the proportions of the structure.

Let us suppose, for example, that fig. 9 is placed before

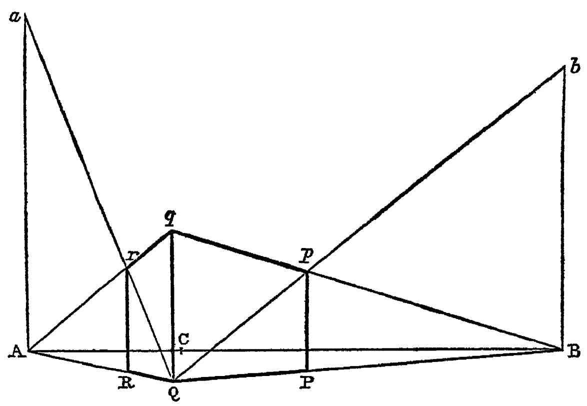

Fig. 9.

us. We recognise that it is intended to pourtray the block of a building, and infer that the building is rectangular. Query, with this inference can we deduce the actual proportions of the structure from its picture in perspective?

The first thing to be discovered is the position of the point of sight. Having produced QP, qp to meet in B, QR, qr to meet in A, we obtain the two principal vanishing points, and having joined AB we have the level of the eye. If the picture plane have been placed upright, and if the drawing have been accurately made, the lines Rr, Qq, Pp, are perpendicular to AB. The point of sight E must be in a plane perpendicular to the plane of the paper, and meeting it along the line AB. Now, the line EA is parallel to the lines represented by QR, qr; EB to those represented by QP, qp; wherefore the angle AEB must be right, and the point of sight must be found somewhere in the circumference of a semicircle described on AB as a diameter; but we have no positive means of determining at what point in that semi-circumference the eye ought to be placed. However, it is customary to place ourselves right in front of a picture, so that if we take C, the middle of that portion of the eye-level which is included within the limits of the paper, we may assume it as the middle of the picture. Erecting then at C a normal to the picture-plane, equal to a mean proportional between CA and CB, we obtain the position of the point of sight, and thus we can construct the part ABCE of fig. 1.

Binocular Perspective.

In order to discover the proportions of the parts of the building, draw the diagonals Qp, Qr on the picture, and produce them to meet vertical lines drawn through the vanishing points B and A, then, since the line joining the eye with b is parallel to that represented by Qp, we have the proportion EB : Bb : : length represented by QP : length represented by Pp, and thus we obtain the ratio of the length to the height of the building. Similarly EA : Aa : : breadth : height.

The ground-plan of the building may be reproduced by measuring from C, in fig. 1, a horizontal distance CP, taken from the picture, joining Ep, and producing it to any supposed distance pP. A line drawn through P, parallel to BE, is the line of the front, and the length of it may be found by measuring off Cq equal to the horizontal distance on the picture, by joining Eq, and producing it to meet the line of the front.

From these examples it is easy to see how the whole details of the structure could be scrutinized, if it ever should happen that the actual dimensions had to be obtained from a perspective drawing. It is evident that these operations cannot give the actual dimensions: some object of a known magnitude must form part of the picture, so as to be a standard of comparison.

Unless a picture be viewed from its proper point of sight, the impression produced must be different from that intended by the artist. In landscape and figure paintings the effect of a misplacement of the eye is not very conspicuous, but in drawings of buildings and machinery it is painfully felt. When the picture of a house is viewed from beyond the point of sight, that corner which is towards the eye appears acute; it seems, in fact, equal to the angle of two straight lines joining the eye with the vanishing-points A and B; and conversely, if the spectator come too close to the picture, the corner appears to be obtuse. By changing slowly one's distance from a perspective drawing, and studying the effect of the change, the proper distance may be passably well ascertained.

On moving the eye across the picture, the faces of the building, seeming always to be parallel to the lines joining the eye with the vanishing-points, appear to change their directions, as if the whole structure turned to follow the observer. This effect is well known in the case of portraits in which the model has been looking at the painter; the eyes of such portraits seem to follow the spectator wherever he may go.

In preparing vignettes and frontispieces, it is very common for engravers to reduce some well executed drawing; the effect of this is to reduce also the distance of sight, and to bring it far within the limits of distinct vision. The eye cannot be placed nearer the paper than twelve or ten inches, while distance of sight for vignettes is reduced often to three or four inches, sometimes even to less. Hence a painful and even ludicrous distortion: if there be buildings, they look as if sharpened at the corners to angles of 50, 40, or 20 degrees; and if it be a landscape, the retirement of the distant objects is out of all proportion to the breadth of the foreground.

BINOCULAR PERSPECTIVE.

We cannot realize the meaning of a perspective drawing without the aid of the association of ideas; but if we had two drawings of the same object as seen from two known separate points of view, we could thence deduce strictly the dimensions and form of the object represented by them. The distance between the two points of sight would form

the base of a triangulation, and the problem would become a case in trigonometry.

Actually the appearances presented to the two eyes are two such pictures, and the convergence which we find it necessary to give to the two optical axes in order to bring the images of a given point to coincide, enables us to estimate the nearness of that point. Of this we have a beautiful example in the habits of the chameleon. The eyes of that lizard are set upon two projecting balls which turn freely in their sockets, and their motions are quite independent of each other, so that while the one eye may be intently watching some insect, the other may be moving about in search of a more convenient prey. The field of view is very small, and hence an incessant motion of exploration. As soon as the animal has perceived a fly tolerably within range, he brings both eyes to bear upon it, and advances cautiously till it be within the reach of his long tongue: he never mistakes the distance; single vision does not enable him to estimate it with sufficient nicety, but the convergence of the two eyes does so.

Professor Wheatstone showed, many years ago, that if two properly projected drawings be presented, one to each eye, the effect of the double vision is to give the appearance of solidity. The only thing which hindered Wheatstone's stereoscope from at once becoming a valuable addition to our stock of illustrative apparatus was the extreme difficulty of making the drawings sufficiently exact. Only simple geometrical forms could be attempted, and the invention had almost been forgotten. But the recent discovery of photography, by enabling us to obtain minutely exact views of actual objects, has invested the doctrine of binocular perspective with new importance.

The projection of twin drawings for the stereoscope differs in no respect from the processes of ordinary perspective; the only thing to be attended to is the choice of the points of sight. If we were to make two pictures of a large building as seen from points only $2\frac{1}{2}$ inches apart, the differences between them would be almost imperceptible; in the language of the surveyor, the base would be far too short. Hence we are obliged to separate considerably the points of sight; but when we come to unite the two pictures, we see them from the eyes, which are $2\frac{1}{2}$ inches separate, and hence the impression is not that of a large building but of a small model. In other words, the stereoscope is applicable to objects at hand, and can only give diminutive views of remote objects.

The accompanying figures (fig. 10) are the projections of a rhomboidal solid, with one of its diagonals drawn. When

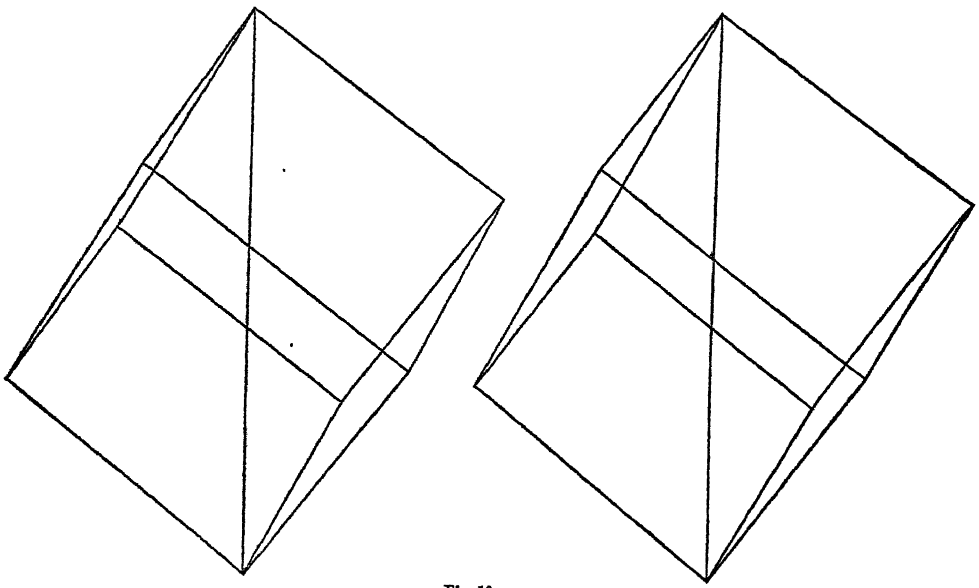

Fig. 10.

viewed through any of the ordinary stereoscopes, the illusion is complete; but if the wood engraver had attempted to draw the other three diagonals, they would have been seen, in all probability, to have passed each other at the middle, as any one may convince himself by drawing them in pencil; the reason is, that the slightest deviation from the proper place occasions a great change in the apparent position of the line; and hence the great difficulty of making stereoscopic engravings, or even of touching up by hand photographic pictures.

It must be observed, that a pair of stereoscopic views can never produce on the eyes exactly the same effect which the sight of the object would; for when we look from one part of an object to another, the adjustment of the focal length, as well as the convergence of the axes, is changed, and these two, from habit, are inseparably connected. Now, it is only the convergence of the eyes which is accommodated in the arrangement of binocular drawings, so that the use of the stereoscope must always do violence to the natural association of the muscular efforts. (E. S.)

PERTH, the principal town of Perthshire, and the most central in Scotland, is situated on the banks of the river Tay, about 25 miles above its confluence with the German Ocean, in Lat. 56. 23. 40. N., and Long. 3. 26. 20. W. The city, eminent for the beauty of its situation, occupies the centre of an amphitheatre, varied, pleasing, and highly picturesque. Encircled by richly wooded and highly cultivated heights, sloping more or less proximately, sits embedded the "Fair City," with its splendid and spacious parks, the Inches, extending their swardy expanses north and south, and its noble river flowing through its apparent confines.

From the rising grounds by which the city is surrounded, although none of them is of great altitude, some of the finest views in Scotland are to be obtained. Those from the summit of Moncrieff and Kinnoull Hills are of great extent, beauty, and variety. The prospect from Moncrieff Hill, described by Pennant as "the glory of Scotland," embraces on the west and south the vale of Strathearn; on the east

the curve of the Tay to the ocean; and in the distant north a noble sweep of the Grampian Mountains, with much of the Alpine scenery of Perthshire and contiguous counties. From Kinnoull Hill the view is less extensive, but scarcely inferior in beauty, variety, and interest. The height of Moncrieff Hill is 756 feet, and the height of Kinnoull Hill is 632 feet above the river.

The site of the town is only a few feet above the level of the sea; and hence it is exposed to partial inundation when the Tay is very much flooded. The height of the low grounds along the bank of the river varies from only 20 to 30 feet above the mean level of the sea; and the plain on which the town is built is still lower. Inconveniences of this kind of much consequence, however, are of rare occurrence.[1] Although lying low, the town is not by any means to be regarded as unhealthy; and though it is also closely surrounded by hills on all sides except towards the north, yet these being of moderate elevation, the hygrometric state of the incumbent atmosphere is little affected by their vicinity, and the air is accordingly more dry and clear than might have been expected. Fogs are not more frequent than in the open plains; and the diseases resulting from a damp soil and a humid atmosphere are of rare occurrence, or rather altogether unknown. The gravelly and sandy subsoil of the district, and the perpetual change of air occasioned by the current of the river in all states of the weather, contribute to render the climate of Perth more salubrious than that of many towns possessing a greater elevation. The mean hygrometric state of the air at Perth (as was ascertained, a good many years ago, by the late Professor Anderson) appears to be when the atmosphere is charged with about four-fifths of the entire quantity of moisture it is capable of holding in solution at the mean temperature. The hygrometrical means for 1857 were—mean of dry-bulb, 50°·6; mean of wet bulb, 45°·9. The quantity of rain observed to fall in the immediate neighbourhood of the town seems to correspond pretty nearly with the mean quantity for the latitude. In the year 1857 the fall was 30·464 inches, and the number of days in which it fell 164; so that against the number of wet or snowy days there were 201 fair days. The mean annual fall of rain, deduced from a period of six years—viz., from the year 1852 to 1857—was 30·30 inches. The mean height of the barometer, reduced to 32° for 1857, was 29·85 inches. The mean annual height, deduced from the same period of six years, as above in the case of the rain, was 29·67 inches. The mean temperature of 1857 was 51°·1, and the annual mean deduced from the above period of six years, 46°·5. The following are the observations of the wind for the year 1857, viz.:—N., 16 days; N.E., 21; E., 14; S.E., $59\frac{1}{2}$; S., $15\frac{1}{2}$; S.W., 63; W., $62\frac{1}{2}$; N.W., $20\frac{1}{2}$; calm, 93 days; mean force of the wind, $\frac{0\ 6}{0\ 38}$. The mortality tables for the years 1855, 1856, and 1857, show respectively somewhat under $2\frac{1}{2}$, 2, and 3 per cent. deaths to the population. The deaths registered in the burgh, exclusive of Kinnoull, in 1855, were 577; in 1856, 490; and in 1857, 695,—being for 1855, 1 in 41; for 1856, 1 in 48; and for 1857, 1 in 34 of the population. For the whole burgh, the births registered in 1857 were, 390 males and 370 females; and the marriages 237.

The greater part of the parish of Perth rests upon the old red sandstone formation, which stretches through the valleys of Strathmore and Strathearn. It contains altogether about 3400 imperial acres, and exhibits much diversity of soil. As regards the town and its suburbs, considerable changes in respect of soil and elevation must from time to time have taken place, as abundant evidence exists, low as it still is, of its having, at one time, been very much lower. Excavations in all parts of the town are constantly exposing the remains of buildings and numerous other traces of a lower level.

Perth is one of the most ancient towns in Scotland, and its civil history, up to the sixteenth century, is deeply interwoven with the national annals. Its origin is buried in the obscurity of the past, and the very etymology of its name is uncertain. The latter is now generally supposed to be of Celtic origin—an opinion which receives considerable support from the analogy of names of other places in the same neighbourhood, as well as all over Scotland, clearly of Celtic derivation. Perth must have been a place of considerable note long before the period when existing history refers to it. The "House of the Green" stood on what for ages had been reckoned the site of an old British temple, which, on the authority of Geoffrey, who wrote his history in the beginning of the twelfth century, was believed at the time of Hollinshed to have been built by the son of Regan, second daughter of Lear, who governed Britain long before the birth of our Saviour. This tradition is so far supported by the fact, that in digging many years ago for a proper foundation for the house which now occupies the site, subterranean buildings were discovered answering the description of such structures. It is a generally received opinion, that Perth was built and fortified by Agricola, who erected a citadel to maintain his conquests, and check the wild spirit of the savage natives. In corroboration of this opinion, it may be stated that there are no fewer than four military or Roman roads from different quarters, all leading to, if not centering in, Perth. The town was early known by the name of St Johnstoun, from the inhabitants, after their conversion to Christianity, having consecrated the church and bridge to John the Baptist, and having made him tutelary saint of the town. But there is no public document in which it is so designated, although the common seal of the burgh, which was in use in the year 1400, and of which many impressions are still in existence, represented the martyrdom of St John, and bore the legend, "S. communitatis ville Sancti Johannis Baptiste de Perth."

That Perth was a burgh in the reign of Edgar, 1106, appears from a charter then granted to a John Burgess, in which he was designated a burgess of Perth. The charter of confirmation by James VI. makes particular mention of one which had been granted by David I., who died 1153. King David's charter was renewed and confirmed by that of William the Lion, which is extant. From this point the authentic history of Perth may be said to begin. It enjoys the dignity of having been the ancient capital of Scotland. James II. was the first Scottish monarch crowned in Edinburgh, an event which happened in the year 1447. Soon thereafter the Parliament and courts of justice were removed thither; but it was not till 1482, in the reign of James III., that Edinburgh was declared to be the capital of Scotland. There seems good reason to believe, that when Edward I. ransacked the chartulary of Scone,

[1] The most remarkable inundations of which we have any record occurred in 1210, 1621, 1740, 1773, and 1814. The greatest of these appears to have been the first; in which, says Fordun in his *Scotichronicon*, "King William, his son Prince Alexander, and the Earl of Huntingdon, the king's brother, left the town in a small boat, and reached the dry land in safety. A few of the nobles who happened then to be at court accompanied them in other boats; others on the tops of houses, along with the townspeople of both sexes, with difficulty escaped a watery grave. . . . The river rose to such a height, that not boats merely, but large vessels, could be impelled along the streets and broadways without any difficulty or impediment. . . . Not only several houses, but the bridge over the Tay and an old chapel, were overthrown by the waters." Of the flood of 1621 it is preserved in the kirk-session records,—"that therethrough the Brig of Tay was hailly dung doun, except only one bow thereof standing. None could get furth of it, nor yet cum within it to make any relief thereto." It appears, however, when at its very height, not to have been such as to have prevented the people repairing to church, for it is also recorded that "Mr John Malcolm, minister, powerfully endowed with God's Spirit, caused ring the preaching bell on Sunday at seven hours of the morning, and the haill inhabitants came to the kirk." Little is recorded of the inundation of 1740. That of 1775 was produced by the shutting up of the river by ice, and was the cause of much injury to property. Of a very similar character was the more recent flood of 1814. It attained the height of $23\frac{1}{2}$ feet, and caused much damage to property. Several families were removed from their houses by means of boats, and communication held with many others in the same way. The last considerable flood took place in October 1847, and was produced entirely by rain. The water on this occasion rose to within 2 feet of the height attained in 1814, and with serious injury to property, submerged all the lower lying parts of the town.

he also made free with the records and documents of public value preserved at Perth; hence the absence of, in a great measure, such papers, as were to have been expected in a city so prominent in the nation's history. The records of the burgh are, however, of very considerable antiquity, but unfortunately the oldest cannot now be deciphered. The earliest legible date is 1512. Cant, in his History, however, produces a full and uninterrupted list of magistrates from 1465 to 1765. From the ancient importance of the city, its annals are replete with incidents and events of more than local interest and consequence. In 1298, after the battle of Falkirk, Edward I. reduced all the fortresses in Scotland, but fortified Perth, and rebuilt the walls in the strongest manner. Such defences proved in these and subsequent times exceedingly necessary. In these rude ages it was surrounded by the feudal castles of several powerful barons, with some of whom the inhabitants appear to have been frequently at feud, whilst with others, as Chartres of Kinfauns, the Earl of Gowrie, the Earl of Atholl, Lord Scone, and Threipland of Fingask, they were on such friendly terms as to have had one of their number for chief magistrate. Amusing evidence is to be found in the records of the burgh, of these alternate feuds and fraternizations. The worthy burgesses seem to have been men of mettle in those days; and on various occasions, sallying forth from behind their walls, set fire to the castles of their haughty neighbours, when the latter, probably in reprisal for some offence, had forbidden their vassals to carry provisions to the city. In the year 1311, Robert Bruce laid siege to the town, but was obliged to withdraw his troops, after various unsuccessful attempts to take it. Not discouraged, however, the Scottish hero, having selected a band of determined men, and chosen a dark night, led them on in person, scaled the walls, and carried the town sword in hand; the king himself being the second man who entered the place. About the beginning of the fourteenth century, the famous combat between the Clan Chattan and the Clan Quhele or Clan Kay, took place on the North Inch, and was decided in favour of the former, partly by the bravery of a citizen or burgess called Harry Wynd, whom the chief of the Clan Chattan had engaged on the spot to supply the place of one of his men who had failed to appear This city has also been the scene of several of those social tragedies, in which the history of Scotland, in those rude times, was so prolific. In the year 1336, King Edward III. of England stabbed his brother the Duke of Cornwall, before the high altar of the church of St John; and in 1437, James I. was murdered in the monastery of Blackfriars, by Walter, Earl of Atholl, Robert Stewart, his lordship's grandson, and Robert Graham, their kinsman, with circumstances of the most savage barbarity. The murderers were executed in Perth, and the details of their punishment are of the most revolting character, reflecting but little honour on the good feeling and humanity of our forefathers. Perth appears to have been several times visited by the plague, particularly in 1512, 1585, 1608, and 1645. Its ravages during the last of these visitations were severe, 3000 persons having become its victims. In 1539, Margaret, queen of James IV. was interred in the Carthusian monastery, beside the tomb of James I. Her Majesty died at Methven Castle. In 1617, James VI. honoured the ancient capital of Scotland with a visit, the details of which, as found in the burgh records, are not a little graphic and entertaining. And in 1623, one of those exhibitions, of which James was so fond, and which leave a stain upon the national annals, took place in Perth; we mean, the burning of three poor women for witchcraft. In 1633, Charles I., in his tour through Scotland, visited Perth; and in 1651, Oliver Cromwell took military possession of the city, and erected a citadel on the South Inch. The year 1600 was rendered memorable by the occurrence of the famous Gowrie conspiracy; one of those events on which ingenuity and research have exhausted themselves, and which, in its origin and circumstances, still remains enveloped in impenetrable mystery.

In the ecclesiastical history of Scotland, Perth occupies a somewhat prominent position. Here, it may be said, the work of reformation in Scotland was commenced by Knox. In 1544, Cardinal Bethune having obtained an act in favour of the bishops and clergy to persecute and punish heretics, came to Perth, when an accusation was forthwith lodged against certain persons for interrupting a friar of the name of Spence while preaching. The accused were found guilty, and condemned, and on the following day were executed—four men being hanged; and one woman, whose offence was refusing to pray to the Virgin Mary, drowned. Other citizens were banished. Before the Cardinal left Perth, the Regent, at his instigation, turned Lord Ruthven, provost of the town, out of his office, and conferred it upon Chartres of Kinfauns. The citizens, however, resisted the attempt, and repulsed in a smart skirmish the Cardinal's nominee, who came to enter upon his duties at the head of an armed force. The means adopted here and elsewhere to suppress the dawning Reformation only served to spread it. Executions became general, and the people became more and more alienated from the Church. The public exercise of the reformed religion having been introduced into Perth, the regent queen commanded all the Protestant preachers to be summoned to a court of justice to be held at Stirling the 10th of May 1559. The people resolved to answer the summons along with their ministers, in such numbers as induced the queen to feign an abandonment of the trial. The people dispersed, and the preachers, with a few leaders, remained at Perth. The dissimulations of her Majesty ended, on the said 10th of May, in the banishment of the still refractory ministers; the day after which John Knox appeared in Perth, and preached the famous sermon against the idolatry of the Church of Rome, which proved indirectly the cause of the first great outbreak of the Reformation. The indiscretion of a priest, who, after the sermon, was preparing to celebrate mass, precipitated such of the congregation as remained into action with tumultuary but irresistible violence. They fell upon the churches, overturned the altars, defaced the pictures, broke in pieces the images, and proceeding next to the monasteries, in a few hours laid these sumptuous fabrics almost level with the ground. The fury of the mob, however, was in a great measure confined to the edifices; little personal insult was offered to any one, and not a single Roman Catholic was put to death. This riotous insurrection was in nowise the result of premeditation, was not joined by the more respectable citizens, and was publicly censured and condemned by the ministers and leaders of the Reformation. Her Majesty heard of the destruction of the religious houses at Perth with much concern, and determined to inflict the severest vengeance on the Reformers. Both parties took the field; negotiations ensued; Perth was thrown open to the queen, and occupied by a French garrison. But no sooner was peaceable admission gained, than all the previous stipulations were disregarded; the whole town was oppressed; swarms of priests were introduced into it; Lord Ruthven and the bailies were superseded in their offices; Chartres was made provost; and the exercise of no other religion than the Roman Catholic was permitted. Relief from the insolence and exactions of the garrison was only obtained after a regular siege by the Reformers. On the 26th of June Lord Ruthven attacked the town on the west, and Provost Halyburton of Dundee fired into it from the bridge, and speedily obliged the garrison to capitulate. From this resulted the destruction of the abbey and palace of Scone on the following day. After the loss of Perth, the Queen endeavoured to seize Stirling. Argyle, and Stewart, prior of St Andrews, having received intelligence of her design, marched out of Perth with three hundred citizens, resolved to prosecute the Reformation, or perish in the attempt. That their determination might be the more apparent, they, instead of ribbons, put ropes about their necks, intimating thereby that whoever of their number should desert their colours should be hanged by the ropes. Hence the origin of the proverb of "St Johnstoun's Ribbons." The people joined them everywhere as they proceeded; and before they reached Stirling, their numbers had increased to five thousand. The gates of Stirling, and of every other town in their way, were thrown open to receive them. They, without violence, took possession of Edinburgh, cast the images out of its churches, and placed in them ministers of the Reformation.

Perth has long since been divested of almost every relic of antiquity, although at one time few places were so highly favoured in this respect. Hardly a trace is left of any of the numerous religious houses with which it abounded. The Parliament House and Gowrie Palace are also entirely removed. Two small portions of the ancient city wall, however, are still preserved; but the *lade* is the only work which has passed entire from ancient to modern Perth.

Claiming to be first noticed among the public buildings of Perth is the old church of St John. It is altogether unknown when and by whom this edifice was founded; but from such historical facts as can now be gathered, it must have been built about the middle of the fifth century. Stones were requested by King Robert Bruce in 1329 for its repair from "our beloved and faithful religious men, the abbot and convent of Scone." In the year 1410, the edifice was in good repair; all the old altars had been removed, and new ones erected. At the period of the Reformation, it is described as in a very high state of repair, containing rich altar pieces, images, decorations, and ornaments. But the fabric is of such very remote origin, and has undergone so many repairs, that it is difficult to say what or whether any of the original building now remains. There can be no doubt, however, that the tower

and the pillars of the East and West churches are of very ancient date. When it was divided, as at present, into three places of worship, is not precisely known. That part of it which is now occupied as the West church must have been separated from the rest about the beginning of the seventeenth century, for it is recorded that a public meeting of the inhabitants was held in it in 1608. A variety of other public transactions are recorded as having taken place there. Prominent among them is the meeting of the General Assembly in August 1618, at which the famous Five Articles of Perth were passed. In 1716 it was fitted up as a place of worship; and in 1771 the eastern division, or choir, now the East church, was separated from the old or Middle church. The present fittings of the churches are all modern. One of the bells bears date 1400, and another 1506. The only other church possessing any particular interest is the South United Presbyterian church, having been erected in 1740 for Mr Wilson, one of the four original seceders from the Church of Scotland.

Of the other public buildings, the principal are the bridge over the Tay, completed in 1771, at an expense of L.26,631, of which government contributed L.11,000, the city of Perth L.2000, and the royal burghs L.500; the County Buildings, erected in 1819–20, at a cost of L.32,000; the General Prison; the military barracks, erected in 1793–4; the public seminaries, erected by public subscription in 1807, at a cost of about L.7000, of which the city contributed L.1050; Murray's Royal Lunatic Asylum, completed in 1827, and erected at an original cost of upwards of L.40,000, bequeathed by Mr James Murray, a native of the parish of Perth, to which considerable additions have been made by the directors, including two contiguous properties; the monument erected to the memory of Provost Marshall, in which are accommodated the Perth Library and the library and museum of the Literary and Antiquarian Society; the water reservoir, erected in 1830; the infirmary, erected in 1836, at a cost of L.6000; and the general railway station, partially erected in 1848, and still uncompleted. The only other building of much note is the hospital, founded by James VI. in 1569, and which has two royal charters.

Perth abounds in religious, educational, and charitable institutions. There are twenty-four churches, comprising six places of worship belonging to the Established, six to the Free, and three to the United Presbyterian Churches; in addition to these, there are Original Secession, Wesleyan, Independent, Baptist, English Episcopalian, Scotch Episcopalian, and Roman Catholic Churches; there is also a Glassite meeting-house. There are eighteen public schools, besides a considerable number of private schools; also three ragged or industrial schools. In eleven of the public schools education is afforded to the poorer classes at fees more or less small; and in one, under the management of the incorporated trades, to the sons of members gratuitously. The charitable institutions are no less abundant. The principal of these are the infirmary, which contains accommodation for 68 patients, and is maintained at an annual cost of about L.1300; the Indigent Old Men's Society, which expended in provisions and clothing, in 1857, L.165; the Indigent Old Women's Society, which similarly disbursed L.170; the Destitute Sick Society, L.52; and the Ladies' Clothing Society, L.28. Besides these, there are the Lethendy Mortifications, the annuities of which amounted in 1857 to L.723; and James VI.'s Hospital, affording outdoor relief to the extent of about L.600 per annum. The incorporated trades also devote a large proportion of their funds to the assistance of their poorer members. In this way, in 1857, the trades expended the sum of L.1062, and the guildry L.464. The poor's rates for the burgh amounted in 1857 to L.6543.

Of the trade of the place a very vague estimate only can be formed. The exports and imports by the river afford no index to it whatever, the great bulk of the traffic being carried on by railway. Perth cannot be said now, as in former times, to be famous for any particular manufacture or branch of business. Cotton goods for foreign markets are made to a considerable extent; so are galas, wincies, and hosiery, for home trade. The number of weavers employed by the Perth manufacturers is variously estimated from 1500 and downwards. Linen is made to a small extent by power-looms. A very large traffic, however, is carried on in wood. In this trade, seven saw-mills, driven by steam, of, in the aggregate, seventy-six horse-power, are constantly employed in cutting up the timber for the various purposes for which it is employed. The value of the wood changing hands at Perth is estimated at about L.50,000 per annum; and the larger proportion of it is the produce of the county. The purposes to which it is principally applied, besides house and ship building, are pit-props, barrel-staves, railway-sleepers, and fences. Ship-building is also vigorously prosecuted, giving employment to about 150 to 200 carpenters and others. Agricultural produce, and commodities connected with agriculture, form perhaps the most prominent feature in the commerce of the place. The salmon caught in the river are also an item of some importance in this respect, the great bulk of them being exported from Perth for the London market; the aggregate rent of the salmon-fishings in the Tay being, for the year 1858, L.11,487. The tonnage of vessels visiting the port for the year ending 1st November 1857 was 25,877 tons register; and 57 vessels, measuring 5000 tons, are owned in Perth.

The government of the city is vested in a lord provost, who is also sheriff and coroner; four bailies; a treasurer; the dean of guild, who is *ex officio* a member of the council; and nineteen councillors. There are two city clerks, a procurator-fiscal, and a chamberlain. The city sends a member to Parliament. After Edinburgh was constituted the capital of the kingdom, Perth stood second on the roll of burghs of the Scottish Parliament, and is still entitled to hold that rank. Its chief magistrate has for centuries enjoyed the title of Lord Provost, which was confirmed by a judgment of the Court of Session, 12th March 1836. The Circuit Court of Justiciary is held here twice a year, when the more aggravated criminal offences committed in the counties of Perth, Fife, and Forfar are tried. There are, besides the magistrates and council, two popularly-elected public commissions, the water and police commissions. Under the former, the city is abundantly supplied with water filtered and raised from the Tay, the whole expense of which was defrayed in 1857 by assessments of 2d. and 8d. in the pound upon places of business and dwelling-houses respectively. In police, paving, lighting, and cleansing, the latter commission expended during the year 1856–7, L.4131. The general police assessment was 7d. per pound.

Although divested of much of their ancient political power, and shorn of much of their former state and dignity, the guildry incorporation and the incorporated trades still occupy a prominent and important place in the civic economy of the burgh. The incorporations are the hammermen, bakers, glovers, wrights, tailors, fleshers, shoemakers, and weavers. Several of the incorporations are possessed of considerable property. The dean of guild and the convener of the trades are *ex officiis* members of most of the local boards. Most of the trades possess interesting relics of departed greatness. The principal of these is a very old flag, called "the blue blanket," in the keeping of the convener. This old banner, tradition saith, was borne in the Crusades by a body of burgesses from Perth. The glovers also have preserved in their repositories various interesting mementos; among the rest, a morris-dancer's dress, with

cap and bells, in which some worthy follower of St Bartholomew exhibited for the diversion of Charles I. on the 8th of July 1633. This incorporation also possesses an antique flag, bearing the date 1604. said also to have been borne by some of the craft at the Crusades. The chief memorial preserved by the guildry is the Incorporation Record from 1452 to 1631—a venerable volume in a complete state of preservation, in which are inscribed the autographs of James R., 1601; Charles R., July 24, 1650; Victoria R., 1842; and Albert, 1842.

The burgh has a very large property and revenue, the former derived chiefly from the favour and munificence of several of the Scottish sovereigns. The property of the burgh consists of lands, feus, fishings, mills and waterfalls, dues, seats in the churches, houses, &c.; and its estimated value is L.97,600. The debt of the city, after deducting assets, was, at the 30th September 1857, L.16,518, 2s. 8d. The revenue for the year 1856–7 was L.6052, 13s. 9d., and the expenditure L.3809, 11s. 7d.

In 1856 the navigation and harbour commission was merged in the town council, and the financial affairs of the one conjoined to those of the other (the accounts, however, of the two concerns being kept separate and distinct), by act of Parliament. This, although originally contemplated, was latterly necessitated by the untoward condition of the finances of the commission. In 1854 the obligations of the harbour commission amounted, in round numbers, to L.82,000; while the revenue, in consequence of the successful competition of the railways, had fallen to a trifle over L.1400, being about L.2300 short of its annual liability in the item of interest. The city, being by the Navigation Acts placed in the position of cautionary obligant for the commission, and the surplus revenue of the one not being equal to the deficiency of the other, an act of Parliament was obtained by the town council consolidating the two bodies, with their respective debts and revenues, and converting their conjoined obligations into bonds of annuity bearing a fixed annual interest of 3½ per cent., and also containing power to levy assessments upon the property within the ancient royalty not exceeding 4d. in the pound. The nett obligations on account of the navigation and harbour, at 30th September 1857, was L.85,949, 8s. 2d. But so favourable a turn had the finances of the united bodies taken, that at the same date of the second year of the operation of the act the conjoined surplus revenue over expenditure amounted to L.1022, 9s. 9d.

The large obligations of the navigation and harbour commission were incurred in the construction of new quays, and in the deepening of the river. These works cost together about L.65,000. Besides this, however, the sum of L.31,500 was awarded to the proprietors for injury done by the operations to the salmon-fishings. There is now about 2000 feet of quay berthage at Perth; and ships of 300 tons register can easily ascend the river, the tide rising from 13 to 19 feet at the harbour. For several years the works of the commission fully realized the most sanguine expectations of their promoters; but, as already remarked, the trade of the place has of late been very much diverted from this channel.

The population of Perth, by the last census (1851), is 23,835; inhabited houses, 1991; parliamentary constituency, 933; municipal constituency (1856–7), 636; annual value of real property in 1855–6, L.62,493.

PERTH-SHIRE, one of the most extensive and beautiful counties in Scotland, is almost circular in form, and occupying nearly the centre of the kingdom. Its extreme length from E. to W. is about 70 miles, and its greatest breadth from N. to S. is about 66 miles. Its area is given at 2835 square miles, of which more than 50 are of water. Of the 1,814,063 acres forming its superficial contents, 267,397 were returned in 1857 as under tillage. Many acres are under wood; and a vast extent of highland country affords grazing, pasture, and preserves for game; while only a small proportion of the county can be said to be wholly barren and unproductive. On the E Perthshire is bounded by the counties of Forfar, Fife, and Kinross; on the N. by Inverness and Aberdeen; on the S. by Stirling and Clackmannan; and on the W. by the shires of Argyll and Dumbarton. Its ancient and still popularly-known divisions are,—Monteith, Athole, Strathearn, Breadalbane, Rannoch, Stormont, Perth proper, and Gowrie, to which some add Balquhidder and Glenorchy. It is under the jurisdiction of a sheriff and two substitutes, one of whom resides at Perth, and the other at Dunblane. There are within its boundaries seventy-eight parishes, or portions of parishes, some of them running into other adjacent counties.

Perthshire is distinguished amongst the counties of Scotland for the rich, varied, and picturesque beauty of its surface. From the commanding range of the Grampians, and numerous other secondary elevations, the country slopes gently down into extensive tracts of rich and fertile land, beautifully diversified, and adorned with wood and water, hill and dale, in every possible combination. Where the elevated ranges gradually disappear in the champaign country, nothing can exceed the rich and undulating character of the scenery, broken into noble and irregular valleys, or spreading out into extensive alluvial tracts, watered by streams of almost every size and character. The county of Perth is now generally divided into the Highland and Lowland divisions, the surface of the former being far more extensive than that of the latter. The fertile or Lowland districts lie chiefly, but by no means entirely, towards the eastern and the southern boundaries of the county. The fine valley of Strathearn, having the Grampian range on the N.W., with the Ochils and Sidlaw Hills on the E., traverses it from N.E. to S.W., and, including certain portions of the contiguous valleys of the Tay and the Almond, forms one the richest and most extensive tracts in the kingdom. Besides the extensive valley of Strathearn, there are others of considerable dimensions studded with lakes, and enlivened with streams of every variety of character. Perthshire is likewise distinguished for its noble ranges of mountains, some of which attain a considerable elevation. The highest is Ben Lawers, 3992 feet; Ben More is 3818; Cairn Gower, 3690; and Schehallion, 3613. This last mountain is distinguished by its fine conoidal outline. Benledi rises to the height of 2381 feet; Ben Ardlanach to that of 3500; and Ben Venu to that of 3300; besides many others of considerable though inferior altitude.

The lakes and rivers of this county are numerous. The largest of the lakes are feeders to the Tay, the watershed of the Glen Tilt mountains bounding the county on the N., and that of the Moor of Rannoch on the W. The principal lakes that feed the Tay are lochs Tay, Ericht, Rannoch, Tummel, Lydoch, Garry, Lyon, and Dochart, besides a great number of smaller lakes, the most part of which are situated in the district of Rannoch. The chief streams whose waters find their way into Tay are the Tummel, the Garry, the Lyon, the Lochy, the Dochart, the Braan, the Isla, the Ericht, and the Almond. The highest of these lakes is Loch Ericht, but only about a third of it is in Perthshire. The next highest in point of situation is Loch Lydoch; and the other lakes lying in the Moor of Rannoch. All these lakes and streams abound in fish, some of them containing trout of a very fine quality; and where no natural obstruction exists, salmon ascend almost to their source. The river Tay is the principal river, and is said to discharge more water into the ocean than any river in Britain. Another great drain of the water which falls in this county is the river Earn, which rises in Loch Earn, and falls into the estuary of the Tay a few miles above Newburgh. The streams that fall into this river are numerous, but none of them are of any great size. The river Forth is the boundary of the county on the S., and the lakes and streams that empty themselves into it are numerous and of considerable size; the principal lochs are Voil, Lubnaig, Katrine, Auchray, Vennachir, Ard, and Monteith. Salmon are got in considerable numbers both in the Forth and Earn;

but owing to the want of protection to the spawning fish, and the constant destruction of the young fish in the parr state, they are yearly decreasing, especially in the Forth and its tributaries.

The Tay is a noble river, and the beautiful scenery through which it flows, with its crystal waters running over its gravel bed, and the great volume of water which it is continually carrying to the sea, entitles it to be called the finest river in Scotland. Loch Tay is about 16 miles long, and fully a mile broad, and lies nearly E. and W.; the rivers Lochy and Dochart discharge their waters into it at its head, the village of Killin being between the two streams. The scenery here is of the finest description; and also for 8 miles up Glen Lochy. Salmon ascend the Lochy as far as the falls of Boreland; and for 10 miles farther up the glen the river is well stocked with native trout. The river Dochart is a sluggish stream, but a good angling river. Salmon may be taken in the spring months, and its pearl fishery is well known.

Loch Tay contains salmon, the common trout, and pike. The annual rental of the Marquis of Breadalbane for the salmon-fishery has been, since 1828, L.50. Some very fine fish are taken with the net, during the months of February and March, at Kenmore, where the river Tay issues from the loch. The Lyon river, which joins the Tay a little above Weem, is one of the most inviting streams in the county both for the tourist and angler. It flows out of Loch Lyon, and after running for one-half of its length through a hilly and grazing country, it enters a finely-wooded gorge in the mountains, from which it emerges a little above Fortingal. There are some of the finest beech trees here to be seen in Scotland. This glen is almost unknown to tourists, as, like Glen Lochy, it has no outlet. Loch Lyon is full of very fine trout, and even salmon reach the loch, and have been caught in it. Loch Ericht is the largest lake in the county, and is so deep that the greater part of it never freezes, notwithstanding its high situation; and during the heat of summer its water feels intensely cold, while in winter it is warm. During severe frosts its surface is enveloped in vapour, from the water giving out its caloric. This lake is full of the finest trout, especially at its S.W. end, where it is shallow. The only kinds of fish in its waters are *S. fario* and *S. ferox*; the latter are more abundant than in any other lake in the county. The scenery is of the wildest and grandest description. Ben Alder rises up perpendicular from the lake to the height of nearly 4000 feet; and a cave overhanging the lake is pointed out where "Prince Charlie" hid himself for a season.

Loch Lydoch, in Rannoch Moor, is a beautiful sheet of water about 6 miles long, and has an island covered with trees, upon which the sea eagle builds; in fact the only trees to be found in the moor are around this lake. It abounds with trout; and so does the river Gauir, that flows from it into Loch Rannoch. This lake, which receives also the waters of Loch Ericht, is 11¾ miles long by 1½ broad, and has more the appearance of a Lowland than a Highland lake. On the N. side its shores are clothed with native birch; and on the S. side there are still many miles of the old black wood of Rannoch, which contains some of the finest natural Scotch fir trees in the country. The lake is well stored with an excellent kind of trout, not inferior to Loch Leven, which cut up as red as sea trout; besides *ferox* and *S. salvelinus* or charr. This is a fine lake for the angler, and liberty can easily be obtained to fish it. The river Tummel flows from this lake at Kinloch-Rannoch, and falls into Loch Tummel. Along this part of its course the country around is strewed with rounded boulders to an extent that is hardly conceivable. The scenery around the lake is equal to any in the county; the view from Allean of the lake, the strath, and Rannoch mountains, is very fine. A few miles after leaving the lake the river rushes over the rocky barrier which forms the falls of Tummel. Salmon can ascend no higher than this, and a net is suspended to catch those that make the attempt; which fishing has been regularly let. If a few pounds were spent in blasting the rock, the breeding-ground of the salmon would be greatly enlarged, but this would subject the upper proprietors to close time, which many of them would not like. The Tummel is joined by the Garry near Faskally, at the mouth of the far-famed Pass of Killiekrankie, and after flowing 10 miles, it joins the Tay near Logierait. Loch Tummel contains fine large trout, although they are not numerous, as the lake is also stocked with pike, which have never found their way to any of the lakes farther up. The river Garry flows from the lake of the same name near Dalnaspidal. It is a picturesque, brawling stream, and has some salmon in its pools, but its native trout are small.

The Braan river, which enters the Tay at Inver, near Dunkeld, is for the greater part of its course rapid, and flows from Loch Freuchie, near Amulree. This lake is a favourite resort of the angler, but the trouts are not large. The river Isla empties itself into the Tay at Mickleour. It rises in Glen Isla in Forfarshire, and is a rapid-running stream until it enters Strathmore, when its current for miles is hardly perceptible. Trout are numerous in its waters, and salmon were once so; but pike and eel are very plenty, and the want of sufficient protection to the breeding fish has rendered the salmon-fishing of little value. The Ericht, a picturesque small stream which flows into the Isla a little below Blairgowrie, was not many years ago famous for its salmon; but its waters are so poisoned by public works, and the ascent of the salmon obstructed by dam-dykes, that very few fish are now to be found in it.

The Almond river enters the Tay a little above Perth, but so much of its volume of water is abstracted to supply the neighbouring printfields and mills, that very little of it enters the Tay by its natural channel. Salmon, however, find their way up when the water is in flood; and by the lowering of the fall at Buchanty in Glen Almond, the fish find a great amount of additional spawning-ground in the Sma' Glen.

The river Tay issues from Loch Tay as a large stream, and at once enters and runs through the fine grounds of the Marquis of Breadalbane. Having received the waters of the Lyon a little above Weem, it flows on smoothly until it has to encounter the rocky chasm at Grantully, where there are some fine salmon pools. At Logierait its stream is increased by the junction of the Tummel, which river sends as much water to the ocean as the Tay; still, at the meeting of the waters the Tay appears to be very little increased in volume. A few miles above Dunkeld it enters the grounds of the Duke of Atholl; and no river scenery can be finer than what is met with here. The salmon fishing is very good, but his grace reserves the whole to himself. The view from the bridge of Dunkeld arrests the attention of the tourist; and the scenery on the banks of the river, as it flows through Marthly grounds, is inferior to none in its course. Having reached Mickleour, where it is joined by the Isla, it runs more swiftly, being confined between steep banks, until it rushes over the Linn of Campsie at Stobhall. This fall, when the water is low, may be about 3 feet in height; but when the water is high, no fall is perceptible. The late Professor Anderson of St Andrews stated, in a paper which he read before the Literary and Antiquarian Society of Perth, that after examining the ground with care, it was his opinion that, previous to the river bursting this barrier, its waters followed the course of the Isla through Strathmore, and entered the sea at Montrose or Lunnan Bay. The old bed of the river can yet be distinctly traced in many places; and the numerous lakes still in existence along the old channel bear evidence to the professor's theory. It is a singular fact that a number of Stormontfield-marked *grilse* have been caught in Lunnan Bay. After passing the linn, the river has to pass over the most rugged part of its whole course, the fall being 28 feet in the distance of half a mile. This fall in the river has been taken advantage of for the purpose of driving the machinery of the large cotton-mills at Stanley, which were originally erected by the celebrated Arkwright. Opposite these mills, the *lade* that supplies the Stormontfield bleaching-works is taken off the river; and a little farther down, the *lade* that supplies the Luncarty bleachfield is taken off. A little farther down a remarkable dyke of trap crosses the river, called the Thistle Brig: this trap dyke is very similar to that at the Linn. The whole of the rocks in this gorge, from the junction of the Isla with the Tay to this bridge, are of the old red sandstone formation. About a mile farther down the river are the Stormontfield salmon rearing-ponds, which have thrown so much light on the natural history of the salmon. (See article FISHERIES.) At the junction of the Almond with the Tay, about 2 miles above Perth, the action of the tidal wave ends, rising at spring-tides little more than half an inch. At low-water there is a gentle current from Perth bridge to Newburgh, the fall being about 8 feet. The Tay below Perth is surpassed in beauty by no river in the kingdom. Kinnoull Hill, and the castle and grounds of Kinfauns, are fine features in the landscape on the one side; while on the other are the venerable ruins of Elcho Castle, and Moncrieff Hill. Six miles below Dundee the Tay enters the German Ocean.

Before closing the description of this fine river, a few words will be necessary upon its salmon-fisheries. The net-fishing for salmon and sea-trout on this river is of considerable importance in a national point of view, not only from the quantity, but from the quality of the fish. Until the year 1828, the net-fishing closed on the 26th August; but after that time an act was obtained which altered the time for closing to the 14th of September. The whole assessed annual rental of the Tay in 1828, previous to the alteration, was L.14,574, 10s.; last season (1858) it was L.11,487, 2s. 5d.; although in 1852 it had fallen as low as L.7973, 5s. This state of matters having alarmed the proprietors of the fishing, a new salmon bill was carried through Parliament this last session, making the close time to last from the 26th August until the 1st February for net-fishing, and extending the rod-fishing until the 1st October. This measure has already had the effect of raising the rental nearly up to that of 1828, besides making the rod-fishing very

valuable, which before had fallen so low that very little of the river was let for that purpose. Since the nets were taken off this season, on the 26th of August, the river is swarming with salmon, and anglers have had good sport. Salmon have been caught with the fly on Lord Gray stations, in the tideway, which the oldest fishermen acknowledge they have never heard of before. The protecting force during close time has also been increased; and there is little doubt that in a few years the Tay will become as famous for its salmon-fishing as it once was.

The river Earn, the second largest drain for the waters of the county, rises in Loch Earn, and flows through Strathearn until it reaches the Tay near Abernethy. The upper part of this strath is of considerable elevation, and consequently, until it is joined by the Machany river, a little above Trinity Gask, flows for the most part with a rapid current. Between this part of it and its junction with the Tay it is more like a canal than a river, and when flooded does much damage to the crops in the low grounds. After heavy floods, it generally finds, in various places of its course, a new channel for itself, which is very hurtful to the land upon its banks, although much money has been spent upon embankments. These old courses of the river are full of pike, some of which attain a great size; ducks and water-fowl also abound in them. A considerable quantity of salmon are annually caught in this river. The rental of that part of it near its junction with the Tay, belonging to the Earl of Wemyss, was, for 1858, L.121; for 1829, L.166; the rental of the upper proprietors is not generally known. Salmon ascend as high as Loch Earn, and the best spawning-ground is situated between Crieff and that lake. Besides *Salmo salar*, this river is famous for *S. trutta*, or sea-trout. *S. fario*, or common trout, are abundant; and *Esox lucius*, or common pike, are far too numerous for a large increase of the genus Salmo. The Machany is a beautiful little stream, flowing through the grounds of Lord Strathallan: it is well protected, and abounds in sea and common trout. Strathearn is second to no strath in the county for the beauty of its scenery, and in the lower part of it for the richness of its crops.

The third great drain is the Forth and its tributaries; but as for the greater part of its course it is the boundary of the shire, it will be sufficient to glance at those of its tributaries that are in Perthshire. Loch Katrine, which is about to become the reservoir for supplying the city of Glasgow with water, has been immortalized by Sir Walter Scott. In this lake there is good fishing; it contains *S. ferox*, common trout, and pike. The scenery is so well known that no description is required. Lochs Achray and Vennachir are continuations of Katrine, but, in addition to the fish inhabiting the latter, a few salmon are found in their waters. The stream that flows from these lakes joins the river Teith at Callander. The Teith rises in Loch Lubnaig, a few miles farther up than the last-named village. Loch Lubnaig is a fine sheet of water, and abounds in *S. ferox* and small trout. The Teith contains a few salmon; but the salmon-fishing of the Forth and Teith has fallen off ever since Blair Drummond moss was sent in such quantities into the river; and no increase can ever be looked for until such time as the proprietors see it to be their interest to afford more protection to the spawning fish and the fry. The water of Allan, which enters the Forth at the Bridge of Allan, not many years ago used to be highly esteemed by anglers for the multitude of its sea-trout, but owing to the wholesale destruction of the fry in the parr state that is carried on, it contains now very few. The Forth proper takes its rise from a large spring near the foot of Ben Lomond on the N. side. The spring is so large that from the first it is a considerable stream; but after flowing until it reaches Aberfoyle, it receives the waters that issue from the upper and lower Lochs Ard Lochs Ard are the favourite fishing-ground of the anglers of the west, and contain trout of a very fine quality. The Forth on the whole is a sluggish-running river, and contains salmon, sea-trout, common trout, pike, perch, and eels.

In the more elevated districts of the county, where the mountain ranges slope down into the level country, and amongst the numerous glens which penetrate these in all directions, the climate is charged with moisture in a higher degree, the winters are longer and more severe, the snow frequently lies longer on the ground, and the spring is generally later than in the lower districts of the county. The highest summer temperature rarely exceeds 65°, and the mean temperature, in three different situations in the county (none of them, however, more than 150 feet above the sea), has been found to be 47°. The cloudy character of the atmosphere in the mountainous districts, by intercepting the light of the sun, retards the ripening of the crops, and accumulates moisture, which tends to lower the average temperature. The district of Perth proper is said to be the least humid, the average rain-fall being only 23 inches; but in the Carse of Gowrie, on the shores of the Firth of Tay, the mean quantity of rain for twelve years was 24½ inches; at Perth, for a period of six years, it was 30·30 inches; and at Belmont in Strathmore, for thirty years, it was as high as 30·40 inches. The extensive drainage. executed by various proprietors, has no doubt tended considerably to ameliorate the climate.

As the county may, from its external configuration, so it may also from its geological structure, be divided essentially into Highland and Lowland divisions. The former consists mainly of metamorphic schists, clay, mica, chlorite, and hornblende slates, and gneiss; while the latter is made up of the old red sandstone series The Lowland or southern division of the county is made up of a broad belt of the old red sandstone, which stretches right across Scotland from the Clyde, between Dumbarton and Helensburgh, to the E. coast between Stonehaven and Dundee. Over this belt lie the great valleys or plains of Strathmore, Strathearn, and the Carse of Gowrie. The old red sandstone is bounded on the N. by a very narrow belt, varying from half a mile to 3 miles in breadth, of clay and other slates,—which belt stretches parallel to that last described; also from the Clyde about Helensburgh to the E. coast at Stonehaven. North of this there is a broad band of mica-slate likewise passing across Scotland from the W. to the E. coast. This is succeeded, farther N. still, in the Rannoch district, by quartz rock and gneiss; the latter forming the geological basis of the greater part of the north of Scotland. The sandstone forms level plains; the slates rise into the majestic range of the Grampians. Here and there the strata of sandstone or slate are penetrated by erupted hills of granite or trap,—the former chiefly in the Highland, the latter in Lowland districts.

The northern or Highland part of the county is made up chiefly of the broad range of the Grampians, which at the same time form a natural northern boundary. The slates of which they are chiefly composed, are very variable in structure; passing into each other by insensible gradations. Thus, the clay-slate passes frequently into the graywacke on the one hand, and mica-slate on the other; mica-slate graduates into gneiss, and the latter into quartz rock. One consequence of this is, unequal disintegration by exposure to the weather; and a result of this again is, the peaked or "aiguille-like" form of many of the Perthshire mountains. The clay-slate series may be well studied about Dunkeld. Near Birnam, and on both sides of the river, are extensive quarries of roofing slate of fine quality. The hills on both sides of the river, where the railway from Perth enters the pass or ravine at Birnam, are formed of clay-slate. The clay-slate may here be found passing into graywacke, mica, hornblende, talc, and chlorite slates. Garnets are common in the micaceous slates here; while micaceous iron ore and crystallized chlorite are to be met with at Birnam quarries. The mica-slate about Dunkeld frequently also contains tourmaline, sometimes calc-spar; and on the S. side of Craig-y-Barns there is a vein of copper pyrites. There are abundant evidences about Dunkeld of the depositary action of water in pre-Adamite ages. There are numerous hillocks and mounds of gravel and sand, excellent sections of which, as well as of the clay-slates, may be seen in the railway cuttings. M'Culloch regards the valley above Dunkeld as having once been a lake. The clay and mica slate series may be easily and satisfactorily studied in the classic regions of the Trossachs and Loch Katrine, in the vicinity of Callander, to which there is now ready communication by railway with Edinburgh and Glasgow. The well-known Ben Ledi is formed, on its N.W. side, of mica-slate, and on the S.E. of clay-slate, which, as at Dunkeld and elsewhere, frequently passes into graywacke. Clay-slate is quarried on Ben Voirlich, another hill in the same neighbourhood. Of the Breadalbane hills, Ben Lawers consists chiefly of mica-slate at its base, and skirting Loch Tay this is interstratified with beds of limestone. About Killin the mica-slate passes into chlorite slate, as in Craig Chailliach, which again is frequently penetrated by, or interstratified with, quartz rock. The latter, as well as the chlorite slate, abounds in beautiful needles of the rare mineral *rutile*. A micaceous slate, which occurs along with the chlorite slate on Craig Chailliach, contains hornblende and large cubical pyrites. At Tyndrum the mica-slate joins or passes into quartz rock, and the junction is marked by the occurrence of a rich metalliferous vein, the basis being *galena*, with which, however, are also associated arseniate of cobalt, black cobalt ore, silver, copper pyrites, zinc, blende, sulphate of baryta, and calcareous spar. This vein is traceable for at least 10 miles; it has long been worked for its lead by the Marquis of Breadalbane, to whom it belongs. About Taymouth the slates have the talcose character, and sometimes contain asbestos. Schehallion in Rannoch may be regarded as classic ground, geologically speaking, since this mountain was selected by Drs Maskelyne and Charles Hutton as a site for their experiments on the density of the earth. The upper portion of the hill consists of quartz rock, the lower of mica and hornblende slates. Passing from the Breadalbane to the Atholl mountains and valleys, Glen Tilt at once arrests our attention. It was here that the celebrated Dr James Hutton

Perth-shire.

first obtained physical proof of the correctness of his views on the igneous origin of granite The penetration of quartz rock, gneiss, limestone, and various schists, by granite, may be seen at various points in the glen. This glen is further famed for its marble; the greater part of which is white, and associated with steatite and serpentine; but a portion of which is also of a beautiful flesh colour, with radiating masses of actinolite, asbestos, tremolite, and sahlite, occur in the limestone of this district. Actinolite slate occurs sometimes, interstratified with gneiss, in the valley of the Garry. Kyanite occurs in Cairn Lia; fluor spar, rutile, crystallized mica, and chlorite, in Ben-y-Gloe. This hill, as well as Ben Vrachie and Cairn Gower, consists of quartz rock, with mica-slate and gneiss. Besides Glen Tilt and Loch Tay, limestone also occurs about the Pass of Leny and Aberfoyle, in the western part of the district, and here it is occasionally wrought for agricultural purposes.

We have already mentioned casually, that occasional outbursts, or erupted masses of granite occur throughout the district. At Comrie, in the Lochearn district, granite occurs both in isolated erupted masses, and in the form of a couple of long and large veins or dykes. There is no granitic centre in Perthshire at all. It does not distinctly appear whether there is any connection between this geological phenomenon and the frequent occurrence of earthquakes, for which Comrie is so famous; but the latter would seem traceable to causes acting at no great distance below the surface.

The Lowland or southern division of the district is partly bounded on the S., partly broken up by the ranges of the Ochils and Sidlaws. These may be regarded as branches of the same great trunk. The Ochils are generally regarded as commencing about Stirling, at the Bridge of Allan, and as terminating at Perth. Here they may be considered as dividing into two main branches or continuations, one of which runs down the S. side of the Tay, and terminates at Ferry-Port-on-Craig, constituting Norman Law, Clatchart Craig, and the other hills so prominent about Newburgh. The other stretches along the N. side of the Tay from Perth to Montrose, and divides the great valleys of Strathmore and the Carse of Gowrie; this is generally known by the name of the Sidlaw range. These hills, by whatever name known, are all trappean in their structure, consisting at various points of every gradation and intermixture of basalt, greenstones, amygdaloids, porphyries, compact felspar, tufas, and breccias. The variable structure of some of these hills is very interesting. Moncrieff and Kinnoull Hills, near Perth, are fine mural precipices of trap, rising abruptly from the old red sandstone on the S., and sloping gently towards the N. They run parallel to and closely resemble each other. Moncrieff Hill consists of greenstones, basalt, porphyries, and tufas, passing into each other. Its basalt and greenstones are sometimes obscurely columnar; a phenomenon not unfrequently observed in other hills of this range. Good specimens of the traps of Moncrieff Hill may be procured from the heaps of rubbish thrown up around the ventilating shaft of the tunnel of the Scottish Central Railway, which pierces the hill between the Friartown of Perth and the village of Craigend. These specimens here consist, in great measure, of amygdaloids and tufas, frequently intermixed with much free earth (chlorite). Kinnoull Hill is still more variable in its structure, consisting of basalts, greenstones, porphyries, amygdaloids, tufas, and breccias. Of these, the amygdaloid is perhaps the most interesting, from its abounding in agates and chalcedony calc spar, and drusy cavities lined with amethyst and other forms of quartz. Its basis varies from a basalt to a hardened clay. Kinnoull Hill has long been celebrated for its agates, excellent specimens of which may be seen in the shops of the Perth lapidaries. Specimens are not readily found *in situ*, from the perpendicular and rugged character of the cliffs, but they are frequently to be found on the banks of the Tay between Barnhill and Kinfauns. Chlorite is particularly abundant in all the trap rocks about Perth, frequently in nodules of considerable size; sometimes filling what have been cavities, or diffused through a brecciated amygdaloid. In addition to the Ochils and Sidlaws, which form a sort of backbone of trap to the lowland district of Perthshire, the old red sandstone is pierced by numerous dykes or veins of trap, sometimes of such extent that they can be traced across the whole length or breadth of the district. Hutton speaks of one as running from a little to the S. of Crieff, by Lynedoch and Campsie Linn, in a line N.E. through Strathmore, for about 3 miles. When it comes in contact with limestone the trap sometimes passes into serpentine. Limestone occurs but sparingly in the lowland district. It is, or has been worked, however, at Meigle and Cargill. In connection with some such trap dykes or veins as have been above described, the mineral spring of Pitcaithly is supposed to occur. This, according to the analysis of the late Professor Thomas Thomson of Glasgow, contains chiefly the chlorides of calcium and sodium, and the sulphate of lime. Having probably some similar geological relation or origin is the mineral spring of Crieff, or more properly of Cowgask, near Crieff It was only discovered some eight or ten years ago, and has not yet become so popular or fashionable as it undoubtedly deserves. The water is of the same character as that of Pitcaithly, Airthrey (Bridge of Allan), and Dunblane. According to the analysis of the late Professor Thomas Thomson of Glasgow, the Crieff or Cowgask mineral water contains chiefly the chlorides of calcium, sodium, and magnesium, and the sulphate of lime. According to Professor Christison it contains about 640 grains of saline matter per gallon,—that is, nearly 1 per cent. Great efforts have been made of late years, and are still being made, by the townspeople to render Crieff all that can be desired as a residence for invalids requiring the use of the waters. Before leaving the traps we must not omit to refer to Glen Farg, the amygdaloid of which abounds in zeolites, for which indeed this locality has long been famous. They consist chiefly of analcime, mesotype, stilbite, and prehnite.

The old red sandstone of the Carse of Gowrie and Strathmore consists essentially of the three following beds or divisions:—1. A coarse conglomerate, which may be well seen in some of the river gorges, as at Invermay and Craighall, Blairgowrie, both of which ravines or glens are celebrated for the beauty of their scenery—the former being the subject of Mallet's song of the "Birks of Invermay." At Blairgowrie the imbedded stones are chiefly purple amygdaloids, and other rocks of the trap series. A finer conglomerate may also be seen in the building-stones of Perth bridge. 2. A gray sandstone, which forms the basis of the old red sandstone of the Carse of Gowrie. It may be seen at Dupplin and Dunning in Strathearn. 3. A bright red-spotted sandstone, which lies above the last named, and which is quarried at Inchture, Dunbarnie, Pitfour, and Clashbennie. The two latter quarries are celebrated for their fossil fish, by which this sandstone has been identified, as to its age and position, with the sandstones of the valley of the Eden in Fife. Clashbennie, in particular, is almost classic ground: it was here that the first and finest specimen of the *Holoptychius nobilissimus* was found, which specimen is now deposited in the British Museum. The quarry is about half a mile distant from the Glencarse station of the Perth and Dundee Railway, on the right side of the road between St Madoes and Errol; it is therefore easily accessible. But unfortunately it has not been worked for years, and few of the scales of the *Holoptychius* are now to be had. The beds of dark-red coarse sandstone, containing the scales as originally found, and as they were found by the writer several years ago, cannot now be got at, the section being vertical, or nearly so, with a deep, large pool of water below. Scales may, however, occasionally be picked up among the debris, or purchased from the children of neighbouring cottars for a trifle. On a recent visit, the writer found that a new part of the quarry had just been opened. The stone exposed was much lighter in colour and coarser in texture than that in which the scales were first discovered. It was interlaid with beds of what is locally called "keel,"—a hardened ferruginous clay. Some layers also had a conglomerate character, the imbedded nodules consisting chiefly of the ferruginous slate-clay just mentioned. Among the conglomerate chiefly, scales and ichthyodorulites of the *Holoptychius* were not uncommon; but they were generally smaller, and with the groovings or sulci less distinctly marked than in those formerly found. The texture of the scales was generally replaced by carbonate of lime (calc spar). Carbonaceous impressions are comparatively common in some beds of the old red sandstone: they are supposed by some authorities to be of vegetable origin, but their nature has not been satisfactorily determined. Another source of considerable doubt and discussion has been the yellowish or pale circular spots on the bright-red sandstone, as it occurs at Inchture and other quarries of the Carse of Gowrie. It is generally supposed that the presence of minute organisms of some kind, for they are not now visible, may have been the means of discharging the colour over limited spots or localities. The old red sandstone is sometimes of the character of marl, containing a considerable proportion of carbonate of lime. This renders it very serviceable to the farmer. Sandstone-marl occurs at or near Stanley, on the Tay; near Perth; Lynedoch, on the Almond, also near Perth; and at Abercairney, near Crieff.

Superimposed upon the old red sandstone in the Carse of Gowrie is the great alluvial deposit of the "Carse clay." This may be divided into the following beds or strata:—1. A boulder clay, which forms the basis of the rest; 2. A blue clay proper; 3. A peat, containing roots, branches, leaves, and fruits of trees; and, 4. The Carse clay proper—a mixture of sand and clay, the latter predominating. In the latter, about five feet above the peat, and considerably above the present high-water mark, is a bed of marine shells. These consist entirely of existing littoral species, being mostly made up, in specimens which we have examined, of the *Cardium edule*. The peat would appear to have given rise to some discussion among geologists as to its nature and origin. The late

Professor Fleming of Edinburgh has described it as a submerged forest, due to subsidence of the banks of the Tay; but Dr Buist of Bombay controverts this idea. It may be examined about Errol and Pitfour; and throughout the Carse it will be found to be of pretty uniform dimensions and contents.

On the lessons taught by the structure of the Carse clay we cannot here enter. It is supposed by some local geologists, who have bestowed much attention on the subject, that at one time a depression of the land below sea or estuary water occurred, and that this was followed, at some considerable lapse of time, by an elevatory action. The existence of the peat—its present situation, and the presence in it of roots apparently *in situ*, and of the leaves and fruit of forest trees, are explained on this hypothesis. Evidence is very contradictory. Remains of boat-rings and staples have been found considerably below, as well as considerably above, the present river or sea level, apparently coeval in date, and of course belonging to the human epoch. It is impossible to admit, as some would have us to do, these as proofs of movements of elevation and depression, occurring at the same time and in the same place. Doubtless much error has been introduced by traditions which have not been founded on facts.

There are few counties in Scotland which can boast of the same variety and richness of their flora as Perthshire. In the northern and southern divisions of the county are to be met with some of the rarest plants in Scotland. Ben Lawers, for instance, is, botanically speaking, classic ground; and its alpine flora is perhaps as rich and rare as that of the more famed Clova. We cannot pretend to give anything like a vidimus of the flora of Perthshire. All that we can here attempt is to give a brief enumeration of the rarer plants only of the district, leaving the reader to infer therefrom the character of the more ordinary vegetation.

Referring first to the northern or Highland section of the county, Ben Lawers alone is the habitat of the following rare alpines:—*Saxifraga cernua*, *S. rivularis*, *Erigeron uniflorus* (which is probably a mere form of *E. alpinus*), *Veronica fruticulosa*, *Eriophorum capitatum* (according to Don, who, however, has probably confounded it with *E. vaginatum*), *Carex rupestris*, *C. curta*, *C. ustulata*, *Woodsia hyperborea*, *Poa nemoralis*, var. γ (of Hooker and Arnott's *Flora*), *Triticum caninum*, var. β, *Cystopteris montana*, *Salix arbuscula*, var. β, *Bartsia alpina*, *Draba verna*, var. β, *D. rupestris*, *Sagina saxatilis*. On other members of the Breadalbane range of mountains occur the following:—*Cherleria sedoides*, *Arenaria verna* (Mael Duncrosig), *A. rubella*, *Cerastium alpinum*, *Potentilla alpestris*, *Sibbaldia procumbens*, *Rosa involuta* (near Meggarnie in Glen Lyon), *R. cæsia* (valleys), *Epilobium alsinifolium*, *E alpinum*, *Saxifraga stellaris*, *S. nivalis*, *S. oppositifolia*, *Hieracium pallidum*, *H. strictum*, *Erigeron alpinus*, *Azalea procumbens*, *Arctostaphylos alpina*, *Myosotis alpestris*, *Veronica saxatilis*, *Bartsia alpina* (Maelgrædha, Corrach-Uachdar, &c), *Melampyrum sylvaticum*, *Plantago maritima* (Glen Dochart, and also on summits of highest mountains), *Salix arenaria*, var. α, *S. Myrsinites*, var. ..(Craig Chailliach), *S. procumbens*, *S herbacea*, *S. lanata* (Mael-Uachdar, near Killin), *Juncus castaneus*, *J trifidus*, *J. biglumis*, *J. triglumis*, *Scirpus sylvaticus* (about Killin), *Kobresia caricina* (Shroine-ach-Lochan), *Carex Bœnninghausiana* (Killin), *C atrata*, *C. rigida*, *C. saxatilis*, *C. vaginata* (Craig Chailliach and Corrach-Uachdar near Killin), *C. capillaris*, *Phleum alpinum*, *Cystopteris montana* (Corrach-Uachdar, &c.), *Equisetum palustre*, var. β. The following grow on the Atholl mountains:—*Carex capillaris* (Ben-y-Gloe), *Crepis succisæfolia* (Falls of Tummel), *Gnaphalium sylvaticum*, var. β (Ben Chat near Blair Atholl), *Campanula rapunculoides* (Blair Atholl), *Menziesia cœrulea* (on the "Sow of Atholl," Dalnaspidal), *Polygonum verticillatum* (Blair Atholl), *Tilia grandifolia* (Blair Atholl), *Rubus arcticus* (Ben-y-Gloe), *Cryptogramma crispa* (on Birnam Hill), *Genista anglica*, *Trientalis europœa*, *Listera cordata*, *Callitriche autumnalis* (Loch of Cluny), *Lactuca virosa* (Dunkeld), *Stratiotes aloides* (Loch of Cluny), *Gymnadenia conopsea*, *Habenaria albida*, *Butomus umbellatus* (Loch of Cluny, introduced), *Asplenium alternifolium* and *A. septentrionale* (Stenton Crag, Dunkeld). To these may be added as growing in the Highland division of Perthshire—*Pimpinella magna* (banks of the Teith), *Linnœa borealis* (in fir woods in different parts of the county), *Salix ambigua*, var. α, *Elatine hexandra* (Loch Ruisky near Callander), *Silene acaulis*, *Ulex nanus* (Dalguise), *Potentilla opaca* (Braes of Balquhidder). In the lowland division of Perthshire we find its flora equally rich and varied. The most interesting plants of this section are probably *Scheuchzeria palustris* (abundant in a marsh on the side of the Methven road, 4 miles from Perth), *Monesis grandiflora* (abundant in a fir wood about 1½ to 2 miles beyond the village of New Scone), *Teucrium chamædrys* (Methven Wood), and *Turritis glabra* (Redgorton). But the following plants, also, are of great interest. In the Methven district, including the woods and grounds of Methven and Lynedoch and the valley of the Almond, occur *Corallorrhiza innata*, *Epipactis grandiflora*, *E. ensifolia*, and *E. latifolia*, *Listera nidus-avis*, *Paris quadrifolia*, and *Erigeron alpinus*, the seeds of which would appear to have been carried by the Almond from the Breadalbane mountains. The Redgorton district, which includes a portion of the banks of the Tay, possesses *Peplis Portula*, *Nuphar lutea*, *Nymphœa alba*, *Thalictrum minus*, *Hypericum humifusum*, *H. hirsutum*, *H. pulchrum*, *H. quadrangulum*, *H dubium*, *Cichorium Intybus*, *Bidens tripartita*, *Cnicus eriophorus*, *C. heterophyllus*, *Trientalis europœa*, *Adoxa moschatellina*, *Chelidonium majus*, *Habenaria viridis*, *H. bifolia*, and *Listera ovata*. In the Carse of Gowrie district, which includes the salt marshes on the banks of the Tay, between Perth and Dundee, the alluvial plain of the carse proper, and the "Braes of the Carse," or the southern declivities of the Sidlaw range of hills, are to be found *Galium saccharatum*, *Cynoglossum sylvaticum*, *Calamintha Acinos*, *Poterium Sanguisorba*, *Pyrola rotundifolia* and *P. media*, *Lotus corniculatus* var. *tenuifolia*, *Centaurea scabiosa*, *Stachys arvensis*, *S palustris*, *Galeopsis Ladanum*, *Ranunculus hirsutus*, *Chrysosplenium alternifolium*, *Leonurus Cardiaca*, *Scrophularia vernalis*, *Typha angustifolia*, and *Dianthus Armeria*. In the Kinnoull and Perth district, which includes the hills of Kinnoull, Moncrieff, and Craigie, and the Glen of Balthayock, occur *Ceterach officinarum*, *Sagina ciliata*, *Lychnis Viscaria*, *Geranium columbinum*, *Sedum anglicum*, *S. album*, *Potentilla argentea*, *P. reptans*. In the Strathearn district, including Invermay, Dupplin, and Glen Farg, occur *Dentaria bulbifera*, *Doronicum Pardalianches* and *plantagineum*, *Listera nidus-avis*, *Rumex alpinus*, *Mentha viridis*, *M. piperita*, *Lychnis Viscaria*, *Betonica officinalis*. To the foregoing we may add *Nepeta Cataria*, between Culross and Kincardine, on the Forth; *Viscum album*, Mickleour Woods, introduced; *Galium pusillum*, Ochil and Strathblane Hills; *Dipsacus sylvestris*, abundant on Kinnoull Hill; *Lactuca virosa*, of great size, on the talus at the foot of Kinnoull Hill; *Hieracium strictum*, Ochils; *Cnicus arvensis*, Culross, on the Forth; *Doronicum Pardalianches*, island at the junction of Almond and Tay; *Campanula latifolia*, Invermay Woods; *C. glomerata*, banks of Tay, near confluence of Almond; *Thalictrum minus* β *majus*, island at junction of Almond and Tay; *Helleborus fœtidus*, Scone Woods; *Hypericum barbatum*, according to Don, at side of a hedge near Aberdalgie, Strathearn; *Ornithopus perpusillus*, near Perth; *Agrimonia agrimonioides*, Dundee road, near Perth; *Vicia tetrasperma*, Ruthven, near Perth; *Senecio aquaticus*, *Scirpus triqueter*, and *S. lacustris*, marshes on the Tay, immediately below Barnhill Toll; *Astragalus glycyphyllus* and *Vicia sylvatica*, banks of Almond, a short way above its junction with the Tay.

Equally interesting with the Phanerogamic is the Cryptogamic vegetation of the district; but more than a mere passing allusion, want of space compels us to omit.

In a county of so great extent, and possessing such a variety of surface, considerable diversity must exist in the character of the soil. The carse or alluvial lands on the shores of the Frith of Tay have long been celebrated for their fertility. They are considered as the joint produce of river and sea deposition for a series of ages. The general character of the soil is that of a rich clay, very deep, in some places alternating with layers of peat, and having sand and marine deposits at the bottom. This soil is not wholly alluvial, being sometimes mixed with the debris of trap-rocks, and also of the sandstone, which, as already mentioned, forms a geological characteristic of the lowland districts of Perthshire. Considerable tracts of this inferior description of alluvial soil are found accompanying the courses of the principal rivers, and extend into the upper portions of Strath Tay, Strath Airdle, and Strath Tummel. A soil composed of clay and sand, and called by agriculturists a *till*, extends along a vast tract of this county from E. to W., and is supposed to be formed from the red sandstone prevalent in that district. Peat is to be met with almost everywhere in Perthshire; that known by the name of *Flanders Moss* is said to extend over 10,000 acres, and is amongst the largest continuous tracts of this description in the United Kingdom.

In the arable districts of this county, such as the Carse of Gowrie, and the fertile lands skirting part of the course of its principal rivers, the modes of agriculture and management of farms are much the same as in the other agricultural counties of Scotland. Drainage has been effected to a very large extent; new discoveries and inventions in the theory and practice of tillage are freely adopted, and the spirit of improvement and enterprise very fully pervades the agricultural population. The arable farms vary in extent from 50 to 500 acres and upwards: and in the Carse of Gowrie the rents are as high as in any part of the kingdom. Wheat is largely raised on the best soils, and not unsuccessfully even in several of the Highland districts. In the wheat-growing soils this crop usually alternates with beans and peas, barley, hay, and oats. The agricultural statistics of Scotland give the number of acres in this county under the different kinds of crop in 1857 as follows:—Wheat, 25,638; barley, 18,802; oats, 64,084; rye, 77; bere, 655; beans, 3949; peas, 301; vetches or tares, 1241; turnips, 33,313; potatoes, 17,482; mangold, 33; carrots, 32; cabbage,

Perthshire.

42; rape, 8, flax, 15; turnip-seed, 205; other grain or root crops, 17; bare or summer fallow, 1840; grass and hay under rotation, 99,656. The pasture-farms in the higher parts of the county are large, and raise great numbers of sheep. Other descriptions of live stock are also largely cultivated. Dairy farming does not form a prominent feature in the rural economy of this county. In some favoured spots orchards succeed well, many of them are very large, and their produce is highly celebrated. Perthshire is remarkable for the great extent and beauty of its woods. Of these, many are of natural wood, chiefly oak. But extensive plantations of various kinds of trees have been made during the last 50 or 60 years by several proprietors, especially by the late Duke of Atholl, whose planting operations were carried on upon the most extensive scale, at once beautifying and enriching one of the finest parts of the county. To him Perthshire is indebted for the introduction of the larch, which has been found singularly adapted to the climate and soil. The plantations of this tree have thriven amazingly, and are of great extent and value. In 1674 the valued rental of Perthshire was L.28,324 sterling; in 1815 the annual value of assessed property amounted to L.555,552 sterling; and in 1858 the valuation made up in terms of the recent Valuation Act amounted to L.677,114, 9s 9d.

This county is particularly rich in splendid seats and mansions belonging to the great proprietors. Of these, the most remarkable are Taymouth Castle, the palace of Scone, Kinfauns Castle, Murthly House, Dupplin Castle, Rossie Priory, and Blair Castle. Castle Huntly and Blair Castle are fine specimens of the old baronial and castellated habitations of the ancient lords of the soil; and Doune Castle is considered as one of the finest ruins of its kind in Scotland. Perthshire is not remarkable for antiquities, secular or ecclesiastical. Druidical circles and Roman remains are found in various places. Of the former, one circle almost entire, called by the country people "Standing Stanes," formerly existed at Craigmakerran, the property of the guildry of Perth; but about 40 years ago it was barbarously destroyed, and the stones blasted for the purpose of being employed in the erection of a farm-steading. Before this act of vandalism was committed, the circle in question, which stood on a projecting crag about 6 miles from Perth, on the Isla road, was perhaps one of the most perfect of the kind in the kingdom. Of the latter, the camp or station at Ardoch and that at Comrie are well known, as well as the Roman road which seems to have connected them. There is another at Delvin, which is scarcely less remarkable. The ruins of the cathedrals of Dunblane and Dunkeld are also in excellent preservation, though the architecture is by no means of the highest order. The tower of Abernethy, which has long puzzled the heads of antiquaries, is unfortunately decaying rapidly, as is also the fine old abbey of Culross.

In the animal kingdom there is little peculiar to the county. Game beasts and birds of every description abound in their respective districts. These are everywhere strictly preserved, and the sport furnished in the county forms a very considerable item of its wealth.

The principal towns are,—Perth and Culross, which are royal burghs; Crieff, Callander, Kincardine, Doune, Comrie, Dunblane, Auchterarder, Dunkeld, and Blairgowrie. The villages are numerous, and many of them populous and thriving. The greater part of Coupar-Angus is included in the county of Perth.

Mills for spinning flax, bleachfields, and calico-printfields, are numerous; and there are some large establishments for spinning cotton-yarn at Stanley, near Perth, and at Deanston. Oil-mills are also to be found in various places. The tanning of leather is carried on to a considerable extent at Crieff and at Thornhill. Wool is likewise an article of considerable sale. From the more fertile districts large quantities of grain are annually brought to market. Bark and timber, principally larch and oak, also form commercial articles of no small importance. The produce of its fisheries has already been noticed as being among the list of exports.

The population of the county of Perth amounted in 1831 to 142,166, being an increase since 1821 of 3919. In 1841 it was 137,457; and in 1851, 138,660. In the last-mentioned year Perthshire contained in all 196 places of worship, with 84,583 sittings. Of the former, 59 belonged to the Established Church, 60 to the Free Church, 35 to the United Presbyterians, 10 to the Episcopalians, 8 to the Baptists, 7 to the Independents, 5 to the Roman Catholics, 3 to the Original Secession, 2 each to the Relief Church and Wesleyans, and 1 each to several smaller sects. The number of day schools was 307 (221 public and 86 private), with 21,143 scholars. There were also 230 Sabbath schools, with 16,294 scholars; 19 evening schools, with 464 scholars; and 10 literary and scientific institutions, with 693 members. The county sends a member to Parliament, as does also Perth, the principal city. Culross, Queensferry, Dunfermline, Inverkeithing, and Stirling, unite in returning a third.

Perthes.

PERTHES, Christoph Friedrich, an eminent German bookseller, was born at Rudolstadt on the 21st of April 1772, known in Germany as "the great hunger year." His father, who was secretary of the exchequer to the house of Rudolf Schwartzburg, died in 1777, and left his widow and child almost entirely unprovided for. The fatherless boy had the good fortune, some years afterwards, to be taken in charge by his maternal uncle, a state official, and a man of great uprightness and kindliness of disposition. After spending in a somewhat unsatisfactory manner some years at the gymnasium of his native town, he was apprenticed to one Böhme, a bookseller in Leipzig, on the 11th September 1787. Perthes was passionately fond of reading; and if he no longer found leisure to indulge his propensity for perusing books, he at least got plenty of them to carry through the streets of Leipzig. After six "happy years of earnest striving," as he calls it, in the strict service of this rough, honest old bookseller, relieved not a little at times by the smiles of his fair daughter Frederika, Perthes, no longer in abject poverty, and full of enthusiasm, set out for Hamburg in 1793, to assist one Hoffman, an extensive publisher in that city. After a three years' residence there, during which he laboured hard to improve his education, both by careful study and by cultivating the friendship of men of intelligence and worth, he entered into partnership with an old fellow-apprentice named Nessig. This copartnery soon broke up, however, and Perthes continued on his own account. Bookselling with Perthes was, even at this time, something more than a mere commercial employment. The moral influence of the trade he considered to be very great, if only the booksellers could be brought "to care more for honour than gold." He accordingly resolved to aim at a thorough reform of his profession in Germany. His acquaintance with literary men was already extensive, and the ready intelligence, thorough business habits, and honest, genial temper of the young publisher, gradually drew around him the most eminent literary men of his time in Germany. He was already held in esteem by the Stolbergs, by Voss, and by Count Reventlow; and he regarded Jacobi, "the German Plato," with the love and reverence of a father. On the 2d of August 1797 Perthes married Caroline, daughter of Claudius, editor of the *Wandsbecker Bote*, and one of the noblest women Germany has yet known. In the following year he entered into partnership with Besser, who was his superior both in education and in his knowledge of books, and set steadily to work to make their firm the medium of the literary intercourse of the nations of Europe. The blockade of Hamburg by the French in 1803 brought trying times to these enterprising men, which a long series of years of trouble and anxiety hardly brought to a close. The French having regained possession of Hamburg, after their expulsion by the Russians in 1813, devastated the town, plundered Perthes' shop, and closed it up as sequestrated. As one of the ten who were refused pardon for their staunch resistance of foreign oppression, Perthes was forced to fly. His wife, who, with her children, had found a refuge at Wandsbeck, was, despite extreme privation, devoutly thankful "that your [Perthes'] name stands among the ten enemies of the tyrant." By the exertions of Besser, business was again resumed in 1814. Having lost his wife in 1821, Perthes removed from Hamburg, and, settling at Gotha, commenced an extensive business as a publisher, chiefly of works in theology and in history. He brought out the works of Neander, Ullman, Tholuck, and Bunsen in theology, and of Niebuhr and other eminent writers in history. Niebuhr had the greatest regard for Perthes, always spoke admiringly of his "glorious power," and esteemed his judgment of books as superior to that of most men in Germany. Perthes married a second time in 1825; ultimately resigned his business

to his son Justus, who continues to carry it on; and having retired to the neighbourhood of Gotha, this good man died on the 18th of May 1843.

A highly instructive and entertaining Life of Perthes was published by his son Clemens Theodor, professor of law in the university of Bonn, in 3 vols. 8vo, 1848-55. This work has been translated into English, with some condensation, and published under the title of *Memoirs of Frederick Perthes; or, Literary, Religious, and Political Life in Germany from* 1789 *to* 1843, 2 vols. 8vo, Edinburgh, 1856. There is also an abridgment of this work, entitled *Life and Times of Frederick Perthes*, 1 vol. 8vo, Edinburgh, 1858. In addition to these memoirs of his father, C. T. Perthes has written *Der Deutsche Staatsleben vor der Revolution*, 1845; and *Einverleibung Krakaus, und die Schlussacte des Wiener Congresses*, 1846.

PERTINAX, Helvius, a Roman emperor, was the son of an humble wood-merchant and charcoal-burner, and was born in 126 A.D., according to some in Liguria, but according to others at Villa Martis, among the Apennines. The prudence and integrity of his character raised him rapidly from his native obscurity. From being a teacher of grammar, he passed gradually through many important offices, both civil and military, twice holding the consulship, and governing in succession most of the provinces in the empire. At length, on the last day of the year 192, he was chosen to succeed the murdered Commodus. His death took place by assassination eighty-six days afterwards, in the sixty-seventh year of his age, after a reign of two months and twenty-seven days. (See Roman History.

PERTUIS, a town of France, in the department of Vaucluse, on the Lese, not far from its confluence with the Durance, 18 miles S.S.E. of Apt, and 41 E.S.E. of Avignon. It is surrounded with ramparts; and contains a fine church and a college. Woollen yarn, earthenware, and brandy are made here; and there are also dye-works, brick and tile kilns, &c. Some trade is carried on in grain, wine, brandy, and oil. Pop. 4776.

PERU.

Peru, a republic of South America, lies between 3. 35. and 21. 48. S. Lat., and 68. 10. and 81. 30. W. Long. It is bounded on the N. by the republic of Ecuador, W. by the Pacific Ocean, and E. and S. by the territories of Brazil and Bolivia. Its extreme length from N. to S. is about 1250 miles, and its breadth varies from 60 to about 750 miles, the width increasing gradually from S. to N. The coast-line stretches along the Pacific from the mouth of the Rio Tumbez on the N. to that of the Rio Loa on the S. The area may be roughly estimated at about 500,000 square miles.

The present state comprehends only a small portion of that vast empire over which the Incas exercised their sway at the time of the Spanish invasion. The ancient empire of Peru extended over nearly forty degrees of latitude, from the second degree of north to about the thirty-seventh of south latitude. Its breadth, however, must have been altogether disproportioned to its length; but the exact limits cannot now be determined. It extended eastward from the shores of the Pacific, in many parts considerably beyond the mountains, to the confines of barbarous states whose position cannot now be ascertained.

Early inhabitants.

Of the various traditions respecting the early inhabitants of Peru, the one best known is that which ascribes the introduction of civilization to Manco Capac, the first of the Incas, who is said to have flourished in the early part of the twelfth century. At the time of his advent the people were among the most barbarous of the American savages, roaming over the country without any fixed place of abode, at constant war with each other, and feasting on the flesh of their slaughtered captives. The sun, however, the great luminary and parent of mankind, taking compassion on their degraded condition, sent his son Manco Capac with Mama Oello Huaco, at once his sister and his spouse, to reclaim and civilize them. He taught them to till and irrigate the soil, to construct residences, and to worship the sun; and farther, instructed them in the moralities of life, and framed wise and benevolent laws for their guidance. The empire, which at first comprised only a small territory around the city of Cuzco, gradually extended its authority over the surrounding tribes, until it became the first in size and importance of the South American States, occupying here a position equally prominent with that of Mexico in North America. Another legend, probably not less generally received among the Peruvians, but one which is less known among other nations, speaks of certain white and bearded men who, advancing from the shores of Lake Titicaca, established an ascendancy over the natives, and imparted to them the blessings of civilization. None of these legends, however, throw any light upon the early history of the people. The date usually assigned to these events, 400 years before the conquest, is manifestly too early, as none of the accounts assign to the Inca dynasty more than thirteen princes, a number much too small to extend over such a period. There is also reason to believe that there existed in the country a race advanced in civilization before the time of the Incas, and the extensive architectural remains still existing on the shores of Lake Titicaca, evidently of a date anterior to the pretended advent of the Incas, would indicate that as their original seat. Who this race were, and whence they came, is a tempting theme for speculation, but lies far beyond the domain of history. It is only as we approach the time of the Spanish conquest that we begin to emerge from the impenetrable mists that overhang the early annals of the country. In the middle of the fifteenth century the famous Topa Inca Yupanqui, grandfather of the monarch who occupied the throne at the coming of the Spaniards, led his armies across the terrible desert of Atacama, and penetrating to the southern region of Chile, fixed the permanent boundary of his dominions at the River Maule. His son Huayna Capac, possessed of ambition and military talent fully equal to his father's, marched along the Cordillera towards the north, and pushing his conquests across the equator, added the powerful kingdom of Quito to his possessions.

Ancient Peru.

Were the accounts given by the earlier writers of the state of the country and of its inhabitants at the period of the conquest not borne out by existing remains, and corroborated by what we know of such nations as the Chinese and Japanese of the present day, they would be quite incredible. The surface of the country was naturally very unfavourable for the purposes of agriculture. A sandy tract, seldom or never refreshed by rain, and watered only by a few scanty streams, extended along the coast, beyond which was the steep and rocky range of the Cordillera. But notwithstanding this unpropitious nature of the country, by means of a judicious system of artificial irrigation, an abundant supply of provisions was raised for a numerous population. Canals and subterraneous aqueducts were constructed in all directions, and terraces were raised upon the steep side of the Cordillera, where the productions of temperate and northern, as well as of tropical countries, were reared. Traces of these water-conduits are still to be seen in all parts of Peru. They were formed of large slabs of freestone nicely fitted together, and were sometimes several hundred miles in length, carried through rivers and marshes, and not unfrequently tunnelled through the solid rock. The earth to the terraces had frequently to be brought from a considerable distance; and not uncommonly was the arid soil of the valleys and plains

removed in order to reach a lower stratum more suitable for cultivation. They further made large use of the different kinds of manures, with the properties of which they were well acquainted. Guano especially, that valuable manure which has attracted so much notice of late years, was largely employed by them. Still more remarkable as monuments of labour and ingenuity were the great roads which traversed the kingdom in various directions, the remains of which are still in sufficient preservation to attest their former magnificence. The most remarkable of these were the two which extended from Quito to Cuzco, and again diverging from the capital, were continued in a southern direction towards Chile. "One of these roads passed over the grand plateau, and the other along the lowlands on the borders of the ocean. The former was much the more difficult achievement, from the character of the country. It was conducted over pathless sierras covered with snow; galleries were cut for leagues through the living rock; rivers were crossed by means of bridges that swung suspended in the air; precipices were scaled by stairways hewn out of the native bed; ravines of hideous depth were filled up with solid masonry; in short, all the difficulties that beset a wild and mountainous region, and which might appal the most courageous engineer of modern times, were encountered and successfully overcome. The length of the road, of which scattered fragments only remain, is variously estimated from 1500 to 2000 miles; and stone pillars, in the manner of European mile-stones, were erected at stated intervals of somewhat more than a league all along the route. Its breadth scarcely exceeded 20 feet. It was built of heavy flags of freestone, and, in some parts at least, covered with a bituminous cement, which time has made harder than the stone itself. In some places where the ravines had been filled up with masonry, the mountain torrents, wearing on it for ages, have gradually eaten away through the base, and left the superincumbent mass—such is the cohesion of materials—still spanning the valley like an arch." (Prescott.) "The great road of the Incas," says Humboldt, a man not given to exaggeration, "was one of the greatest and most useful works ever executed by man." Their bridges were constructed of the tough fibres of the *maguey*, or of the osier of the country, woven into cables of the thickness of a man's body. Several of these enormous cables, bound together, and attached at each end, formed the bridge, which was covered with wood, and well secured by a railing on each side. As the length of this bridge sometimes exceeded 200 feet, and as it was supported only at the extremities, it presented an alarming inclination towards the centre; while the motion given to it by the traveller caused an oscillation still more frightful, as his eye wandered over the dark abyss of waters that foamed and tumbled many a fathom beneath. Yet these light and fragile fabrics were crossed without fear by the Peruvians. In the level country the broad and tranquil rivers were passed in *balzas* or floats, to which sails were attached,—the only instance of their use among American Indians. All along these highways caravanserais, or *tambos* as they were called, were erected at the distance of 10 or 12 miles from each other, for the accommodation more particularly of the Inca and his suite. Some of these were very extensive, consisting of a fortress, barracks, and other military works, and were evidently destined for the accommodation of the imperial armies when marching across the country. Posts were also established along all the great routes, and stations were erected within short distances of each other, where runners were stationed to carry forward dispatches. Messages were thus carried through the country at the rate of 150 miles a day. At the time of the conquest of Peru no nation in Europe could boast of any work of public utility that could be compared with the great roads of the Incas.

The industry and ingenuity of the Peruvians was also shown in the construction and ornamenting of their temples and palaces. The ruins of these magnificent edifices, which are to be found in many parts of the country, attest at once the great power of the Incas, and the high degree of knowledge in the arts to which the people had attained; whilst they also show that, during two centuries at least, the nation must have subsisted in a state of considerable advancement. They were usually low, but covered a vast extent of ground, and were constructed of blocks of stone, some of them of great size, but of no regular form; and though no cement was used, they were adjusted to each other with such exactness that it was impossible to introduce even the blade of a knife between them. Some of these stones were full 38 feet long, by 18 broad, and 6 thick. They were hewn from their native bed and fashioned into shape by a people ignorant of the use of iron; they were frequently brought from great distances, across rivers and ravines, up to a great elevation on the sierra, and finally adjusted with the nicest accuracy, without the aid of beasts of burden or machinery of any kind. The interior of the palaces was adorned with the finest and most costly materials. "The sides of the apartments were thickly studded with gold and silver ornaments. Niches prepared in the walls were filled with images of animals and plants, curiously wrought, of the same costly materials; and even much of the domestic furniture, including the utensils devoted to the most ordinary menial services, displayed the like wanton magnificence!" (Prescott.) The magnificent Temple of the Sun at Cuzco covered a great extent of ground in the centre of the city, and was surrounded by a wall. Such was its splendour, that a Spaniard who saw it in its glory asserts that there were only two edifices in his own country that could, in point of workmanship, be compared with it. Every part of the interior was richly ornamented with gold. On the western wall, and so situated that the rays of the sun struck directly upon it at his rising, was a figure of their god, engraved on a massive plate of gold of enormous dimensions, thickly studded with emeralds and precious stones. All the ornaments of the temple, and every kind of utensil appropriated to the uses of religion, were of gold or silver. Adjoining the principal structure were several chapels of smaller dimensions, one of which was consecrated to the moon,—the deity held next in reverence to the sun, as the mother of the Incas. Besides the Temple of the Sun, there are said to have been no fewer than four hundred inferior temples and religious houses in the Holy City. Other temples and religious houses were scattered over the provinces, some of them constructed on a scale of magnificence that almost rivalled that of the metropolis.

The Peruvians manifested great skill and ingenuity in the manufacture of ornaments of various kinds. Here, however, like the Chinese and some other eastern nations of the present day, their works are characterized more by minuteness in imitation or delicacy of finish than invention or beauty of design. Many specimens of elaborate workmanship have been dug out of the *huacas*, or sepulchral mounds. They comprise vases of gold and silver; bracelets, collars, and other ornaments for the person; utensils of every description; and mirrors of hard, shining stones, highly polished. Though iron exists in the country, they were unacquainted with its use. Their tools were of stone, or more frequently of copper; but they had also a composition of copper and a small quantity of tin, which had almost the hardness of steel. In their textile manufactures they likewise manifested considerable skill. Their vast flocks of sheep, and the cotton which grew luxuriantly on the coast, supplied them with abundant materials for clothing; and they also manufactured a species of cloth from the tough thread of the maguey tree. Some of their woollen manufactures were of such delicacy and beauty, that the Spanish sovereigns, with all the luxuries of Europe and Asia at their command, did not disdain to use them.

The government of Peru was a despotism, mild in its character, but pure and unmitigated in its form. The sovereign was the source of all power and all authority, and stood at an immeasurable distance from even the highest of his subjects, none of whom could venture into his presence unless barefoot, and bearing a light burden upon his shoulders in token of homage. As descended from, and as representative on earth of the sun, his person and acts were endowed with a sacredness that no merely secular position could confer upon them; and hence any disobedience of his law was looked upon as sacrilege. But, while vested with all this power, the sway of the Incas was not a tyrannical one. They sought rather to imitate their supposed progenitor the sun, and to promote the welfare and happiness of all their subjects. Though so immeasurably above his subjects, there were occasions when he condescended to mingle with them. He presided at some of the religious festivals; and at intervals of several years he travelled in great pomp and magnificence through the empire, inspecting and inquiring into the condition of the various classes of his subjects. Once a year, too, he repaired to a field in the vicinity of the capital, and there, in presence of his court, and a vast assemblage of the people, turned up the earth with a golden plough. The nobility of Peru were of two orders,—the *Incas*, or descendants by the male line from the founder of the monarchy; and the *Curacas*, the caciques of the conquered nations, and their descendants. The Incas were divided into different lineages, according to the member of the royal dynasty from whom they were descended; and as polygamy was freely indulged in, this class of nobility came in time to be very numerous. They were distinguished by a peculiar dress, and enjoyed many important and exclusive privileges. They filled every high place of trust and emolument,—the government of provinces, the command of armies,—and were alone admissible to the great offices of the priesthood. The Curacas were usually continued in their places by the government, and were possessed of more or less power according to the extent of their territory and the number of their vassals, subject, however, to the jurisdiction of the great provincial governors. They were required occasionally to visit the capital, and to allow their sons to be educated there as pledges of their loyalty. The object of war with the Incas was to extend the worship of the sun, and to confer upon the conquered nations the blessings of such a civilization as they themselves enjoyed; and hence their contests were not carried on in a bloodthirsty or rapa-

Peru.

cious spirit, and the conquered nation was immediately on submission admitted to the full enjoyment of all the privileges of the natural subjects of the Inca.

The empire was divided into four great provinces, each under a viceroy or governor, who was assisted in his administration by one or more councils for the different departments. These viceroys resided for at least a portion of their time in the capital, where they constituted a sort of council of state to the Inca. The nation was further divided into bodies of 10, 50, 100, 500, 1000, and 10,000 inhabitants, each of which was under the authority and supervision of a responsible officer. The laws were few and exceedingly severe. There was no appeal from one court to another; but visitors patrolled the kingdom at certain times to examine into the conduct of the judges and magistrates, to hear complaints, and to report any neglect or violation of duty.

The whole land of the empire was divided into three parts,—one for the sun, another for the Inca, and the last for the people. The lands assigned to the sun furnished a revenue to support the temples and maintain the costly ceremony of Peruvian worship and the multitudinous priesthood. Those reserved for the Inca went to support the royal state, and to supply the various exigencies of the government. The remainder of the lands were divided, *per capita*, in equal shares among the people. This division of the soil was renewed every year, and the possessions of the people were increased or diminished according to the number of their families. The whole territory, however, was cultivated by the people. The lands belonging to the sun had to be first attended to; then those of the widows, orphans, sick, &c.; then their own; and lastly those of the Inca. The immense flocks of sheep scattered over the various provinces belonged exclusively to the sun and the Inca. They were entrusted to the care of experienced shepherds, and regulations for their management prescribed with the greatest minuteness, and with a sagacity that excited the admiration of the Spaniards, who were familiar with the management of sheep in their own country. At the appointed season they were all sheared, and the wool deposited in the public magazines, whence it was dealt out to each family according to its wants. Care was taken that each household should employ the materials furnished for its own use in the manner that was intended, so that no one should be unprovided with the necessary apparel. All the mines belonged to the Inca, and were wrought exclusively for his behoof by persons familiar with this service. A small portion of the community was instructed in the mechanical arts. The nature and amount of service required of every individual was prescribed by law, and was so regulated with regard to the welfare of the people, that even the more wearing and unwholesome of the labours were carried on without any detriment to health. Work was provided for all, and idleness was severely punished as a crime The different employments usually descended from father to son. A part of the agricultural produce and manufactures were sent to the capital, but the greater portion was stored in magazines scattered over the different provinces, where there was frequently a supply of grain that would last for several years; and thus seasons of scarcity were provided for, and relief furnished to those whom sickness or misfortune had reduced to poverty. There were no poor in the land. An account was kept of the births and deaths in the various districts throughout the country, and exact returns of the actual population made to the government every year. At certain intervals, also, a general survey of the country was made as to its soil, fertility, products, &c.

The Peruvians believed in the existence of one great Supreme Being, the creator of the world, whom they called Pachacamac (from *camac*, creator, and *pacha*, world). No temple was raised to this invisible being, save one only in the valley, which took its name from the deity himself, not far from the Spanish city of Lima. Subordinate to Pachacamac, but endowed with intercessory power, was the sun, the deity whose worship they specially inculcated, and whose temple rose in every city and almost every village throughout the land It was he who presided over the destinies of man, gave light and warmth to the world,—the founder of their empire, and the father of their royal dynasty. Besides the sun, the Incas acknowledged other objects of worship, as the moon his sister-wife, and the stars; while among their subjects, the earth, wind, rain, thunder, as well as mountains, rivers, &c., received divine honours. They also admitted among their gods the numerous deities of the conquered nations. The sacerdotal order was very numerous. At the head of all was the high priest, or *Villac Vma*, who was second only to the Inca in dignity, and was usually chosen from his brothers or near kindred. He was appointed by the monarch, and held office for life; and he in turn appointed to all the offices under him. The duties of the priest were confined to ministrations in the temple, and his science was limited to an acquaintance with the fasts and festivals of his religion, which were very numerous, and their rites very complex and elaborate. Their sacrifices consisted of animals, grains, flowers, &c.; and we would fain believe that Garcilasso, an Inca by birth, is correct in asserting that "no human victim was ever offered in the Temple of the Sun," or permitted in worship,—though this is expressly contradicted by most of the Spanish writers. On the death of an Inca, however, a number of his attendants and favourite concubines, amounting sometimes, it is said, to a thousand, were immolated on his tomb. Marriage was a ceremony performed once a year by the Inca among his own kindred, and by the Curacas and governors in their various districts. The nobles, like their sovereigns, were allowed a plurality of wives; but the people generally, whether by law or necessity, were limited to one.

In looking at the ancient Peruvians, one is in doubt whether the knowledge they display in some respects, or their ignorance in others, is the more remarkable. In looking at their government, we can scarcely conceive of anything more suitable for a people in their condition. Though despotic in its nature, it was eminently patriarchal; every one, from the highest to the lowest, being made to feel his dependence upon it in every act of his life. Poverty and idleness, the two great causes of dissatisfaction in a people, were carefully guarded against. No one could be poor, neither could any one become rich; for, however industrious, he could not add one rood to his possessions, nor advance himself one hair's-breadth in the social scale. All might enjoy, and did enjoy, a competence; and ambition and avarice found no place in the breast of the Peruvian. No despotic system of government was ever devised more suited for its object than was this one. It contributed not a little to the security of the empire, that under the sovereign there was an order of hereditary nobles of the same divine origin with himself, and immeasurably above the rest of the people. They thus received implicit deference from the multitude, while, from long training, they became ready and expert agents in carrying out the measures of government. It is not a little remarkable that, while in government, in morals, and in some of the mechanical arts, they had made such advances, in all that more properly belongs to intellectual culture they were extremely ignorant. They possessed no written language, but used as a substitute an instrument called a *quipu*. This was a cord about two feet long, composed of different coloured threads tightly twisted together, from which a quantity of smaller threads were suspended in the manner of a fringe. The colour of the threads represented various objects, the number of which was indicated by knots. Such was the imperfect substitute for writing, and in this way the annals of their country were handed down from generation to generation. They had no species of money, and carried on no commerce. Their knowledge of astronomy was very imperfect, which is the more remarkable, seeing that the celestial bodies were the chief of their deities. In this respect they were far behind the ancient Mexicans. (See farther on the civilisation of ancient Peru, Prescott's *History of the Conquest of Peru*, and the various works therein cited.)

History.

The first distinct information received by the Spaniards of the existence of Peru was about the year 1511. Vasco Nuñez de Balboa, then governor of the small colony of Santa Maria in Darien, made frequent incursions into the neighbouring country; and on one of these occasions a dispute having arisen amongst the Spaniards about the division of some gold, a young cacique who was present struck the scales with his fist, and scattered the precious metal, exclaiming, "If this is what you prize so much that you are willing to leave your distant homes, and risk even life itself for it, I can tell you of a land where they eat and drink out of golden vessels, and gold is as cheap as iron is with you." The eager cupidity of the Spaniards was roused by this information, and no time was lost in preparing for the invasion of this land of gold. Balboa, accompanied by a hundred and ninety of his countrymen, and about a thousand Indians, commenced his journey across the isthmus, which, although not more than sixty miles in breadth, presented so many obstacles that five-and-twenty days were spent before he obtained a sight of the Pacific Ocean. Armed with sword and buckler, he rushed into its waters, and cried out that "he claimed this unknown sea, with all that it contained, for the King of Castile, and that he would make good the claim against all Christians or infidels who dared to gainsay it." This spot he designated the Gulf of St Michael, a name which it still bears; and here he obtained more explicit information respecting the Peruvian empire. But though he extended his discoveries some twenty leagues farther south, he was not destined to accomplish his object; for, having returned for reinforcements, he was superseded in his command by an ungrateful government, and although afterwards restored to high authority, he soon fell a victim to the jealousy of the individual with whom he was associated in the government.

It was some time after this before any farther attempts were made to discover Peru; but in 1519 the capital of the colony was transferred from the shore of the Atlantic across the isthmus to the ancient site of Panama, on the Pacific, some distance east of the

present city, as being more suitable for prosecuting discoveries in that region. In 1524 an expedition was fitted out, at the head of which was Francisco Pizarro, the natural son of a gentleman of family, but himself totally uneducated, and doomed to spend the early part of his career as a swine-herd. He subsequently entered the army, and being of a daring spirit, and endowed with a robust frame of body, he was foremost in every danger, and able to endure the greatest fatigue. Such qualities soon brought him into notice; and he was found to be possessed of others of a higher order, fitting him to command as well as to serve Thus, while a favourite with the soldiery, his superiors saw in him a man eminently fitted for carrying out their more difficult and dangerous enterprises, and the success that attended him on such occasions speedily raised him to an eminent position. He was one of those that had accompanied Balboa on the previous expedition, and gained the esteem of that general; and he subsequently distinguished himself in the wars in the north. Associated with him on the present occasion were Diego de Almagro, a man of like mean birth with himself, but a gallant and brave soldier, and Hernando de Luque, an ecclesiastic, who acted as priest and schoolmaster at Panama. The last of these was to contribute principally to the expenses of the expedition, while the others were to give their labour and experience, with what small funds they had. A vessel was speedily got ready, and Pizarro set sail from the port of Panama about the middle of November 1524, with little more than a hundred men, Almagro being to follow in a second vessel of inferior size, as soon as it could be fitted out. The season of the year was the most unsuitable for the enterprise, for the periodical winds which then set in were directly adverse to the course which he proposed to steer. He touched at several places on the coast, but found the country everywhere of the same uninviting character,—the low grounds covered with swamps and marshes, and the high lands overgrown with impenetrable forests. In seventy days they had reached no farther south than Punta Quemada, and a fierce engagement with the natives here, in which they had two killed and many wounded, at length determined them to return for assistance. By this time famine, disease, and encounters with the natives had reduced their numbers by more than a fifth. Almagro had in the meantime fitted out another vessel, and set sail from Panama with about seventy men. He reached Pueblo Quemada in a much shorter time than Pizarro had done, and was received in the same hostile manner by the natives, whom, however, he vanquished, burning their town, and forcing the inhabitants to take refuge in the forests. This victory, however, cost him dear, for by a wound received in the encounter he lost one of his eyes. He pursued his voyage, touching at several places on the coast, till he reached the mouth of the Rio de San Juan, about 4. N. Lat. He here met with a higher state of civilization than he had yet seen,—neat cottages and cultivated fields; but his mind was by this time filled with anxious thoughts regarding Pizarro, having seen no traces of him beyond Quemada, and he resolved to return. Touching at the Pearl Islands, he learned that his colleague was at Chicama, a place on the mainland at a short distance from Panama. Here the two adventurers met; and after recounting each other's exploits and escapes, they consulted regarding their future operations. It was at length resolved that Almagro should proceed to Panama to raise the necessary supplies, while Pizarro was to remain in his present quarters. The former, however, met with considerable difficulty in the execution of his mission, for the governor Pedrarias declared against the expedition, and was only after a time gained over by the intercession of Hernando de Luque. The three colleagues now entered into a contract, by which the whole of the conquered territory and spoils were to be divided equally among them, —Hernando having advanced as his share of the enterprise 20,000 *pesos* of gold, a sum estimated at about L.50,000 of our money. Two larger vessels were now purchased, and stores laid in; but it was with the greatest difficulty that they could muster a force of 160 men. They at length set sail, each in his own vessel, and accompanied by an experienced pilot named Ruiz. In a short time they arrived at the mouth of the Rio de San Juan, where Pizarro succeeded in surprising a small village, and carrying off a considerable booty in gold, together with a few of the natives. They now saw the necessity of having a stronger force to cope with the increasing population of the country; and accordingly it was decided that Almagro should return to Panama with the treasure, and beat up for reinforcements, while Ruiz, in the other vessel, should reconnoitre the country towards the south, and Pizarro, with the rest of the force, remain in the neighbourhood of the river. Ruiz proceeded as far south as Punta de Pasado, about half a degree beyond the equator, and returned, after an absence of several weeks, to the spot where he had left Pizarro and his comrades. The latter had just returned from a long incursion into the interior, where he had undergone great hardships and lost not a few of his companions. Almagro sailed into port soon after with his vessel laden with a fresh supply of stores, and bringing with him a considerable number of volunteers. With renewed spirits they proceeded on their journey; but by this time the favourable season had passed, and they were long tossed about before they reached the Island of Gallo. Proceeding still southward, they found the country more and more populous, and the evidences of civilization to increase; and when they anchored off the port of Tacamez they saw before them a town of 2000 or more houses laid out into streets, and containing a numerous population. Further reinforcements were again necessary; and it was agreed that Almagro should return to Panama, Pizarro and the rest remaining at Gallo. With Almagro, however, came news to Panama of the deplorable condition of the party; so that the governor not only refused to countenance any further attempts, but despatched two vessels to bring home Pizarro and his companions. While most of the latter gladly embraced the opportunity of getting away, Pizarro and thirteen others sternly refused to return. These were accordingly left on the island, and they subsequently removed to the uninhabited island of Gorgona, about 25 leagues farther north, and 5 leagues from the continent. The governor filled with indignation when he heard of the obstinacy of Pizarro and his followers, and sternly refused to render any assistance to men thus bent on their own destruction. At length, however, he was so far overcome by the arguments and entreaties of Almagro and De Luque that he consented to another vessel being sent to Pizarro, but with no more hands than were necessary to work her, and with express orders to Pizarro to return within six months. Though disappointed that it brought no additional recruits, Pizarro yet gladly welcomed the little vessel, having been by this time seven months on the island. In twenty days after leaving Gorgona, the adventurous vessel rounded the point of St Helena, and glided smoothly into the Gulf of Guayaquil, anchoring off the island of Santa Clara, at the entrance of the Bay of Tumbez. Here they beheld a town of considerable size, with many buildings apparently of stone and plaster. The people collected along the shore, and friendly relations were exchanged between them and the Spaniards. Here the latter had their golden dreams, if possible, more than realized; but for the present they could only feast their eyes on the riches before them. To attack the place with his handful of followers Pizarro saw to be useless; and accordingly he took a friendly leave of the natives, promising soon to return. He continued his progress southward; and everywhere received the like friendly welcome from the natives, and gathered information of the wealth and magnitude of the empire of Peru. He proceeded to about the ninth degree of south latitude; and having by this time seen enough to convince him of the value of his discovery, he turned his prow northward, and sailed for Panama. In his way he touched at Tumbez, where some of his followers were at their request left, and two or three Peruvians were taken on board. The excitement caused by their arrival at Panama was very great; but still the coldness of the governor held out to them but little hopes of efficient help being obtained from that quarter, and it was resolved to apply to the crown itself. Pizarro was accordingly sent to the mother-country, and reached Seville early in the summer of 1528. He was graciously received by the emperor Charles V., and was invested with supreme civil and military authority over the country to be conquered, for 200 leagues south of Santiago. Pizarro, on his part, engaged to raise 250 men, with the requisite vessels and stores for the conquest of the country within six months. He could scarcely, however, raise half this body of men, and had to steal privately out of the port of Seville, in order to avoid the scrutiny of the officers of government. He was accompanied by four brothers, three of whom were illegitimate like himself,—Francisco Martin de Alcantara on the mother's side, and Juan and Gonzalo Pizarro on the father's. The legitimate brother was named Hernando. At Nombre de Dios, Pizarro was met by his two associates, and great was Almagro's wrath to find that all the chief offices had been conferred upon his colleague. A reconciliation, however, was at length effected; and early in January 1531 the expedition, consisting of 180 men, with 27 horses for the cavalry, left Panama in three vessels, Almagro remaining behind, in order to collect reinforcements. Having encountered contrary winds, they had in thirteen days only reached St Matthew's Bay. Here it was resolved to disembark the troops, who would advance along the coast while the ships held on their course at a convenient distance from the shore. In the province of Coaque they suddenly fell upon a town, and obtained a valuable booty in gold, silver, and precious stones. A large quantity of this was sent to Panama with the ships, while the troops continued their march southwards. At Puerto Viejo they were joined by a reinforcement of thirty men, under an officer named Benalcazar. While at Puna, an island on the Gulf of Guayaquil, which they had treacherously taken possession of, notwithstanding the friendly reception they had met with from the natives, they received a further reinforcement of 100 men in two vessels; and Pizarro now con-

sidered himself in a position to enter upon the proper theatre of his labours. He accordingly passed over to Tumbez, and there learned that the country had been for some time distracted by a civil war between two sons of the late monarch.

Huayna Capac was the reigning Inca at the time when the Spaniards first visited the coast of Peru. He is represented as a prince distinguished both in peace and war. He brought under the sway of the Incas the powerful state of Quito, and reduced to subjection many of the independent tribes on the remote borders of his territory. He likewise pursued an enlightened policy towards his subjects, encouraging agriculture and other branches of industry, opening up new roads, and introducing the civilization of the Incas among the conquered nations. He is said to have been deeply impressed with the accounts brought to him of the white men. He saw in their ships and weapons indications of a civilization far superior to that of his own people; and he feared that at no distant day they would return, and might shake to its foundations the mighty empire of the Incas. Oracles, too, had darkly predicted mighty events that were to happen on the death of the twelfth Inca; nor were omens wanting—those powerful preachers to the untutored mind. Huayna Capac died about 1529, leaving his kingdom of Peru to his eldest son Huascar, but Quito he left to his favourite son Atahuallpa, by a daughter of the conquered monarch. The two sons, however, did not long rest contented with their respective possessions, and a civil war was the consequence. Victory at length declared for Atahuallpa; and in order to seat himself more firmly on the throne, he put to death all the descendants of the late Inca that he could seize either by stratagem or force. The life of Huascar, however, was, for political purposes, spared in the meantime; but he was detained a close prisoner. These events occurred in the early part of 1532, and completely diverted the attention of the Peruvians from the circumstance of a foreign invader having landed on their soil. Pizarro at once saw the importance to him and his cause of this state of the country. After some time spent in reconnoitring the country, he fixed upon a spot in the rich valley of Tangarala as a site for a settlement. Hither accordingly the Spaniards removed and set about building a town, to which they gave the name of San Miguel. Pizarro here learned that the victorious Atahuallpa lay encamped about ten or twelve days' journey off, and though his entire force would not amount to 200 men after leaving 50 for the protection of his new settlement, he resolved to set out to meet the Inca. On the 24th of September 1532, therefore, he marched out of San Miguel at the head of his small body of adventurers, amounting in all to 177 men, of whom 67 were cavalry. Everywhere the people received them with confiding hospitality, and as yet the Spaniards saw it to be their interest to reciprocate their friendships. At length they arrived at Caxamalca, within a league of the Peruvian encampment, and here they saw the slope of the hills white with pavilions as thick as snow-flakes for the space apparently of several miles. The sight caused something like fear in the stoutest bosom; but it was now too late to draw back. In the afternoon of the 15th of November 1532, the Spaniards reached Caxamalca, which had been vacated by the inhabitants for their reception, and immediately they sent an embassy to the Inca inviting him to visit them in their new quarters. They were graciously received by the Inca, and he promised to pay them a visit on the following day. The reception prepared for the Inca was such as he little expected when he set out with an unarmed retinue to redeem his promise. He was borne on the shoulders of his principal attendants seated on a throne or couch resplendent with plates of gold and silver, enriched with precious stones, and adorned with waving plumes of the most gorgeous hues. When he entered the plaza or great square of the town, a dominican friar, Fray Vicente de Valverde, came forward with his breviary, or, according to other accounts, a Bible in one hand and a crucifix in the other, and, approaching the Inca, expounded to him the doctrines of the Christian religion, exhorting him to embrace the true faith, and to acknowledge himself a vassal of the Spanish crown. Enraged and astonished at this extraordinary proceeding, the Inca demanded by what authority he said these things. The friar handed him the book which he held in his hand. "This," said he, holding it to his ear for a moment, "tells me nothing," and dashed it to the ground with disdain. The monk immediately ran towards Pizarro, calling out that the Christian religion had been dishonoured, and at a given signal the Spaniards who had been concealed in the adjoining buildings rushed out upon the defenceless natives. The slaughter was immense on the side of the Indians; and the murderous nature of the attack may be gathered from the fact, that not a single Spaniard was killed or wounded with the exception of Pizarro, who received a slight wound on the hand from one of his own men. Atahuallpa himself was taken prisoner; and a rich booty was found in the Peruvian camp, consisting of gold and silver, precious stones, cotton, and woollen stuffs, &c. The captive monarch, though receiving every attention at the hand of Pizarro, naturally felt anxious to regain his liberty. He feared also that the news of his captivity might reach Huascar, who, by corrupting his keepers, might obtain his liberty, and would find little difficulty in putting himself at the head of the empire. The love of gold, he soon learned, was the prime motive that had brought the Spaniards into the country; and as the price of his liberty, he offered to Pizarro to fill the room in which they stood with gold as high as he could reach. This room is said to have been 22 feet long by 17 feet wide, and the height 9 feet from the floor. Pizarro, charmed with the idea of so much gold, and knowing how easy a matter it was to break faith with a captive, readily entered into the agreement, and the terms of it were duly drawn up by a notary. Atahuallpa therefore, with all haste, despatched couriers to Cuzco and all the principal places of the kingdom, with orders to forward the gold utensils and ornaments of the palaces, temples, &c., to Caxamalca without delay. In the meantime, the Spaniards remained in Caxamalca unmolested, and small detachments of their number marched into the remoter provinces, and were everywhere received with marks of the most submissive respect. News having by this time reached Huascar of the Inca's captivity and of his offered ransom, he is said to have offered to the Spaniards a much greater amount if they would restore to him his dominions, of which he had been unjustly deprived. Atahuallpa was greatly alarmed on hearing of this, and fearing lest the Spaniards might listen to his brother's request, he caused him to be assassinated. Meanwhile Indians were daily arriving at Caxamalca loaded with treasure; and at this time, too, arrived Almagro, with a strong reinforcement of 150 foot and 50 horse. This was about the middle of February 1533, and now Pizarro found himself in a position to go forward with the conquest of the country. The whole of the Inca's ransom, however, had not yet arrived; but at length they agreed to accept what had already arrived in full of the obligation. The total amount of gold, when melted down, was found to be 1,326,539 *pesos de oro*, equivalent to about L.3,500,000 sterling. Besides this there were a number of articles of very delicate workmanship, which were reserved for being sent as a present to the emperor. After deducting one-fifth for the crown, the rest was divided in certain proportions among the troops, Pizarro himself and his officers receiving sums in proportion to their rank. Considerable difficulty was experienced in dealing with Almagro's followers, who demanded to share in the spoil, but at length they agreed to resign all claim on being paid a stipulated sum. Nothing in this division is said of Almagro, who in terms of the original contract was entitled to an equal share with Pizarro himself. Luque, indeed, was no longer to be benefited by worldly treasure, having died a short time before Almagro's last departure from Panama—too soon to learn the full success of the enterprise which, but for his exertions, must have failed. After dividing the spoil, it came to be considered what was to be done with the Inca, who now became clamorous for his liberty. Rumours of a rising among the natives now began to be current, and though they seem to have had no foundation in fact, they yet served to give colour to a proceeding which would get them over their difficulty with the Inca. This was nothing less than the putting him to death. A ceremony preparatory to execution was gone through (it cannot be called a *trial*), and he was sentenced to be burned alive in the great square of Caxamalca that very night. When bound to the stake, Father Valverde made a last attempt to induce him to adopt the Christian faith and be baptized, promising that if he did so he would receive the less painful death of garrotting. On being assured by Pizarro that such would be the case, he consented to abjure his own religion and be baptized; and accordingly he suffered by the latter mode on 29th August 1533. Thus perished by an ignominious death the last of the Inca monarchs of Peru.

On the death of Atahuallpa, Pizarro invested a son, or, according to others, a brother of that monarch, with the insignia of royalty, hoping that a young man without experience might prove a more passive instrument in his hands than an ambitious monarch who had been accustomed to command; but the young prince did not live many weeks to enjoy his new dignity, and no one was substituted in his place. At Cuzco a brother of Huascar, named Manco Capac, was elevated to the throne. Early in September the Spaniards, now amounting to almost 500 men, of whom nearly one-third were cavalry, set out from Caxamalca for the capital. Pizarro halted for some time at Xauxa, in order to found there a Spanish colony, judging it a favourable position for keeping the natives in check; while at the same time it afforded an easy communication with the sea coast. Though during this march bodies of Indians were seen hovering about at a distance, yet they had offered no actual resistance. A detachment of sixty horse, however, under De Soto, having been sent forward to reconnoitre the country in advance, were attacked by a body of the natives, who fought with great fury, and the issue was doubtful, till the arrival of Almagro with a reinforcement of cavalry struck terror into the

natives, and prevented them from renewing the contest. Pizarro at length set out from Xauxa, leaving his treasures there under a guard of forty men; and nothing of importance occurred on the road till he reached the vale of Xaquixaguama, about 5 leagues from Cuzco. Here he halted for several days, and one of his first acts was the execution of Challcuchima, one of the ablest of the Peruvian generals. He had attended his royal master during his captivity, and since his death he had remained in the Spanish camp. He was now accused of having stirred up the natives against the Spaniards, and was sentenced to be burned alive. When at the stake he coldly replied to Father Valverde's entreaties to adopt the Christian faith, that he "did not understand the religion of the white men." Soon after this Manco Capac arrived in great state at the Spanish camp, and, announcing his title to the throne, claimed the protection of the white men. He was received with great cordiality, and assured that they had come into the country in order to vindicate the claims of Huascar to the throne, and to punish the usurpation of his rival. Taking with him the Indian prince, Pizarro now resumed his march, and on the 15th November 1533 entered the Peruvian capital. This city far surpassed anything that they had yet seen in the New World. The beauty of its edifices, the length and regularity of its streets, and the appearance of comfort, or even luxury, visible in its numerous population, excited their astonishment. The population of the city itself is said to have amounted to 200,000, and that of the suburbs to as many more. Though doubtless the inhabitants had concealed much of their treasures, yet the gold obtained here is said to have even exceeded that received as the ransom of the Inca. One of the first acts of Pizarro, after dividing the spoil, was to place Manco on the throne, in order to give his acts some air of authority with the natives. He afterwards organized a municipal government, and induced his soldiers to settle in the place by liberal grants of houses and land. In March 1534 a Spanish force, amounting to 500 men, under Don Pedro de Alvarado, a general who had greatly distinguished himself in the Mexican war, arrived in the Bay of Caraques. He had come to take possession of Quito, which he believed, or pretended to believe, was not included in Pizarro's territory. Almagro was immediately despatched to meet the invaders, and came upon them in the plains of Riobamba. By this time Alvarado's army had been reduced by more than a fourth, in consequence of the great hardships they had undergone on their march; so that they were little inclined to enter upon a contest which it was Almagro's interest to avoid. Negotiations were accordingly commenced, and at length Alvarado agreed to hand over his fleet, forces, and stores, to Pizarro for 100,000 *pesos de oro*.

Cuzco being found to be unsuitable as the capital of the colony, it was resolved to build another near the coast; and accordingly, on the 6th January 1535, the new capital was founded in the valley of Rimac. It was first named *Ciudad de los Reyes*, or "City of the Kings;" but subsequently it came to be called Lima. The Spaniards applied themselves with vigour to the task of building the new city, under the eye of their chief. In the meantime, Almagro had arrived at Cuzco and taken command of that capital, and here he received intelligence of the return of Hernando Pizarro from the court of Spain. This time he had taken the precaution to send a secret messenger of his own along with Hernando, to look after his interests at court; and he now learned that he had received a grant of all the country lying south of the southern limit of Pizarro's territory. Almagro was greatly elated at these tidings, and immediately laid claim to Cuzco as being within the bounds of his territory. He accordingly proceeded to exert his independent authority, and matters were approaching an open rupture when Pizarro himself appeared among them. He managed to appease his rival; and Almagro agreed to waive his claim to the capital in the meantime, and set out on the conquest of Chile. Pizarro now returned to the coast, and had the satisfaction of seeing his new capital rapidly advancing.

Manco Capac, who had hitherto so tamely submitted to be a tool of the Spaniards, was nevertheless a person of some spirit and courage; and at length, exasperated by the repeated indignities to which he was exposed, he effected his escape from Cuzco, where he then was. A rising among the natives immediately followed, and Cuzco was besieged in February 1536 by a force amounting, it is said, to 200,000 men. To add to the distress of the Spaniards, their city was set on fire by the burning arrows and red-hot stones of the natives, and more than one-half of it was reduced to ashes. They frequently sallied out of the town, but beyond killing a number of the natives, they effected no advantage, while the natives increased in skill and bravery with each contest. They however succeeded in taking possession of a fortress overlooking the city, but Juan Pizarro lost his life in the struggle. Month after month passed away, and still there came no relief. Indeed the rising had been general. Several hundred of the Spaniards living upon their estates had been massacred; Xauxa was besieged; and a strong force had attempted to besiege Lima, but were put to flight. Several detachments had been sent by the governor to relieve Cuzco, but they were all cut off by the natives. In this dilemma, Pizarro sent letters to the governors of Panama, Nicaragua, Guatemala, and Mexico, imploring them for assistance.

The siege of Cuzco had now lasted more than five months, and as the season of planting had come on, Manco, fearing a famine, sent the greater part of his followers home, with orders to return and renew the blockade as soon as their field labours were over. The Spaniards beheld with joy their enemies melting away; but a new cause of dread appears in the person of Almagro. He had proceeded as far south as the vale of Coquimbo, about 30. S. Lat., but found nothing to induce him to remain; and his men, who had suffered many hardships on the way, now became clamorous for his return. On reaching Arequipa, he learned of the revolt of the Indians, and hastened forward to Cuzco. He now renewed his claim to that city, and sent an embassy to the municipality requiring them to recognise him as their lawful governor. A truce was, however, concluded in the meantime; but Almagro, hearing that a strong body of troops were marching from Lima towards Cuzco, suddenly took possession of the capital, and the two Pizarros were made prisoners. He then set out to meet the force from Lima, at this time lying at Xauxa. The two armies came in sight of each other at the Rio de Abancay. Aided by the treachery of one of the officers of the opposite army, Almagro forced the river during the night, and obtained an easy victory, on the 12th July 1537, and took the commander Alonzo de Alvarado prisoner. He now returned in triumph to Cuzco.

Meanwhile aid began to reach Lima, and Pizarro was soon able to set out for Cuzco at the head of 450 men, most of whom were cavalry. On his way, he heard of the arrival of Almagro and of the defeat of Alvarado, and immediately he returned with all haste to Lima, to put himself in a position for defence, judging, not incorrectly, that Almagro might also lay claim to that city. The latter having now obtained possession of Cuzco, was easily persuaded by his restless followers that Lima also fell within his territory. He accordingly set out for that city, and on the way heard of the escape from Cuzco of Gonsalo Pizarro, Alvarado, and other prisoners, and of their arrival in Pizarro's camp,—Hernando Pizarro he had taken along with him. Pizarro now attempted to negotiate; and at length it was agreed to wait for definite instructions from Castile, Almagro meanwhile remaining in possession of Cuzco, while Hernando Pizarro was to be set at liberty under promise to leave the country within six weeks. During the time that negotiations were pending, Pizarro was busily engaged in warlike preparations, and when his brother was set at liberty, he found himself in a condition to unmask his intentions. Almagro, on seeing that he had been deceived, immediately made for his capital; and a council of war being held, it was resolved to wait the arrival of the enemy at Las Salinas, a place within a league of Cuzco. Almagro, himself at this time too ill to take the command of his troops, devolved it upon Orgoñez, the ablest of his generals. Pizarro had intrusted the command of his forces to his two brothers, and returned to Lima. Almagro's force amounted to about 500 men, while that of the enemy was about 200 more. The fight took place on 26th June 1538, and for some time raged with great fury, but at length Orgoñez being slain, and his troops thrown into confusion, victory declared for the Pizarros. Hernando now took possession of Cuzco, which he gave up to pillage. Almagro was taken prisoner, and thrown into irons, and shortly after, this brave man and able soldier was condemned and executed.

Pizarro, on learning of the victory of Las Salinas, immediately set out for Cuzco, but waited for some time at Xauxa, it is said, till he should hear of the execution of Almagro. He then entered the city in great state; and his conduct now showed that he considered himself the undisputed possessor of all this vast kingdom. Instead of attempting to conciliate Almagro's party, he treated them with undisguised contempt; while many of his own adherents he disgusted by his haughty bearing, and by the manner in which he appropriated to himself, or bestowed on his brothers and favourites, all the most valuable districts of the country. But the time had not yet come for a revolt. The country being now in apparent peace, Hernando prepared to revisit Spain, and accordingly embarked at Lima in the summer of 1539, earnestly counselling his brother to beware of the Chile men, as Almagro's followers were called. Not a few of these, however, were already in Spain, and the reception of Hernando in that country was colder than he had expected. Indeed the clamours against him became so great, that he was at length cast into prison. He lay there for twenty years, and when at length, in 1560, he was released, he was an old man, bent down by years and infirmities; but he still survived for several years, an object of pity rather than of indignation.

The state of Peru was now such as to demand the immediate in-

terposition of government; but the mission was one of extreme difficulty, for Pizarro's power was now firmly established over the country, and he would not readily submit to any interference with his authority. At length Licentiate Vaca de Castro, a member of the Royal Audiencia of Valladolid, was selected for this delicate mission. He was to appear before Pizarro in the capacity of a royal judge, to consult with him on the redress of grievances, especially with reference to the natives, to transmit an account of the state of the country to the court at Castile, and, in the event of Pizarro's death, to take upon himself the government of the country. The last provision was, as the result showed, necessary, for before he reached his destination Pizarro had fallen by the hand of assassins.

Almagro had left a son by an Indian woman, and had named him his successor. This young man, on the imprisonment of his father, was sent to Lima, where he continued to live, and his house became the resort of the disaffected of his father's followers. A number of the more desperate of these, goaded on by poverty, and the insults to which they were continually subjected, at length resolved on the assassination of the governor, who was now in Lima. Pizarro himself seems to have been singularly blind to his danger, and notwithstanding numerous cautions that he received, he took no precautions for his safety. On the 26th of June 1541, the conspirators, to the number of eighteen or twenty, sallied out from Almagro's house, headed by Juan de Herrada, shouting "Long live the king; death to the tyrant." They gained the palace without opposition, and reached the apartment where their victim was conversing with some friends, having just risen from table. Hastily enveloping one arm in his cloak, and seizing a sword, he maintained for some time the unequal contest; but at length he received a deadly thrust in the throat, and fell to the ground, when he was immediately despatched. Thus perished the man who had acquired for Spain the richest of her possessions,—a man possessed of great abilities, and adorned with many excellent qualities, but whose perfidy and cruelty have left a stain upon his character that, however much it may be extenuated by the circumstances of his early life, and the times in which he lived, can never be removed. With him fell his half brother Martinez de Alcantara.

On the death of Pizarro, the young Almagro was placed at the head of the government, but his authority was only tardily acknowledged in places at a distance from Lima. Gonzalo Pizarro, who had been appointed governor of Quito, was at this time away on an expedition into the country lying eastward of the Andes. Vaca de Castro meanwhile received the news of the death of Pizarro at Popayan. He continued his march to Quito, where he was well received by Gonzalo's lieutenant, and he now produced his royal commission to assume the government. Emissaries were despatched to the principal towns, requiring their submission, while Castro himself continued [illegible] slowly towards the south. Almagro meanwhile had proceeded to Cuzco, where he learned of the arrival of Castro at Lima. Resolved to try the effects of negotiation before an appeal to arms, he sent an embassy to the new governor, stating that he did not dispute his authority over Peru, and that he had only taken up arms to secure possession of the territory bequeathed to him by his father, of which he had been unjustly deprived by Pizarro. To this he received no answer; and thus saw that his only recourse was to arms. He accordingly left Cuzco about midsummer 1542, at the head of a well-disciplined and well-appointed force of about 500 men. Castro had by this time set out from Lima, and on reaching Xauxa, found himself with an army of about 700 men; but they were not so well disciplined or armed as those of Almagro. The two armies met in the plains of Chupas, and the battle took place on the 16th September 1542. Both sides fought with great bravery, and the victory was long doubtful, but at length it declared for Castro. Almagro, by his feats of valour, showed himself not unworthy of his father's name; but when all was lost, he fled with a few followers to Cuzco, where he was taken prisoner, condemned, and executed. He met his fate with the utmost composure, made no appeal for mercy, and only requested that his bones might be laid by the side of his father's.

Vaca de Castro having now got rid of his rival, gave his attention to the settlement of the country. He laid down laws for its better government, and attempted to ameliorate the condition of the natives by in some measure protecting them from the unjust exactions of their conquerors, and by establishing schools for teaching them Christianity. But while these gradual measures were being carried out in Peru, one of a much more sweeping nature was resolved upon in Spain. This was nothing less than the proclamation of all the Indians vassals of the crown of Spain, and thus only to be employed in voluntary labour, for which they were to receive a fair remuneration. Slaves were declared to be free on the death of their present proprietors; but all those held by persons in public offices, ecclesiastics, or persons criminally concerned in the feuds of Almagro and Pizarro, were to be immediately set at liberty. To carry out this measure, Blasco Nuñez Vela was appointed governor of Peru, with the title of Viceroy. A royal audience, consisting of four judges, was also named to assist him in administering the law. The news of this caused the greatest indignation in Peru, and it was with difficulty that the governor could prevail upon the people to wait the arrival of the viceroy, and try the effect of pacific measures.

The viceroy reached Tumbez on the 4th March 1544, and immediately showed his determination to act up to his instructions by liberating a number of slaves. The country was now in the greatest consternation, and all eyes were turned towards Gonzalo Pizarro, the last in the land of that family who had led the armies of the conquest, and the one most likely to afford them redress. He was invited to Cuzco, and was there invested with the title of Procurator-General of Peru. The viceroy, meanwhile, had reached Lima, where he was installed in his new office; and one of his first acts was to proclaim his determination to fulfil his commission. He, however, offered to join the colonists in a memorial to the crown, soliciting the repeal of a code which he now believed would be neither for the interests of the colony nor the crown; but in the meantime he had no warrant to suspend its execution. Gonzalo was not long in mustering a force of nearly 400 men, with whom he set out from Cuzco ostensibly for the purpose of putting down the Indians, who were a continual source of annoyance to the Spaniards. Scarcely had he left the city when he heard of the death of Manco. He had been assassinated by a party of the Almagro faction, who had taken refuge among the Indians on the defeat of their young leader, and they in their turn were all slain by the Indians. Though the alleged cause of Gonzalo's warlike preparations was thus removed, yet it had little effect upon his proceedings. His intentions being now apparent, many of his followers, shrinking from the idea of open rebellion—for loyalty was ever a crowning feature of the Spaniard—secretly withdrew from his army. On the other hand, he was joined by others less scrupulous, and several bodies of troops sent out to oppose his progress came over to his ranks; so that in a short time he found the force with which he left Cuzco nearly doubled. Among those who joined his standard at this time was Francisco de Carbajal, a distinguished soldier, but now eighty years old, and preparing to return to Spain. He was at length, however, induced by the earnest entreaties of Pizarro to join his cause, and to take command under him. The viceroy now rigorously prepared for war, but he was a man particularly ill suited for an emergency like the present. He was arrogant and domineering, while he was also weak and vacillating. His arrogance was a natural result of his weakness; and unfortunately he was weak and vacillating when he should rather have been arrogant, and arrogant when it would have been better to have been vacillating. The defections from his cause led him to be suspicious of every one about him, and of none more so than his best friends. Castro he suspected of holding communication with the enemy, and he was ordered to be placed under arrest and confined on board a vessel lying in the harbour. In the meantime, he was strengthening the fortifications of the city; but at last he resolved to abandon the capital and withdraw to Truxillo, about eighty leagues distant. The judges, however, having recently arrived at Lima, were strenuously opposed to any such measure, and disapproved of his conduct in every particular. They appealed to the citizens for support, and passed a decree that the viceroy should be arrested. He was taken prisoner in his palace, and placed in strict confinement. A provisional government was then established, and one of its first acts was to suspend the odious ordinances till instructions could be received from court. Pizarro was called upon to lay down his arms, but this he refused to do, and demanded of the judges that they ratify his appointment as governor of the country by the people. Loath as they were to lay down their newly-acquired authority, they had to submit with the best grace possible, as they were without the means of resistance. Accordingly they invited Gonzalo to assume the government; and he entered the city in great state, at the head of nearly 1200 followers, on the 28th day of October 1544. The first act of the new governor was to apprehend and punish those that had taken the most active part against him; some he condemned to death, and others he sent into banishment. His next concern was to fill all the places of trust with his own partizans.

Meanwhile the ship in which Castro was confined suddenly left the port;—that officer not caring to trust himself in the power of Pizarro, had prevailed on the captain to convey him to Panama. On his arrival in Spain, there were not wanting parties to accuse him of embezzlement, injustice, and mismanagement; and though he was at length acquitted of every charge, it was only after he had been imprisoned for twelve years that the tardy tribunal of Castile were able to pronounce a judgment. Pizarro had scarcely begun to exercise his new powers when a new enemy arose to oppose him. This was the viceroy Nuñez, whom the judges had put on board a ship under the charge of one of their number, Juan Alvarez, in

order that he might be carried to Spain. Scarcely, however, had they put to sea when Alvarez, moved either by fear or remorse, put himself and vessel into the hands of Nuñez. The latter landed at Tumbez, and immediately raised the standard of royalty. Numbers flocked to his cause, and he soon found himself at the head of a considerable army. Pizarro, alarmed at these proceedings, set out in person with a large force to attack the viceroy, who was then in San Miguel. The latter, however, did not feel himself in a position to risk a battle, and consequently retreated, first to Quito, and then to Popayan. At the latter place he was joined by Benalcazar, and now found his force to amount to about 400 men. Pizarro meanwhile, at Quito, by a feigned retreat, drew the enemy towards that city, and at length the two armies met for battle about a mile from Quito on the 18th of January 1546 Pizarro's force amounted to about 700 men; and though the enemy behaved bravely, the victory was not long doubtful. About one-third of the viceroy's troops had perished; Nuñez himself was slain; and Benalcazar had fallen, covered with wounds. Pizarro remained for some time at Quito, and then set out for his capital. He was everywhere received with the greatest demonstrations of joy, and saluted with the titles of "Liberator and Protector of the People." He was now undisputed master of Peru, and began to assume a state corresponding with his fortunes.

At home the news of these proceedings caused the greatest consternation and dismay to all classes; and the government felt the greatest difficulty in coming to a decision regarding the course to be followed. At length it was resolved to try conciliatory measures, and to send out a representative who, by arguments and politic concessions, might bring back the people to their allegiance. For this difficult mission was chosen Pedro de la Gasca, an ecclesiastic who, though bred to the church, had also distinguished himself as a soldier and a diplomatist. He was a man well qualified for the management both of affairs and men; he was possessed of great abilities, of a gentle and winning manner, with at the same time great firmness and decision of character, and of undoubted fidelity and loyalty. He received the title of President of the Royal Audience, and was placed at the head of every department in the colony, civil, military, and judicial—being, in fact, invested with all the powers of the sovereign himself. His preparations were few and simple; and he set out with a slender band of followers on 26th of May 1546. By this time Panama and Nombre de Dios were in the possession of Pizarro, guarding jealously any communication with the mother country. Little danger, however, was apprehended from the arrival of a poor ecclesiastic, without an armed force, and with hardly even a retinue to support him. Great, therefore, was the astonishment of the governors when they came to know the extent of the powers vested in Gasca. At length, by his address and the promise of pardon to all who should immediately lay down their arms, they were induced to join his cause; and on the 19th of November 1546 he obtained possession of the fleet at Panama. He now adopted a bolder policy, by publicly raising levies of men and drawing supplies from all quarters. The alacrity with which people of all classes espoused his cause showed that the ancient sentiment of loyalty still prevailed. Many deserted the standard of the usurper to rally round that of a person who was invested with lawful authority; and those who had been driven to the forests and caverns now quitted their hiding-places and joined the royalist. Meanwhile Pizarro was making every preparation for war; but as town after town, and general after general, was declaring for the royalist, he judged it safer to leave Lima and go to Arequipa. No sooner had he left Lima than that city opened its gates to the enemy. Gasca himself remained at Panama till 10th of April 1547, when he set sail with his whole fleet for Peru, and after encountering much bad weather, he reached Tumbez on the 13th of June. He was everywhere received with the greatest enthusiasm, and at length reached Xauxa, where he established his head-quarters. Pizarro had meanwhile decided to evacuate Peru and go into Chile; but the mountain passes through which his route lay were commanded by a hostile force about double his own. He hazarded a battle in the plains of Huarina on 26th of October 1547; and his men, fighting with the desperation of those who had everything to lose, at length defeated the enemy with great slaughter. Elated by this victory, he now resolved not to leave the country, and marched to Cuzco. The royalists at Xauxa were much dismayed by the news of this defeat when they were looking for an easy victory. Gasca meanwhile exerted himself to raise a large force, in order to put a speedy end to the war, and at length found himself at the head of nearly 2000 men, the largest European force that had yet assembled in Peru. The two armies met in the plain of Xaquixagua; but no sooner were they drawn up in battle array than company after company of Pizarro's troops passed over to the enemy, and no alternative was left to that commander but to yield himself a prisoner. He was tried, found guilty, and soon after executed. Thus perished the last and youngest of that remarkable family, in the forty-second year of his age. His remains were deposited side by side with those of the two Almagros. Carbajal and others of the leaders were also executed; while many more were banished, and their estates confiscated.

Gasca now devoted his attention to settling the state of the country, and to establishing the government upon a true and firm basis; by which means [illegible] the hands of his successors, and facilita[illegible] orderly government of the country. Having at length accomplished his mission, he set out for Spain in January 1550, and entered the harbour of Seville in little more than four years from the time that he had sailed from that port. He was soon after raised to a bishopric, and passed the rest of his days in the peaceful discharge of his ecclesiastical functions, honoured by his sovereign, and enjoying the admiration and respect of his countrymen. Petty disturbances continued to break out in Peru for some time after the departure of Gasca, but they shortly subsided under the wise and temperate rule of his successors, who profited by his policy and example; and finally the royal authority was as completely established in Peru as in any other portion of the Spanish colonial possessions.

In the subsequent history of Peru there occurs little of interest to the general reader till the time of the war of independence. The whole of the Spanish dominions in the New World were at first divided into two governments, one subject to the viceroy of Mexico, and the other to the viceroy of Peru. In 1718 the province of Quito was separated from Peru and annexed to New Granada, and in 1788 the provinces of La Plata, Potosi, Charcas, Chiquitos, and Paraguay were detached from Peru to form the government of Buenos Ayres. Each of these governments constituted a viceroyalty; while Guatemala, Venezuela, Caraccas, Cumana, and Chile were severally formed into distinct jurisdictions under a captain-general. In 1780 an insurrection broke out among the Indians in Peru, under Tapac Amaro, who assumed the title of Inca, but it was at length suppressed. Peru did not join in the celebrated war of independence that broke out among the Spanish possessions in South America in 1810, and it was the last to throw off the Spanish yoke. It soon became evident, however, that the expulsion of the Spaniards from Peru was necessary to the safety of the other states; and hence a combined Chilean and Buenos Ayrean army, under San Martin, laid siege to Lima in February 1821. At the same time, the fleet under the command of Lord Cochrane blockaded Callao, and it was here that that gallant officer performed one of those desperate feats of valour for which he is characterized. With the boats of his little squadron he entered the port of Callao, and under the guns of its tremendous batteries boarded, captured, and carried off one of the largest of the Spanish ships of war, with more men on board than were in all the boats that attacked it. After some months, a convention was agreed to, when Lascerna, the Spanish general, with his army, left Lima, and San Martin took possession of the city. On the 28th of July 1821 the independence of Peru was declared; and a few days afterwards San Martin was proclaimed protector. Among the first legislative acts of the protectorate was a decree declaring that the children of slaves born in Peru subsequently to the 28th of July 1821 should be free. This was followed by another abolishing the tribute, and enacting that the aborigines be thenceforth denominated Peruvians like the Creoles. On the 21st of September the fortress of Callao surrendered to the protector. The success of the patriots, however, received a check in the defeat of General Tristan. He had the command of a body of troops at Ica, and had allowed himself to be surprised, and his retreat cut off, by Canterac, who took 1000 prisoners, besides some pieces of artillery and other spoil. This reverse, however, was counteracted by the victory gained over the royalists at Pinchincha on the 24th of May 1822. The protector did not long retain his popularity; deputies were summoned; and he resigned his power into their hands on 21st of September 1822. Congress lost no time in appointing a new executive, under the title of the *Junta Gubernativa*. One of the

first acts of that assembly was to decree that San Martin should bear the title of "Founder of the Liberty of Peru;" and the thanks of the nation were likewise awarded to Lord Cochrane for his achievements in the Peruvian cause. The proceedings of the new government were marked by feebleness and discord. An unsuccessful attempt to reduce the royalists increased popular clamour against the government junta, which was at last expelled from power, and General Don Jose de la Riva Aguero was made president of the republic.

Santa Cruz, a Peruvian, who in the sequel greatly distinguished himself, assumed the chief command of the army; and it was determined in a council of war to make another effort in the Puertos Intermedios. Whilst they were employed in this enterprise, General Sucre arrived at Lima with 3000 Colombian troops; but this force, with 2000 Peruvians, partly militia and partly the wreck of a former army, was found insufficient for the protection of the capital, against which Canterac advanced at the head of 9000 well-disciplined men. Lima was accordingly abandoned by the patriots, and immediately taken possession of by the royalists, who, however, soon afterwards evacuated it, after having exacted heavy contributions from the remaining inhabitants, and destroyed the mint. Both Generals Santa Cruz and Sucre, who with a united army might have accomplished something of moment, proved unsuccessful; and the former allowed himself to be out-generalled by Canterac. The cause of independence in Peru seemed hanging by a thread, which it required little exertion to break, when the celebrated Bolivar made his appearance in Lima on the 1st of September 1823. He was received with the greatest enthusiasm, and was immediately invested with supreme authority, military and political. Great activity was now infused into the measures of government; and acting in the capacity of dictator, Bolivar dissolved Congress, and levied an army, with which he sallied from the capital on the second week of November. Riva Aguero refused to join him, and was imprisoned by his own troops, who immediately submitted to the dictator. But a fresh misfortune awaited the patriots in the mutiny of the soldiers at Callao. The consequence was, that this town, along with the city of Lima, once more fell into the hands of the royalists. The cause of independence in Peru now seemed desperate; but the conduct of Bolivar at this critical moment is deserving of the highest praise. By his firmness, activity, and seasonable severities, he checked further defections, and obtained the respect and entire confidence of every true patriot.

In the month of July 1824 the liberating army commenced its march towards Pasco in three divisions, two of which were Colombians, headed by Generals Lara and Cordova; and one was Peruvian, under Lamar. General Sucre was chief of the staff of the whole army. In his preparatory measures for facilitating the passage of the troops on a march of 200 leagues, through the most mountainous region in the world, this officer displayed great skill; and the army reached the old Pasco district in safety, and unmolested by the royalists. Various manœuvres now took place; and in an action of cavalry at Junin the patriots inflicted a severe blow on their adversaries. A series of marches and countermarches occupied the months of August, September, October, and November; and on the 6th of December the patriots reached the village of Quinua; whilst the royalists, by entering Guamangilla, cut off their retreat, and placed them in an extremely critical situation. On the 8th, the viceroy Lascerna moved from this position, and occupied with his whole force the heights of Condorkanki, within gun-shot of the encampment of the patriots. Between the opposing armies lay the plain of Ayacucho. It is in shape nearly square, about a league in circumference, and flanked right and left by deep and rugged ravines. The eastern boundary is formed by the abrupt and savage ridge of Condorkanki, whilst the western extremity is the Indian village Quinua, a little distance in front of which lay the patriot army, not 6000 strong, that of the royalists being fully one-third more numerous. Next morning, the 9th of December 1824, the conflict took place, and continued for about an hour, when the royalists were defeated with great loss. Indeed their army may be said to have been almost annihilated; for 3200 rank and file, amongst whom was the viceroy, were made prisoners of war, the remainder dispersing in a state of total disorganization in all directions. The battle of Ayacucho is pronounced by Mr Miller "the most brilliant ever fought in South America;" and it may be considered as the last regular engagement, although not the last struggle, in which Spain was engaged for the recovery of her revolted colonies. Rodil still held out at Callao for the mother country with the most desperate tenacity. For thirteen months he sustained, unaided, bombardments both by sea and land, rendered still more terrible by the accumulated miseries of pestilence and famine. At length he capitulated upon honourable terms on the 19th of January 1826; and thus the last link of the chain which had bound America to the Spanish crown was finally broken.

Bolivar continued dictator till the month of July 1825, when he resigned, and placed at the head of affairs a council of government composed of his own ministers. Towards the end of 1826 he promulgated a new constitution, according to which the executive was to be vested in an irresponsible president elected for life. This new constitution excited great discontent among the people; but it was accepted by the electoral colleges, and Bolivar was named president. The people were further incensed by the presence of the Colombian troops; and soon after, Bolivar being called away to quell an insurrection in Colombia, an open revolt broke out in Peru. The Colombian troops were expelled from the country, a Congress was assembled at Lima, and the Bolivian constitution abolished. On the 18th of June 1827 a new constitution was promulgated, and General Lamar named president. An increased dissatisfaction between Colombia and Peru at length led to a declaration of war between the two states; and Lamar entered the Colombian territory at the head of a considerable army. A battle took place on Tarqui, near Jiron in Quito, on the 27th of February 1829, in which the Peruvians were defeated, and the next day preliminaries of peace were agreed to. The imbecility manifested by Lamar on this occasion gave rise to a conspiracy against him, and he was deposed in the month of June by General Gamarra, who convoked a Congress, and caused himself to be nominated president. He retained office for the four years designated by the constitution; and at the end of this term a convention was convoked to reform the constitution. The reformed constitution was promulgated in the month of August 1834, and General Orbegoso was named president. In January 1835 General Salaverry, who commanded the garrison at Callao, instigated the troops to declare against the government at Lima, and took possession of that city, declaring himself supreme chief of the republic. The president Orbegoso, who was at this time in the southern provinces, finding himself unable to cope with Salaverry, applied for aid to Santa Cruz, president of the Bolivian republic. That general accordingly entered Peru with an army, and joining forces with Orbegoso, the combined army came up with the enemy at Cuzco. Salaverry had committed the command of his army to Gamarra, remaining himself at Lima. The battle took place at Yauacocha on the 13th of August, when Gamarra was totally defeated, the greater part of his troops having gone over in a body to the enemy. Salaverry lost no time in preparing to meet the enemy; and having collected a body of about 2500 men, posted him-

Peru.

self on the heights of Challapampo, to the north of Arequipa. Towards the end of January 1836, the united forces of Orbegoso and Santa Cruz, amounting to double the number of those of Salaverry, advanced to attack him; but he had fortified himself in such a manner that they were obliged to have recourse to stratagem. This was the adoption of a retrograde movement, which led the enemy to believe that they were in full retreat, and drew them from their strong position. Santa Cruz, seizing the favourable moment, fell upon them with great vigour. The contest was obstinate; but the issue was not long doubtful. Salaverry was completely defeated, and himself and most of his army taken prisoners. Salaverry, with seven other officers, were tried by a court-martial, condemned to death, and shot on the 18th of February. Lima, Callao, and the rest of Peru immediately submitted to the conquerors. Santa Cruz having succeeded in establishing tranquillity, now assumed the supreme power; and, dividing the country into North and South Peru, he conjoined it with Bolivia, nominating himself supreme protector of the three states. This arrangement met with a powerful opposition both in Peru and Bolivia, and also brought him into collision with the republic of Chile. At length, in January 1839, a bloody battle was fought at Yungay, in which Santa Cruz was defeated, and driven out of the country. The confederation was thus brought to a close, and the two countries, Peru and Bolivia, returned to their former limits and forms of government. In Peru a Congress was convoked, which, in November 1839, gave out a new constitution, and nominated General Gamarra, who had commanded the Chile-Peruvian troops, president of the republic. General Gamarra died in November 1841, and Señor Menendez, president of the council of state, entered into power, but was deposed in the month of August 1842 by General Torico. A civil war followed, and the government passed successively into the hands of General Vidal, Señor Figuerola, and General Vivanco. In 1844 the civil war was brought to an end by General Castilla, and Menendez replaced in power. A Congress was called in accordance with the provisions of the constitution, and General Don Ramon Castilla was elected president, and entered upon office on the 1st of April 1845. Castilla completed his six constitutional years of office, and under his rule the country enjoyed great peace and prosperity. His successor, General Echenique, assumed the supreme power on 1st April 1851, but the people soon became dissatisfied with him. His government was accused of committing the grossest frauds against the national credit by issuing *vales de consolidacion* on fictitious grounds; and hence the financial reputation of Peru fell into the lowest state of discredit. At length the people rose against the government, and, headed by Castilla, gained a decisive victory at the Palma, close to Lima, in the early part of 1855, and Echenique was driven from power. After the expulsion of Echenique, Vivanco stirred up an insurrection against Castilla, and having gained over the commanders of three of the government steamers, he was able to convey his troops rapidly from place to place, and thus maintained the struggle for some time. At Callao he suffered a severe repulse, and afterwards he congregated his forces in the town of Arequipa, a place which had always remained attached to him. His steamers prevented all approach by sea; and at one time they held possession of the Chincha Islands, with their guano treasures. Fortunately the war was at length brought to a close in March last (1858), by the taking, by assault, of Arequipa, after a most obstinate and heroic defence by Vivanco and his adherents, the number of killed and wounded amounting to about 3000. The confidence in Castilla's government is evinced in the fact; that the *vales de consolidacion* have risen in Peru from 43 to 80 per cent. Though slavery had been abolished by the charter of independence, yet it still continued to be carried on till prohibited by the present governor in 1855. He has also freed the Indians from the unjust capital tax to which they had been subject since the time of the Spaniards. Among the other changes that have been introduced is a law by which illegitimate children are entitled to one-fifth part of the moveable property of their parent. The punishment of death for political offences has also been abolished.

Name.

The name *Peru* was not known to the early inhabitants, but was given to the country by the Spaniards; and is said to be a corruption of the word *Pelu*, the Indian name for "river," and mistaken by the Spaniards for the name of the country. The name given to it by the natives was *Tavantinsuyu*, or "four quarters of the world."

Physical character.

The most distinguishing natural feature of Peru, and that from which the country derives its peculiar aspect and character, is the vast chain of the Andes, which traverses it in a direction from S.S.E. to N.N.W. The country is thus naturally divided into three distinct regions, differing widely from each other in their physical characteristics, and familiarly known as *La Costa*, or the region between the sea and the Andes; *La Sierra*, or the mountain region; and *La Montaña*, or the wooded region to the E. of the Andes, forming part of the basin of the Amazon.

Coast.

La Costa, or the coast region, extends the entire length of the country, but its average breadth is not more than 30 miles. In some places it does not exceed 10, but in others it is more than 58 miles in width. With all its extent of coast, Peru has few good harbours, probably not more than a dozen in all. The best are those of Payta, Salinas, Callao, Pisco, Islay, Arica, and Iquique. The water on the coast being almost uniformly deep, vessels are obliged to approach within a quarter of a mile of the shore before they can anchor; and as the great swell of the Pacific occasions a heavy and dangerous surf, landing with boats is both difficult and hazardous. The operation, however, is effected with ease and safety by means of *balsas* or rafts, constructed usually of cane, and supported by means of inflated seal-skins. The coast region is almost one continuous sandy waste, where no rain falls, and where neither plant nor animal can obtain subsistence. Vegetation is only to be met with along the banks of the streams that come down from the high lands. Many of these are dry for the greater part of the year, and only a few of them are perennial. Some of the larger streams reach the sea, but the smaller ones are absorbed by the encompassing desert, or exhausted in irrigating the cultivated patches. The insulated river valleys are thus the only habitable parts of the coast, and they are from 20 to 90 miles apart. The rest of the region is covered with a fine light-yellow drift-sand. It presents, however, great inequalities of surface, being frequently intersected by sand-hillocks called *medanos*, which are sometimes of considerable size. Some of these are permanent, but others are driven about with great velocity by the wind, which, when violent, frequently raises columns of sand to the height of 80 or 100 feet. The rainless region extends to the height of about 7000 feet above the level of the sea; but to the height of about 2000 feet above the sea the coast region is periodically refreshed by sea vapours or drizzle, called *garua*. These vapours prevail from May to November, and are most dense and abundant towards the end of June, when the *lomas* or hillocks bordering the sand-flats become covered with a luxuriant vegetation. At Lima this coast vegetation is most abundant in the months of July, August, and September. The heat of this region is not so excessive as might be supposed; and during summer the thermometer rarely rises above 85°:—the mean annual temperature is 72°, the maximum 82°, and the minimum 55°. In this district are produced most of the plants of tropical countries. The plantain, banana, pine-apple, sugar-cane, vine, cocoa, olive, coffee, and cotton, as well as

Peru.

the most delicious fruits, some peculiar to the country, arrive at great perfection. Maize, rice, wheat, barley, and potatoes are also cultivated. (See two papers, by Dr Archibald Smith, on the Climate of Peru, in the *Edin. New Phil. Jour.* for October 1857 and January 1858.)

Sierra.

The district called *Sierra*, or highlands of Peru, commences immediately above the rainless district, at 7000 feet above the level of the sea, and extends to the eastern chain of the Andes. The Andes here consist of two main chains or cordilleras, running nearly parallel to each other, and connected in various parts by cross ridges; but they do not in general rise to such a height as in Bolivia. The eastern cordillera from Bolivia preserves its grand character northward to 13. S. Lat., being composed of a series of snowy peaks, which terminate in the Nevada de Sacantahi; but N. of this no snow-capped mountains occur. In the western chain, near 15., a considerable portion of the range is covered with snow; S.E. of Lima the Toldo de Nieve rises above the snow-line; and between 11. and 11. 30. is the elevated summit of La Vinda, nearly 16,000 feet in height, and the nevadas of Pelagotas, Mayapota, and Huayhillas. Between the last mentioned and Chimborazo in Ecuador none of the summits of this chain attain the snow-line. The chains of the E. and W. cordilleras are usually about 100 miles apart. South of 11. S. Lat., the country between the two chains consists properly of two inclined planes sloping down from the Andes of Vilcanota and the table-land of Pasco, and separated from each other by the water-line of the Mataro, a feeder of the Apurimac, near 12. S. The southern plane lies at a great elevation, the town of Cuzco being 11,380 feet above the level of the sea; but even here wheat and Indian corn are raised, and farther N., where the country is considerably lower, the sugar-cane is cultivated. The surface is by no means level, being traversed by various ridges of hills, which rise several hundred feet above their bases. The northern plane has a very similar surface; and contiguous to the western cordillera it forms an undulating valley 40 miles wide, which is drained by the Jauja, and which, on account of its fertility, is one of the best peopled districts of Peru. In the lower part of this valley the sugar-cane succeeds well; while the higher produces cereals and fruits in abundance. To the N. is the table-land of Pasco, which lies between 11. and 10. 30. S., and, with the exception of a few miners' huts in the regions of permanent snow, is the highest inhabited part of the Andes. Were it not for the rich mines which it possesses, it would have remained a sheep-walk. Its surface presents several low but steep ranges of hills, with level grounds between them. These level tracts are from 13,000 to 14,000 feet above the sea, or about 1500 feet below the snow-line in this latitude. The climate is exceedingly cold all the year round, and unfavourable to any kind of cultivation. In the numerous and deep lakes which cover a considerable part of its surface, the rivers Marañon, Huallaga, and Ucayale take their rise. The northern portion of the Peruvian Andes consists of three cordilleras, of which the western contains the nevadas already mentioned. The central chain is connected with the table-land of Pasco, and runs parallel with the western chain to about 7°, their summits being about 50 miles apart; but northward of this parallel the chain runs N.E. to its termination on the banks of the Amazon. In the northern portion of this central chain a few summits occur which rise above the snow-line. The eastern cordillera is connected with the mountain system of the eastern border of the table-land of Pasco, and runs in a direction parallel with the central chain, terminating near 6° S., opposite an offset of the central range, which here comes close up to the Huallaga. The highest summits of this range are towards the S., but probably none of them much exceed 15,000 feet in height. Toward the N. they sink down to mere hills. Of the two valleys inclosed by these three ranges, the western, or that of the Marañon, is very narrow in its southern parts, and here the river is one continuous series of rapids and falls until it reaches 8°, where it enters a wider valley, which spreads out to 20 miles in width. This wider valley gradually subsides from 3000 to 2000 feet above the level of the sea. Its climate is consequently very hot, and its fertile soil is capable of producing all the intertropical plants and fruits. The eastern valley is drained by the Huallaga. It slopes very rapidly, from 5000 in 10° to 2000 in 9°, and in its fertility, climate, and produce resembles the valley of the Marañon. Dr Smith, in speaking of the climates of the Sierra, says,—"On ascending above the rain-line, a sparse vegetation at first appears, which gradually improves at every step, until the valleys of the Sierra open out into wide pasture-lands up to the snow-line, with many villages and farms all over the ridges and hollows of the mountains. When the western cordillera is crossed, the descent leads into a wide and open district of treeless undulating surface covered with flocks and herds of sheep, llamas, vecuñas, horses, mules, and horned cattle, &c. But from these lofty and inclement grounds valleys of different depth and temperature dip off in all directions, making the Sierra as a whole a region of the most varied climate and production. As a central point of Andine climate, we may take Cerro Pasco as an example. * * * * The wet season is from November to May (just the contrary to what it is on the coast); but December, January, February, and March are the more disagreeable months, the streets being then all wet and slushy. The weather varies extremely, not merely in the course of the same day, but within a very few hours, during which there may be rapid variations of snow, rain, hail, and sleet, gleams of sunshine, high and fluctuating gusts of wind, sudden obscuration from dense clouds drifting in the atmospheric currents, with flashes of lightning, and peals of thunder rolling among the mountain-peaks. For the other six months of the dry season, showers of hail, snow, or rain are only occasional and rare, the prevailing weather being sunny and cheerful by day, and dry and frosty by night. The thermometer of Fahrenheit I found to be about 42° by day, and 36° by night, in the wet season; but in the dry season the night indications fell to 30°, or under." (*Edin. New. Phil. Jour.*, vol. vii., pp. 50–1.)

Presenting as it does almost every variety of climate, the vegetation of this region is extremely varied in its character, from the gigantic growth of the tropics to the dwarf plants of Lapland. In this mountainous district are situated the famous gold and silver mines of Peru. It likewise contains the sources of those vast rivers which traverse the continent of South America. Here the Marañon commences its course, and here rise its magnificent tributaries, the Ucayale, Huallaga, and others, which themselves are swelled by an innumerable multitude of streams descending from the eastern ridges of the Andes,—all being finally absorbed in the mighty Amazon.

Montaña.

But by far the most beautiful and valuable part of the Peruvian territory is the *Montaña*, or wooded region, which lies to the E. of the Andes., commencing on the eastern declivity of the second chain, and stretching to the confines of Brazil and Bolivia. After crossing the Andes, and descending a few hundred feet lower in the direction of the E., the traveller beholds a country totally different from that which he has left—a country richly covered with a luxuriant vegetation. So far as we are acquainted with this region, and as yet it is only imperfectly known, it seems to rival in fertility, and in the luxuriance and variety of its vegetation, even the finest parts of Brazil. "Here," says Dr Poeppig, "are plains traversed by lower hills covered with an ocean of foliage, vieing in beauty with the climate of Chile, and far surpassing it in the abundance and

Peru.

luxuriance of its productions." Dr Lorente, as cited by Dr Smith in speaking of the district of Chanchamayo, says:—"Here everything is on Nature's great scale. The whole country is one continuous forest, which, beginning at different heights, presents an undulating aspect. One moves on his way with trees before, above, and beneath him, in a deep abyss like the ocean. And in these woods, as on the immensity of the waters, the mind is bewildered; whatever way it directs the eye, there it meets the majesty of the Infinite. The marvels of nature are in these regions so common, that one becomes accustomed to behold without emotion trees whose tops exceed the height of 100 varas (290 English feet), with a proportionate thickness, beyond the belief of such as never saw them; and, supporting on their trunks a hundred different plants, they individually present rather the appearance of a small plantation than one great tree. It is only after you leave the woods, and ordinary objects of comparison present themselves to the mind, that you can realize in thought the colossal stature of these samples of Montaña vegetation." The entire region is watered by the Huallaga, Ucayale, and Marañon, with numerous subsidiary streams. The vast plains in which the declivities of the Andes terminate are called sometimes Pampas del Sacramento, or, more usually, *Collona*, or the "Land of the Missions." This name they owe to the Jesuits, whose zeal for the conversion of the natives induced them to penetrate these trackless solitudes. They planted a number of settlements, and by collecting in villages the rude inhabitants, attempted to civilize them not only by instilling into their minds the doctrines of religion, but by teaching them such arts as their uncultivated natural talents enabled them to acquire. Some of these missions still exist. Numerous tribes of wild Indians are scattered over the country, differing from each other in character and language. Some of them are mild and docile, while others are warlike and savage, and continually in a state of hostility to each other. The heat here is not so oppressive as might be expected, being allayed by refreshing breezes that generally prevail. At Sarayacu the maximum temperature is about 85°, the minimum 74°. The rainy season prevails from November to May, during which it often rains for a week without intermission. The dry season is very agreeable, and though, where cleared of wood, the surface becomes parched, the moisture is always preserved a little below; so that there is no need of irrigation. The vegetable productions of the Montaña are numerous. Besides valuable woods, as cedar, ebony, mahogany, walnut, &c., there are pine-apples, almonds, lemons, oranges, citrons, and other fruits; and cacao, cinnamon, guaiacum, cinchona, sarsaparilla, vanilla, black wax, storax, dragon's blood, oil of Maria, gum-caraña, balsam of copaiba, copal, and many other gums, balsams, resins, and oils. Maize is everywhere cultivated, and rice is grown on the marshy banks of the rivers. Tobacco, cotton, indigo, and the sugar-cane are not among the least important of its products.

Rivers.

The rivers of Peru that fall into the Pacific are all short in their courses, shallow, and generally rapid. They are consequently useless for navigation, and serve only to irrigate the adjacent lands. The great rivers of Peru are the Marañon, Huallaga, and Ucayale, which drain the whole country E. of the W. cordillera, and constitute the principal branches of the River Amazon. They are for the most part navigable, and will doubtless at some future period serve, by means of steam navigation, to convey the wealth of this vast region to the ports on the Atlantic. Mr Markham, who in 1853 explored a portion of the Purus, an affluent of the Amazon which separates Peru from Bolivia, says,—"If once the Madre de Dios or Purus was thoroughly explored, the effects it would have on the industry and future prospects of Peru are incalculable. The people of the interior of that beautiful country, the ancient empire of the Incas, would at length succeed in turning the granite barrier of the Andes; a port might be established near Paucar-tambo, and another at the mouth of the Purus; an inland navigation would waft the varied productions of the interior of Peru—its bark, sarsaparilla, copaiba, and india-rubber; its sugar, cocoa, cotton, and tobacco; its alpaca wool, silver, and precious stones,—by a direct and easy route to the Old World; and the dangerous journeys across the cordilleras, and long and tedious voyages round Cape Horn, would be avoided." (*Geog. Soc. Jour*, 1855.)

Lakes.

The lakes of Peru, with the exception of Titicaca, are of small size. Lauricocha is interesting as the source of the Marañon; the Chinchacocha gives rise to the river Jauja; and the small lake of Urcos, to the south of Cuzco, is celebrated from the tradition that a chain of gold made to celebrate the birth of Huasca Inca was thrown into it. Titicaca is about 100 geographical miles in length from N.W. to S.E., and about 40 in greatest width. It is situated on a table-land surrounded by mountains, and is about 13,000 feet above the level of the sea. It contains several islands, the largest of which is about 20 miles in circumference.

Geology.

The geological character of this country has as yet been but very imperfectly investigated. Red sandstone is frequent on the coast, and also in the interior. Granite and porphyry occur on the coast; but the prevailing rocks on the sierras are trachite, augite, and diorite; though granite and porphyry are also common. In a journey from Lima to the summit of the western cordillera, along the course of the Rimac, Dr Smith noted in succession the following rocks:—Coarse-grained granite, syenitic granite, syenite, felspar porphyry, trachite porphyry, and porphyry. At this stage of the series a band of syenitic greenstone or porphyry, with actinolite, crops out across the road above Matucana (at the elevation of about 8000 feet). From this point to San Mateo, through a deep and narrow gorge of about 4 leagues in extent, the rocks, in ascending succession, are, prophyritic greenstone, trap, porphyry, and quartz; on opposite sides of the ravine, trap and limestone. About San Mateo (estimated at nearly 11,000 feet above the sea) he found greenstone; and in the steep ascent above this village, schist, porphyritic greenstone, and porphyry. From Chicla, a few leagues above San Mateo, to the foot of the cordillera, the prevailing rock is conglomerate, and the surrounding soil of a reddish colour. On approaching the cordillera pass by Tucto, the mule path leads over the iron-gray debris of the porphyritic Andine peaks which adjoin the silver mines of Alpamina, in a matrix of limestone above the line of perpetual snow. (See *Peru as it Is*, vol. i., ch. xi.) The sides of the valleys between Titicaca and Cuzco are formed chiefly of clay-slate. Round Arequipa, and thence to Titicaca, the soil is all volcanic; but there is no active crater in the district, though the cone of Arequipa still emits smoke. Earthquakes are frequent, and occasionally very destructive, on the coast.

Minerals.

Peru has long been famous for its wealth in the precious metals, especially gold and silver. The latter is the more common, and is widely distributed over the country. The principal mining regions are those of Hualgayoc, near Micuipampa; Gualanca in Huamalies; Pasco; Lucanas; and Huantajaya; but small mines of it are worked secretly all over the country. The treasures contained in the Cerro de Fernando, at Hualgayoc, were first discovered in 1771; and there are now about 1400 pits opened in the hill. Cerro de Pasco is hardly inferior in mineral wealth to Potosi; and the hill on which the town stands is completely undermined, most of the openings to which are within the houses of the miners in the town itself. The richest gold mines or diggings are about Huaylas and Tarma. Most of the rivers from the Andes bring down auriferous sand. Quicksilver is likewise found, but in such small quantities as not to

repay the labour of the miners. The only quicksilver vein of any magnitude is at Huancavelica. Both mountain chains are very rich in copper ore, but it is only worked on the western cordillera, as the distance of the other from the coast renders the transport too expensive. The lead and iron mines, though prolific, are not worked, the price of these metals being too small to repay the expense of working. Coal has been discovered in the Cerro de Pasco, and brown coal is found in the sandy deserts N. of Arica. In the province of Tarapaca is a forest of prostrate trees buried beneath the sand, which affords excellent fuel, and is much used in the preparation of nitre. It is neither charred nor petrified, and burns with a flame as bright as that of common wood. In the S., and chiefly in the maritime province of Tarapaca, are extensive deposits of salt, nitre, and nitrate of soda. The Pampa, or great plain of Tamarugal, which extends the whole length of the province, running N. into the province of Arica, and S. into the desert of Atacama, and about 30 miles wide, abounds with salt, nitrate of soda, and other saline bodies. The principal deposits of nitrate of soda are found on the western side of the Pampa, at some distance from the coast, in approaching which it seems as if it gradually transferred itself into salt. The beds are insulated deposits, varying much in size and shape—in thickness from 6 inches to as many feet, and in depth, beneath the surface crust of earth and clay, from one inch to many feet. Among the other salts found in the vicinity may be enumerated carbonate and sulphate of soda, biborates of lime and soda, magnesian alum, and chlorate of sodium. Traces of iodine exist in the nitrate, and in most of the waters in the plain traces of boracic acid have been discovered. The existence of nitrate of soda in Tarapaca has been known in Europe for about a century, but it is only recently that its value has been found out. In 1820 some of it was sent to England, but the duty being so high, it was thrown overboard. In 1830 a cargo was sent to the United States, but was found unsaleable; and a portion of it sent to Liverpool met with no better success. In 1831 another cargo was sent to England, and by this time it had become better known, and sold as high as 30s. to 40s. the cwt. From 1830 to 1850 the exports of this mineral from Iquique, the principal port of the province, amounted to 239,860 tons. Vast deposits of salt occur not only on the coast, but even on the Sierra. To the E. of the volcano of Isluga commences an extensive salt plain, said to extend to Challaputo and the insulated Cordillera del Frayle, 40 leagues distant, and near to Potosi, varying in breadth from 3 to 8 leagues, the salt being from 5 to 10 inches thick. The elevation of this plain is at least 14,000 feet.

Vegetable productions, &c.

The more important of the vegetable productions have already been noticed. Among those which at present constitute articles of use and commerce are,—coffee, sugar, wheat, barley, maize, rice, potatoes, copaiba, sarsaparilla, Peruvian bark (*cinchona*), cotton, cocoa, indigo, tobacco, caoutchouc. In describing the qualities of some of these, and the quantities in which they are produced, Thadeus Haenke observes:—"The cocoa of Apolobamba, of Moxos, of Yuracarees, and of all the woods which extend from thence to the shores of the Marañon, is infinitely superior to that of Guayaquil. The finest quality of cascarilla is only found on the eastern side of the Andes; of the indigo there is no end; I can say the same of the cotton and the rice. The precious balsam of copaiba, the sarsaparilla, the gum-elastic, and the most fragrant species of vanilla, are all produced in an extraordinary abundance in these regions. The mighty forests which line the shores of the rivers abound in the finest timber for all uses, especially for ship-building, and in trees distilling the most aromatic and medicinal gums. Among others, there is a species of cinnamon, called by the natives *canela de clavo*, which only differs in the greater thickness of the bark and its darker colour, according to its age, from that found in the East Indies, and which is as fragrant as the spice from which it takes its name (clove)." (*Geog. Soc. Jour.*, vol. v., 1835.) The grapes are so abundant in some parts that large quantities of wine might be made for exportation; but no more is produced than is needed, and a little is even imported. Strong liquors, such as brandy and rum, are distilled; and oil is made from the olive. The various kinds of capsicums are cultivated with more attention and skill than almost any other plants; and when dressed in various ways with garlic, form an important article of food to the greater portion of the inhabitants. Paraguay tea has now ceased to be a common beverage. A liquor in universal use is the *chicha*, which, from having been found in the tombs of the aborigines, is proved to have been used by them prior to the conquest. The chicha of the present day is of the consistence of milk, of a yellowish colour, and when poured from one vessel into another, froths like beer. Its taste is generally acid; but when very fresh, the acidity is scarcely perceptible. It is made by steeping Indian corn in water till it swells, after which it is dried and ground. The flour and bran are boiled in water, strained, and left to ferment for four-and-twenty hours, when it is fit for use. There is a fruit called *chouta*, from which the Indians prepare an intoxicating liquor; but the great nervous stimulant used by them is the *coca*, which is very extensively cultivated, and has become an indispensable necessary of life. The coca plant (*Erythroxylon coca*) is from 6 to 8 feet in length, and somewhat resembles a black thorn in its numerous small white blossoms and the lively bright green colour of its leaves. The latter are gathered and carefully dried, and then finely packed in woollen sacks and covered with sand. The coca-leaf is to the Indian of the interior a necessary of life. Each individual carries a leathern pouch containing a supply of coca-leaves, and a small flask gourd filled with pulverized unslaked lime. Three or four times a day, or oftener, he suspends his labour to *chaccha* or masticate his coca, to which a slight admixture of the powdered lime gives a relish, and is said to counteract the natural tendency of the coca to give rise to visceral obstructions. Deleterious and dire results are commonly attributed to the use of this narcotic; and Dr Poeppig, in his *Travels in Chili and Peru*, &c., draws a melancholy picture of the dreadful effects of this insinuating drug, and of the diseases to which it gives rise. It is asserted, however, by those best able to judge, that these effects are vastly overrated; and some even maintain that, when used in moderation, it may be even conducive to health. Among the latter is Dr J. Von Tschudi, who refers to the numerous instances of longevity among the Indians, who almost, from the age of boyhood, have been in the habit of masticating coca three times a day, and who nevertheless have enjoyed perfect health. (*Travels in Peru*, 1847.) Dr Archibald Smith, a physician of long experience in the country, says that, "Used in moderate quantity, the coca, when fresh and good, increases nervous energy, removes drowsiness, enlivens the spirits, and enables the Indian to bear cold, wet, great bodily exertion, and even want of food, to a surprising degree, with apparent ease and impunity. Taken to excess, it is said to occasion tremor in the limbs, and what is worse, a gloomy sort of mania. But such dire effects must be of rare occurrence; since, living for years on the borders of the Montaña, and in constant intercourse with persons accustomed to frequent the coca plantations, and with Indian yanacones or labourers, all of whom, whether old or young, masticated this favourite leaf, we never had an opportunity of witnessing a single instance in which the coca-chewer was affected with mania or tremor." (*Peru as it Is*, London, 1839.)

Among the wild animals of Peru are the puma, jaguar,

Peru.

Animals.

bear, deer, wild boar, fox, skunk, armadillo, sloth, and several species of monkey. Alligators are met with in the rivers, and seals are common on the coast. Tortoises frequent in great numbers the inlets of the coast. Several species of serpents are found, but they are rather rare. A viper of a very poisonous nature inhabits the sugar-cane fields, and its bite is almost instantaneously mortal. On the shores of Peru are myriads of sea-birds, to whom we are indebted for that valuable manure, guano. Of land birds, falcons, hawks, owls, pigeons, &c., abound. There are four varieties of condor, and the common carrion-vulture frequents the cities and towns. Most valuable among the animals indigenous to the country are the Peruvian sheep, of which there are four varieties—the llama, alpaca, guanaco, and vicuña. The first of these is the least valuable on account of its wool, and was chiefly employed by the ancient inhabitants as a beast of burden. Its wool is long and rough, and is used only in the manufacture of coarse cloths. Though the introduction of horses, asses, and mules into the country since the conquest has rendered the llama less necessary as a beast of burden, it is still much used for that purpose. They usually travel in large flocks at the rate of three or four leagues a day, and each carrying about a hundredweight. The alpaca or paco is smaller than the llama, and yields a very fine, long, soft wool, which is now largely imported into England and other countries. They are kept in large flocks on the heights. The guanaco is the largest of the four varieties, and very much resembles the llama in form. They usually roam in a wild state in groups of four or five on the upper declivities of the western cordillera. The wool is shorter and coarser than that of the llama. The vicuña is in size between the llama and the alpaca, and is a more beautiful animal than any of the other varieties. They inhabit the cold heights of the cordillera, and are always in herds of from six to fifteen females, and one male, who is the leader and protector of the rest. The vicuña is distinguished by the superior fineness of its short curly wool. After the conquest the Spaniards introduced their own breed of sheep into the country; and it is now very common. There are flocks of 80,000 or 100,000 sheep on the inter-cordillera plains of Bonbon and neighbourhood. Horses, asses, and black cattle were also introduced by the Spaniards; and in the valleys and on the coast they are well developed, but on the heights they are small and stunted in their growth.

Manufactures.

The manufactures of Peru are inconsiderable, the great body of the people being employed in agriculture and the mines. Labour of every kind is in the hands of the Indians; and though they manifest considerable ingenuity in some of the mechanical arts, from the want of sufficient instruction or of proper masters, their productions will not bear comparison with those of Europeans. They manufacture a variety of cotton and coarse woollen fabrics, which are consumed in the country. Straw hats of a variety of colours, petates or mats, and sigarreros, also form part of their manufactures. Goat skins are made into good cordovan; and cow-hides are made into saddle-bags, and almofrezes, or travelling-cases for bed and bedding. Tanning, dyeing, soap-making, distilling, and some other manufactures are carried on. Very fine gold and silver filigree work is also executed. Peru, however, looks to Europe for a great part of the necessaries as well as of the luxuries of life.

Trade.

The principal exports of Peru are the precious metals, guano, nitrate of soda, wool, cotton, hides, and Peruvian bark. Guano, which till recently had no place among its exports, is now the most important of its productions. It is found on some parts of the coast, but principally on certain small islands, especially those opposite to Pisco. On the islands of Chincha alone it was estimated that in 1854 there were 12,376,100 tons. In 1854 no less than 344,400 tons of guano were exported, of which more than one-half went to England, and the remainder to the United States, France, Spain, Germany, &c. The imports consist of woollen, cotton, and linen stuffs; machinery, cutlery, earthenware, &c. The trade of Peru with the various countries was as follows in 1853:—

Countries.	Imports.	Exports.
Britain	L.923,258	L.1,763,751
China	57,899	.
Chile	130,800	99,487
Spain	32,473	45,799
Ecuador	39,365	..
United States	117,205	979,676
France	376,756	288,321
Hamburg	97,265	42,963
Antilles	.	52,848
Other countries	42,555	103,216
Total	L.1,817,576	L.3,376,061

It will be seen from this table that Great Britain is the country that carries on the greatest trade with Peru. It imports almost double, and exports nearly three times as much, as any other country. The declared or computed value of British imports from Peru, and of exports thereto in 1856, was as follows:—

Imports.		*Exports.*	
Guano	L.2,053,386	Cotton goods	L.450,376
Alpaca and llama wool	386,798	Woollen	258,998
Sheep wool	111,304	Hardwares and cutlery	56,110
Nitre	220,762	Iron & steel, unwrought	37,273
Copper and copper ore	86,165	Linen goods	41,323
Tin and tin ore	58,399	Silk manufactures	20,692
Peruvian bark	59,099	Apparel	25,499
Cotton, raw	24,542	Earthenware	20,042
Chinchilla skins	5,174	Machinery	7,458
Untanned hides	1,495	Coals	11,778
Cochineal	3,968	Wine	6,879
Borax	2,877	Glass	7,396
Other articles	34,725	Other articles	128,340
Total	L.3,048,694	Total	L.128,340

The internal trade of Peru is not great, owing to the nature of the country and the want of good roads. Except on the table-lands, indeed, there are few roads of any sort. Mules are generally used for the conveyance of travellers and goods; though in the more elevated parts llamas are largely employed for the latter purpose. A railroad extends from the port of Arica to Tacna, and another from Callao to Lima.

The government of Peru is by its constitution pronounced to be a popular representative government; and in theory at least the sovereignty emanates from the people, who are supposed to delegate its exercise to the legislative, executive, and judicial powers of the republic, each of which is independent of the others. The chief executive power is vested in the president, who is elected for six years through the electoral colleges. He has four ministers for the despatch of public business,—one for foreign affairs, one for finance, one for justice and religion, and one for war and marine. The legislative power is vested in a Congress, composed of a Senate and Chamber of Deputies. The Chamber of Deputies consists of representatives chosen by the electoral colleges of the several provinces, in the proportion of 1 for every 20,000 inhabitants, or for any fractional number above 10,000. But any province having an entire population of less than 10,000 is nevertheless entitled to elect a deputy. The Senate is composed of two members for each of the departments. The electoral colleges of the provinces are composed of parochial electors, 1 for every 200 inhabitants in each parish. Each department is politically governed by a prefect, under immediate subordination to the president of the republic; each province by a sub-prefect, subordinate to the prefect; and each district by a governor, subordinate to the sub-pre-

fect. In the capital of each department there is a *junta* composed of two members from each province, elected in the same way as the members of the Chamber of Deputies. Justice is administered by the Supreme Court at Lima, and the superior courts of Lima, Cuzco, Arequipa, Truxillo, Ayacucho, and Puno. In the provinces are courts of primary instance; and in the districts, justices' courts. Besides these, there are special commercial, mining, military, and other courts. The judges are appointed by the president, but are not removeable without sufficient cause. Capital punishment for political offences has been abolished. The land forces of the government consist of about 10,000 men of all arms; and the naval forces, of a frigate, two corvettes, and two galliots. The total national debt amounted, in 1853, to L.9,954,000 sterling. The budget for 1855 estimates the revenue at L.1,874,000 (of which L.1,243,750 is derived from the sales of guano), and the expenditure at L.2,177,643. According to the constitution, the religion of the republic is Roman Catholic and apostolic, and the exercise of none other is permitted. Practically, however, Protestant worship is allowed in private, and an English clergyman regularly officiates at the British consulate. Ecclesiastically, the country is divided into an archdiocese, and the bishoprics of Cuzco, Arequipa, Truxillo, Guamanga, and Chachapoyas. There are 1800 priests or clergymen, 720 friars, and 1200 nuns. The tithes produce annually L.50,000, and the first-fruits L.120,000. There are 26 hospitals in Peru—21 for males, with 1226 beds; and 5 for females, with 497 beds; average annual cost, about L.50,000. Except in larger towns, education is at a very low ebb. In the remote interior, men able to read and write are not always to be found to fill public offices. In the capitals of the departments there are usually high schools or colleges; and there are good private schools in all the more populous districts. The university of St Mark at Lima is the most ancient of the American universities, having been established in 1570, and was long famous as a seat of learning, but it is now superseded in Lima by the college of S. Carlos. The university of S. Fernando in Lima is a thriving medical school. According to the last census, there were in Peru 810 elementary schools, where 26,000 boys and 3600 girls were taught reading, writing, and the catechism; and 42 lycea and high schools, having 320 masters and 4500 scholars. The Latin classes contained 1173 boys, the mathematical 720, the French 550, philosophy 328, Spanish grammar 270, religion 235, English 90, law 50, theology 250, medicine and surgery 50. The annual expense of the government schools and colleges may be estimated at about L.25,000, raised principally from excises, rents of land belonging to them, bull-fights, and sums paid by the pupils.

Peru is divided into 11 departments and 2 littoral provinces, having the organization of departments. The departments are subdivided into 61 provinces, the provinces into 625 districts, and the districts into parishes. The departments, with their population in 1852, are as follows:—

Departments.	Pop.	Capitals.	Pop.
Amazonas	43,074	Chachapoyas	4,500
Ancach	219,145	Huaras	5,200
Arequipa	119 336	Arequipa	36,800
Ayacucho	132,921	Ayacucho	16,700
Cuzco	349,718	Cuzco	44,600
Huancavelica	79,117	Huancavelica	5,200
Junin	222,949	Cerro de Pasco	12,800
Libertad	266,553	Truxillo	6,300
Lima	250,801	Lima	100,000
Moquegua	61,432	Tacna	9,700
Puno	285,662	Puno	8,300
Callao, prov. litt.	8,453	Callao	6,000
Piura	76,332	Piura	11,600
Total	2,115,493		

The inhabitants of Peru consist of three distinct races—Spaniards, Indians, and Negroes. The secondary classes arising from these three are,—the Mulatto, from the Spaniard and Negro; the Mestizo, from the Spaniard and Indian; and the Chino, from the Indian and Negro. The minor subdivisions are very numerous. The Indians, or native Peruvians, are still the most numerous class throughout the country, and constitute fully two-thirds of the entire population. They are naturally timid, reserved, and of a melancholy temperament, arising doubtless in great measure from the cruel oppressions to which they have been for ages subjected. They yet cherish a deep and mournful impression of the days of the Incas; and in the more remote districts of the country, the death of the last of the race is annually celebrated by a sort of rude tragedy, accompanied by plaintive strains of music. They are sunk in gross ignorance; but not a few of them have risen to eminence, and have shown themselves to be possessed of talents and abilities of no mean order. Many of the tribes are industrious cultivators of the soil; and others display great ingenuity in the manufacture of beautiful fabrics. They have also shown themselves to be possessed of bravery by their achievements during the war of independence; and so late as March 1858, they fought like old Spartans under Vivanco at Arequipa. Of the regiment Ayacucho, 600 strong, 540 fell at the barricades before they were overpowered by the army of Castilla. The mixed races are more numerous than the pure Spaniards. According to Mr Stevenson, the Mestizo is strong and swarthy, with very little beard, laborious, and well disposed; the Mulatto is less robust, but acute, talkative, imaginative, and fond of dress and parade; the Chinos have the character of being the worst of the mixed races,—they are a quick, pugnacious, and daring set of fellows. (D. K.)

PERUGIA, a province of the Papal States, bounded on the N. by the province of Pesaro-e-Urbino, E. by those of Macerata and Spoleto, S. by those of Spoleto and Viterbo, and W. by Tuscany. Its length from N. to S. is about 60 miles; extreme breadth, 45; area, 1547 square miles. It lies entirely in the basin of the Tiber, and contains the lake of Perugia, anciently called *Trasimenus*, near the frontiers of Tuscany. This sheet of water, which is about 30 miles in circumference, 8 broad at the widest part, and about 30 feet deep, contains several islands, and is inclosed on three sides by mountains, which on the fourth, towards the west, open out into the plain of Cortona. It is fed by springs rising from its bottom, and having no natural outlet, it frequently overflowed the surrounding country, until in the fifteenth century a tunnel and canal were constructed, which carry off the water from the south-east corner to the Tiber. The Apennines extend along the eastern boundary of the province, and cover it with their ramifications; but to the south of the capital there are some extensive plains. The soil is rich and fertile, and the climate mild and healthy. Corn, wine, oil, silk, and grass are raised; and large herds of excellent horned cattle are fed on the pastures of the province, as well as sheep, pigs, and poultry. Manufactures of cotton, woollen, and silk goods are carried on, and these articles are the objects of a considerable trade. Pop. (1853) 234,533.

PERUGIA (anc. *Perusia*), the capital of the above province, stands on the sides and top of a hill, between 700 and 800 feet high, overlooking the Tiber, 82 miles N. of Rome. It is surrounded by high but not very strong walls in the form of a polygon, about 6 miles in circumference, and is defended by a castle, erected by Pope Paul III. in 1543. Though irregularly laid out, the streets are broad, and are lined with many handsome buildings. Of the nu-

merous churches in the town, the principal is the cathedral, a Gothic edifice of the fifteenth century, containing numerous fine paintings by Barrocci, Guido, and Perugino, as well as four of Raphael's, and having an extensive library of biblical works and MSS. The church of S. Francisco, a fine edifice, formerly contained Raphael's picture of the "Descent from the Cross," now in the Borghese gallery; and that of S. Dominico has a fine painted window, and the beautifully carved tomb of Pope Benedict XI. The town-house, a large Gothic edifice, is the residence of the municipal authorities, and contains the archives of the town. The old Exchange, now no longer used for that purpose, is remarkable for the frescoes, by Perugino, with which its walls are covered. Many of the convents in the town are large and splendid, and contain fine paintings; that of San Pietro is the largest Benedictine convent in the Papal States. The university of Perugia, founded in 1307, is one of the oldest in Europe; it is attended by upwards of 200 students, and has a library of 30,000 volumes, a botanic garden, and collections of minerals and of antiquities. There is here an academy of the fine arts, with a collection of paintings by natives of the town and neighbourhood, and several private picture-galleries. Perugia has a school of music and a literary club; and also two theatres, assembly-rooms, and a bull-ring. A lunatic asylum is the chief benevolent establishment. The manufactures of the place consist of carpets, velvet, silk, woollen stuffs, soap, candles, brandy, and other articles. An active trade is carried on in corn, wine, oil, cattle, and wood. Perugia is the seat of a bishop and of a Papal delegate; a court of justice and a board of police are also held here. Many interesting remains of antiquity still exist in the modern town. It is doubtful whether the walls, which consist of long rectangular blocks regularly arranged, are of Etruscan or of Roman origin; to the latter must be ascribed the gates, two of which remain in their ancient condition,—the Arco d'Augusto, probably built by Augustus, and the Porta Marzia. Undoubted Etruscan remains are to be found in the sepulchres outside the walls, from one of which was obtained the only considerable fragment we have of the Etruscan language—an inscription forty-six lines in length, now preserved in the museum at Perugia. The ancient city was of much less extent than the modern, occupying only the summit of the hill. It seems to have been originally an Umbrian city; but it passed into the hands of the Etruscans, and became one of the chief members of that confederacy. It is mentioned frequently in early Roman history, though not before 310 B.C. It was then an independent city, frequently at war with Rome. After 294, it is not again mentioned as independent; but the precise time and circumstances of its conquest by Rome are not known. During the second Punic war it was one of the allies of Rome, and remained faithful to that power, supplying corn and timber for the fleet of Scipio. Perusia does not again occur in history until the civil wars of the second triumvirate. In 41 B.C. L. Antonius, attacked on all sides by Octavius, Agrippa, and Salvidienus, established himself in Perusia, hoping to hold out till he should be reinforced by Ventidius and Asinius Pollio. Disappointed in these hopes, and blockaded by Octavius, after an ineffectual attempt to break through the enemy's lines, he was forced to surrender. His life was spared; but the city was given up to plunder, and accidentally destroyed by fire. Rebuilt by Augustus, the town acquired the name of *Augusta Perusia*, and soon became a flourishing municipal town. It is not again mentioned till after the fall of the Western Empire; but in the wars which then took place it played a conspicuous part. After falling into the hands of the Goths, it was recovered in 537 A.D. by Belisarius; but on his departure it was taken by Totila. After this period it was an independent municipality, sometimes ruled by tyrants, sometimes divided by factions; till in 1512 it was united to the Papal States by Julius II. Pop. (1848) 19,400.

PERUGINO, Pietro, an eminent Italian painter, whose family name was *Vanucci*, was born at Citta della Pieve in 1446. His study of art was prosecuted amid the embarrassments of poverty. He acquired his first lessons while drudging as a shop-boy in the employment of a painter in Perugia. Then repairing to Florence, he commenced a regular course of study, with no means of support but the small pittance which his inexperienced pencil could earn. Yet in these unpropitious circumstances, Perugino soon attained great eminence. His pictures became notable for their graceful and elegant drawing, and their chaste and harmonious colouring, and began to be exported to various parts of Europe. At the same time, he was extensively and closely employed in the decoration of religious edifices in several different cities. He painted pictures for the churches and convents of Florence, Siena, Vallombrosa, Naples, Rome, and Perugia. So pressing, indeed, were his engagements, that he was often hurried into repeating the same figures, attitudes, and landscapes, over and over again. No less celebrated was Perugino as a teacher of art. The eminent painters Pinturicchio of Perugia, Rocco Zoppo of Florence, Giovanni Spagnuolo, and Andrea Luigi of Assisi, studied under him, and closely imitated his manner. The great Raphael, too, was his pupil, and for some time painted after his style. Perugino died at his native place in 1524.

Some of the extant works of Perugino are preserved in Florence. A celebrated fresco, representing the Crucifixion in the centre, with the Mater Dolorosa and San Bernardo on either side, is in the church of Santa Maria Maddalena de' Pazzi; and pictures of "Our Lord in the Garden of Olives," "The Assumption of the Virgin," "A Dead Christ," and "Two Monks of the Order of Vallombrosa," are in the Academy of the Fine Arts. (See Vasari's *Lives of Painters*, &c., and Lanzi's *History of Painting*.)

PERUVIAN BARK. See Bark.

PERUWELZ, a town of Belgium, province of Hainault, on an affluent of the Schelde, 12 miles E. by S. of Tournay, and 16 W. by N. of Mons. It is for the most part well built, and has a public square, a church, and several schools. The inhabitants are chiefly employed in weaving, bleaching, dyeing, tanning, and brewing. Pop. 7612.

PERUZZI, Baldassare, an eminent Italian architect, was the son of Sienese parents, but was born at Volaterra in 1481. The early part of his life was devoted to painting. He studied that branch of art at Siena, and then repairing to Rome, fairly commenced his professional career. The able and elegant composition of his pictures soon introduced him to notice. He was employed to paint some frescoes in the church of Sant' Onofrio, in the church of San Roccoa-Ripa, and in the fortress of Ostia. But by this time Peruzzi was turning his attention to a species of art better fitted to develope his talents. Having added to his skill in painting a knowledge of architecture, he now began to undertake both the designing and embellishment of edifices. He erected and ornamented many façades and other buildings. The most successful of these was the Farnese Palace, which was so exquisitely constructed that, according to Vasari, it "ought rather to be described as a thing born than as one merely built;" and so successfully adorned that Titian, on visiting it, thought at first that the painted objects were real. In spite of this professional success, the close of Peruzzi's life was shadowed by misfortune. The Spaniards, while sacking Rome in 1527, stript him of all his effects. His subsequent works, and among others his design for the unrivalled Palazzo Massimi, contributed very little to his pecuniary advantage. He died in 1536, leaving his family in indigent circur

stances, and was buried in the Pantheon, near Raphael. One of Peruzzi's paintings, "The Adoration of the Magi," is in the National Gallery. (See Vasari's *Lives of the Painters*, &c., and Lanzi's *History of Painting*.)

PESARO (anc. *Pisaurum*), a town in the Papal States, province of Pesaro-e-Urbino, stands on a well-wooded rocky eminence near the mouth of the Foglia, on the Adriatic, 19 miles E.N.E. of Urbino. It is surrounded by fortifications, and defended by a citadel. The streets are clean and well aired; and hence Pesaro presents a neater appearance than most Italian towns. It has a market-place, containing a fountain and a marble statue of Pope Urban VIII. Being the seat of a bishop, it contains a cathedral, not remarkable for its architecture; but this, as well as several other churches and some of the private houses, contains fine paintings. There are several convents and palaces. One of the latter, which formerly belonged to the dukes of Urbino, is now occupied by the papal legate. Among the public institutions of the place are a college, courts of law, a public library of 15,000 volumes (with museum and botanic gardens in connection with it), two hospitals, a foundling asylum, and a theatre. In the vicinity are several fine villas, one of which was the residence of Queen Caroline in 1818–19. The manufactures are few, consisting chiefly of silk and cotton stuffs; but the inhabitants are largely employed in trade, the principal articles of which are the agricultural produce of the surrounding country, such as wine, oil, and fruit, especially figs, reckoned the best in Italy. Pesaro has a harbour, but it is of small size. The ancient *Pisaurum* was a town of Umbria, where in 184 B.C. a Roman colony was founded; and after this it became a flourishing and important town, although the climate seems to have been then (though it is not now) unhealthy. It was occupied by Julius Cæsar after crossing the Rubicon in 49 B.C., and under the empire it was a place of some trade, where ships were built. The remains of an ancient bridge and theatre, as well as many inscriptions, still exist; and the town is supplied with water by an aqueduct, supposed to be the work of the Romans. Rossini, the celebrated musical composer, was a native of Pesaro. Pop. about 17,000.

PESARO-E-URBINO, a province of the Papal States, bounded on the N. and N.E. by the Adriatic, S.E. by the province of Ancona, S. by that of Perugia, and W. by that of Forli and by Tuscany; area, 1407 square miles. It entirely surrounds the republic of San Marino. The surface slopes gradually from the W., where it is mountainous, being divided from Tuscany by the range of the Apennines, which sends off several branches towards the sea, in which direction also the rivers of the province flow. The principal of these are the Foglia (anc. *Pisaurus*), the Metauro (anc. *Metaurus*), with its affluent the Cantiano; the Cesano; and the Misa. The mountainous parts of the province are generally barren; but the hills afford excellent pasturage, and their lower slopes are covered with vines, olives, and mulberry trees. The lower grounds are fertile and well cultivated, producing corn, pulse, hemp, flax, and various fruits. Cattle, sheep, and pigs are fed on the pastures in large numbers; and considerable attention is paid to bees and silk-worms,—the silk of Fossombrone, a town in the province, being considered the finest in Europe. The chief mineral found is coal, which is obtained in the vicinity of Pesaro. Pop. (1853) 257,751.

PESCE, NICOLA or COLA, a famous Sicilian diver, was born at Naples about the middle of the fourteenth century. His agility in swimming was the wonder of his contemporaries. They believed that he could live in the water as in his own proper element, and they surnamed him on that account *Pesce*, "The Fish." In fact, no feat ascribed to him was too huge for their gaping credulity to swallow. It was this exaggerated fame that became the occasion of the "Fish's" death. Frederick II., King of the Two Sicilies, hearing the astounding reports of his aquatic dexterity, resolved to subject it to a summary test. Accordingly a golden cup was thrown by the royal hand into the dreaded whirlpool of Charybdis, and the diver was desired to plunge after it, and win it as a prize. Twice he dived, and appeared again on the surface of the water. After disappearing the third time, he never came up. His body is said to have been cast ashore thirty miles distant. This fatal incident furnished Schiller with the groundwork of his famous ballad *Der Taucher*. (See Brydone's *Tour through Sicily and Malta*, London, 1773.)

PESCHIERA, a town of Austrian Italy, in the province of Mantua, stands at the foot of the Lago di Garda, where the Mincio, here crossed by a bridge, issues from the lake, 20 miles N. of Mantua. It is fortified, and defended by a small but strong Venetian citadel. There are here two churches and a custom-house. The inhabitants are chiefly employed in fishing. In 1848 the town surrendered, after an obstinate resistance, to the Sardinian army under Charles Albert. Pop. about 2500.

PESCIA, a town of Tuscany, province of Florence, in a beautiful country covered with groves of olives and mulberries, and studded with villas, convents, castles, and towers, 30 miles W.N.W. of Florence, on the Pescia, which is here crossed by two fine stone bridges. It is the seat of a bishop, and contains a fine modernized cathedral, with a painting by Raphael. The other churches are in no way remarkable. There are several palaces, schools, and charitable institutions. The inhabitants are employed in the manufacture of leather, paper, broadcloth, and silk; and some trade is carried on in silk, wine, and oil. Pop. (1852) 4900.

PESCO-PAGANO, a town of Naples, province of Basilicata, on the top of a lofty hill, 18 miles S.W. of Melfi, and 13 E.N.E. of Salerno. It has four churches and a convent, and manufactures of cotton and woollen goods and copper-wares. Pop. 4000.

PESHAWUR, or PESHAWER, a province of British India, in the Punjab, occupying the extreme N.W. corner of the empire. It lies between N. Lat. 33. 42. and 34. 30., E. Long. 71. 35. and 72. 42., and is bounded on the N.W. and S. by the Khyber, Mohmund, Swat, and Khuttuk hills, and on the E. by the Indus. Its length is 65 miles, breadth 50, area about 2324 square miles. Besides the Indus, it is watered by the Kabool river, which joins the Indus near Attock, and by the Swat, the Bara, and other affluents of the Kabool. The water of these rivers is used for irrigation, being conducted to the fields by numerous canals and small channels, from which it is raised by levers or Persian wheels. The country is very fertile, and this abundant supply of water renders it verdant at all seasons of the year. Two crops are raised annually; the principal produce being wheat, barley, maize, millet, and especially rice, which it produces in greater excellence than any other country in the world, and which is known by the name of Bara rice, from the river on whose banks it is grown. Vegetables, such as carrots, turnips, cabbages, onions, and others, are likewise raised; and an important part of the produce consists of what is called *paulaiz*, comprising melons and cucumbers of various kinds, pumpkins, and gourds. The castor-oil plant, the sugar-cane, ginger, tobacco, and cotton are among the other plants cultivated. Agriculture is well advanced; the plough has superseded the spade; and oxen are employed in treading out the corn, and in other labours. Plums, figs, peaches, pomegranates, and quinces are among the principal fruits that the country produces. The climate during the summer is extremely hot, though the occasional breezes from the mountains mitigate its sultriness. The province of Peshawur is traversed by the great route from Khorasan and Kabool to India, which crosses the moun-

tains by the Khyber pass; and there is also a grand trunk road which crosses the country, connecting the town of Peshawur with Lahore, along which the army of the Punjab is stationed. Forming part of the Punjab, Peshawur came into the possession of the British along with that country. Pop. 450,099.

PESHAWUR, the capital of the above province, on the Bara, about 18 miles E. of the eastern extremity of the Khyber pass, and 36 W. by N. of Attock, at an altitude of 1068 feet above the sea; N. Lat. 34., E. Long. 71. 38. It is defended by walls and a fort, which commands the whole of the town, the former having at intervals strong bastions. The fortress, which was erected by the Sikhs, occupies a square 220 yards each way, and has round towers at each corner The walls are all built of mud; and the place is surrounded by a moat and by a fausse-braie. The principal street of Peshawur, which stretches eastward from the Kabool gate, is broad, and lined on each side with houses of one storey. This is the only good street in the town, as the side lanes which diverge from it are very narrow, irregular, and dirty, and the houses mean. Peshawur contains three open places, that in the centre, which is of a circular form, being the finest part of the town. The houses in it are regularly built, and have in front of them a circle of acacias. On each side of this area is an arched gateway leading to a square, one of which is used as a market for grain, and the other for silk cloth, leather, and other articles. The town at one time contained numerous mosques, many of them being magnificent buildings; but they have been profaned by the Sikhs, and are now fast falling into decay. The manufactures are very few, consisting principally of *loongees*, or light-blue scarfs of cotton. In the adjacent country large quantities of salt are obtained; there are also two productive lead mines, and nitre and sulphur are likewise found. A considerable trade is carried on between Afghanistan and India by Peshawur; and this has been much increased since the British took possession of it, by the removal of all the restrictions that had been imposed by the Sikhs. Peshawur was founded by the Mogul emperor Akbar, from whom it obtained its name, which signifies "the advanced post," as it is the frontier city of India. It was formerly much more populous than at present; and in the beginning of this century it contained 100,000 inhabitants. Runjeet Singh took it after his victory over the Afghans at Noushera, and destroyed many of its finest buildings. Pop. 53,295, including 7706 Hindus.

PESTALOZZI, JOHANN HEINRICH, a distinguished educational reformer, was born at Zurich in Switzerland on 12th January 1746. He spent the greater part of a long life in advocating his theory of education, and in endeavouring to exemplify it in practice. The political oppression, moral depravity, and intellectual darkness which characterized the condition of the lower orders of society in his native land, had, at a very early period of his life, profoundly affected his benevolent and enthusiastic mind, and he had resolved to devote himself entirely to the amelioration of that condition. He first entertained the idea that he should best accomplish his object by becoming a political reformer; and, abandoning the clerical profession, for which he had been educated, he took to the study of the law. But the intensity of his application to his legal studies brought on a dangerous illness, and on the advice of his physicians he abandoned this profession also, burning all his manuscripts, and renouncing the study of books. It now occurred to him that he might effect his purpose by making agriculture the pivot of his educational operations. He accordingly went to live with a farmer of some repute, to learn practical agriculture, and to seek advice as to the best mode of prosecuting his plans. A successful experiment which this farmer made in cultivating madder on poor land induced Pestalozzi, in conjunction with a mercantile firm of Zurich, to purchase a tract of heath-land (the Neuhof) in Argovia, and make a similar experiment. But in this, the first important undertaking in which he engaged, Pestalozzi soon gave evidence of a singular deficiency in practical wisdom and tact. For example, he wasted a great deal of capital in erecting a dwelling-house and farm-buildings on his new estate. The experiment did not succeed, and the Zurich firm withdrew their capital with loss. Notwithstanding this failure, and the distress into which it threw him, he determined to go on with the execution of his plans. He wanted to combine with his agricultural operations a model industrial school for poor children. The idea of such a school is now familiar to us; it was then new. His plan met with the approval of many influential persons, and the school was commenced in 1775. For five years he devoted his whole time and energy to teaching and and training fifty destitute boys, literally gathered from the highways. But in the meantime, his own and his wife's fortune were going to the winds; he who was teaching others the conditions of success in life was neglecting some of the most obvious of those conditions in the management of his own affairs. By the end of the period mentioned he had brought himself down to the pecuniary level from which he was endeavouring to raise his pupils.

Nevertheless, we reap the fruits of Pestalozzi's labours in the numerous industrial and reformatory schools which have been established in our own country. It was Pestalozzi's poor-school that suggested to De Fellenberg the one which he established on his estate of Hofwyl; and which, under the skilful management of Wehrli, gained a success which definitively settled the question of the practicability of the idea. Pestalozzi himself, visiting Hofwyl some thirty years after the breaking up of his own school, acknowledged that in Wehrli's school he saw his idea realized. The success of Wehrli's school led to the establishment of many others in Switzerland and other countries. "In the orphan schools which emanated from Pestalozzi and De Fellenberg we found," say Sir James Kay Shuttleworth and Mr Tufnell, in their report on the Battersea normal school, "the type which assisted us in our subsequent labours. In walking with M. De Fellenberg through Hofwyl, we listened to the precepts which we think most applicable to the pauper class. In the normal school of the canton of Thurgovia (at that time conducted by Wehrli), and in the orphan schools of St Gall and Appenzell, we found the development of those principles so far successful as to assure us of their practical utility." Pestalozzi's countrymen could not have raised any memorial to him more appropriate than the orphan school which they founded at Olsberg in Argovia, after the commemoration of the hundredth anniversary of his birthday in 1846. If such establishments are not always successful in a pecuniary point of view, even with the accumulated experience which we now possess, it should make us judge the more leniently the failure of the man who grappled with the difficulties of the task for the first time.

For eighteen years after the breaking up of the Neuhof poor-school, Pestalozzi did not engage in any educational undertaking. Some of his most important works, however, were written during this period; among others, *The Evening Hour of a Hermit*, a series of educational aphorisms very similar to the *Didactica Magna* of Comenius; and *Leonard and Gertrude*, a dramatic novel pourtraying the actual condition of the Swiss peasantry and his own ideal of a good home and school education for the people. The latter work established his reputation, and exercised an important influence on the progress of popular education throughout Switzerland and Germany. A translation of this work is a desideratum in our language. In 1798 he was called upon by the Swiss Directory to go to Stanz in Unterwalden, and take charge of a number of children

left destitute after the terrible punishment inflicted on that resisting canton by the French army of occupation. Without a moment's hesitation, he left his family, and for nine months he acted as the sole teacher and superintendent of eighty orphan boys of the lowest grade of society, in an old desolate cloister, with no books, maps, or other appliances of instruction, and with no assistance of any kind, save such as could be rendered him by an old housekeeper. With these children he made many new experiments in education. Among other plans which he tried were those of monitors and simultaneous reading and speaking. The monitorial plan, however, is as old as Comenius, and the simultaneous plan had previously been introduced into the Austrian schools. The circumstances were highly favourable to the application of his general theory, which required all instruction to be based on real objects and familiar daily occurrences; and many of his lessons, secular and moral, appear to have been fine specimens of intuitive teaching. That, in concentrating his mind upon the development of his own plans, he should sometimes overlook the peculiarity of the circumstances, and constantly neglect matters that appeared to him of minor importance, was to be expected. His extraordinary efforts in this difficult and harassing position had well nigh brought him to the grave, when the progress of events connected with the war compelled him to give up the school. He went up into the Bernese Oberland to recruit his exhausted energies. His next important undertaking was the foundation of an educational institution for the practical application of his method. He had for some time past sought assistance from the Helvetian government towards the attainment of this object, which he regarded as one of national importance. At length the government gave him the use of the castle of Burgdorf, and in those premises he opened his institution in 1800. The institution was removed successively to Münchenbuchsee, near Hofwyl, and to Yverdun, in the canton of Vaud. In the very first years of its existence it attracted much notice, owing in great measure to an account of his plans, which Pestalozzi published under the title, *How Gertrude Teaches her Children.* Subsequently it became, in the language of one of Pestalozzi's eulogists, a "European training institution for teachers and educators." The internal management of the institution, however, appears to have been anything but satisfactory. His own want of governing and practical power necessarily compelled him to place a leading share of the management in the hands of one or other of his assistants, among whom, accordingly, a contention arose which proved fatal to the welfare of the institution and the happiness of its venerable founder, who had the mortification of seeing his enterprise going to wreck, and himself standing powerless at the helm. The institution was finally broken up in 1825. A poor-school, which he had founded at Clindy, near Yverdun, in 1818, had failed from similar mismanagement. He made an attempt to transplant this school to his estate of Neuhof, in the hope that it might succeed better away from "the institution." But the building which he erected for the purpose stood incomplete and unoccupied at the time of his death. This event happened on 17th February 1827. During the last two years of his life he wrote his autobiography in two works—*The Song of the Dying Swan,* and *The Fortunes of My Life.* In these works he reviews his various educational undertakings, and endeavours to trace the causes of their failure. As the works enter very fully into the details of the personal quarrel at Yverdun, they are variously represented by his biographers according as these side with one or other of the parties; and, for the same reason, they are now of very little interest to the world. Shortly before his death he said: "I forgive my enemies; may they find peace, now that I go to eternal rest. I should like to have lived another month, to have completed my last labours; but I again thank God, who in his providence calls me away from this earthly scene. And you, my children, remain in quiet attachment to one another, and seek for happiness in the domestic circle."

Pestalozzi's general theory of education may be stated in few words. He held that all our knowledge is derived, in the first instance, from the perceptions of the senses, and that therefore all instruction should be based upon the observation of real objects and occurrences; or, in other words, should proceed, by a process of induction, from the concrete to the abstract, from the known to the unknown. He further held that the object of primary education was to give a general and harmonious cultivation to the faculties of the mind, not to communicate technical knowledge. He accordingly required that all instruction should be presented to the pupil in a form corresponding to the process of intellectual development, by which the mind rises from the perceptions of the senses to clear ideas; and that the adaptation of different subjects for the purposes of elementary instruction should be judged of by the amount of educative power which they respectively possess. (See NATIONAL EDUCATION.)

Pestalozzi belongs to the modern or "realistic" school of educators, the general tendency of which is two-fold—(1.) As regards the *matter* of instruction, to supersede the languages and literature of Greece and Rome by the mother-tongue and practical knowledge; and (2.) As regards the *manner* of instruction, to supersede the analytic and experimental method by a synthetic and demonstrative one. The most eminent men of this school before Pestalozzi were Rousseau, Locke, and Comenius. Its origin is distinctly traceable to the influence of Bacon's method of philosophy.

Like Lord Bacon, Pestalozzi did very little towards the practical application of his own principles. Some of his attempts to apply them to individual branches of instruction were singularly at variance with them. This was the case with his treatment of the instruction in language, as explained in his work *How Gertrude Teaches her Children* He divides the instruction into—1. Lessons on Sounds; 2. Lessons on Names; 3. Lessons on Language. 1. "The spelling-book (he says) must contain the entire range of sounds of which the language consists, and portions of it should be repeated daily in every family, not only by the child that is going through the exercises to learn how to spell, but also by mothers, within hearing of the child in the cradle, in order that these sounds may, by frequent repetition, be so deeply impressed upon the memory of the child, even while it is yet unable to pronounce a single one of them, that they shall never be forgotten. No one imagines to what a degree the attention of infants is aroused by the repetition of such simple rounds as ba, ba, ba; da, da, da; ma, ma, ma; la, la, la, &c.; or what a charm such repetition has for them." 2. Lessons in names (he says) consist in giving the children lists of the names of the most important objects in all three kingdoms of nature, in history, in geography, and in the pursuits and relations of mankind. 3. In the "lessons in language" he classifies what is to be learned under the following heads:—Geography, history, physics, natural history, and physiology. Each of these five heads he divides again into forty subdivisions. He now proceeds to give lists of words in all these subjects in alphabetical order, which lists are to be impressed upon the children's memories "till it is impossible any should be forgotten." Afterwards, this alphabetical nomenclature is to be transformed into a "scientific" one. He gives the following examples:—"One of the subdivisions of Europe is Germany: the child is first of all made well acquainted with the division of Germany into ten circles; then the names of the towns of Germany are placed before him, at first in mere alphabetical order, for him to read, but each of these towns is previously marked with the number of the circle in which it lies. As soon as the child can read the names of the towns fluently, he is taught the connection of the numbers with the subdivisions of the main heads; and in a few hours he is able to determine the place of the entire number of German towns in these subdivisions." And this is what Pestalozzi calls "changing the alphabetical into a scientific nomenclature." (The quotations are taken from Mr Tilleard's translation of Raumer's *Life of Pestalozzi*) Thus, again, with his so-called exercises in observation; or object-lessons. The type of such lessons was pretty nearly this: Suppose that the lesson was on a piece of sponge. The teacher, holding up the specimen before the boys, would sing out in a high monotone such sentences as the following, requiring the class to repeat each sentence in unison three times:—"That is sponge." "Sponge is an animal product." "Sponge is amorphous." "Sponge is porous." "Sponge is absorbent," &c. Nothing approaching to an elucidation of the scientific principles involved in common objects and processes appears to have been attempted in these lessons. Indeed Pestalozzi says, with the utmost candour, when treating of the instruction in language, "I never pretended to teach any art or

Pestalozzi.

science; in fact, there is not one with which I myself am acquainted. My only object is to facilitate generally the acquisition of the elements of all the arts and sciences, and to give to the neglected and abandoned classes of my countrymen open access to the stores of human civilization."

Pestalozzi was perhaps most successful in the application of his principles to the instruction in arithmetic; but even his method of teaching this subject counteracted them to a large extent The aim of the Pestalozzian arithmetic is to lead children to observe for themselves the properties and relations of numbers, as shown upon the various tables made use of. If the spirit of the method is realized by the master, nothing can be more important than the influence which it has upon his instruction in this subject. It teaches him to base all his explanations upon first principles, instead of condemning his pupils to work from prescribed rules, of which they do not understand the reasons. He thus gives them the power of deducing arithmetical results for themselves, and scope for the exercise of their judgment as well as of their memory. Treated in this common-sense manner, arithmetic is invaluable as a mental discipline; and, from being a dry task, it is rendered an interesting exercise to the children; for the child is always gratified by any instruction that appeals to its reasoning powers. But Pestalozzi caused a manual to be prepared in which the exercises to be done upon the tables were printed at full length, and the boys were made to go through the whole series, under the care of an assistant master, until the repetition became one monotonous sing-song, not requiring the slightest thought. One of his pupils gives the following account of the way in which he himself taught this subject:—"For the ciphering, we had between every two scholars a small table pasted on mill-board, on which, in quadrangular spaces, were marked dots, which we had to count, to add together, to subtract, to multiply, and divide by one another. It was out of these exercises that Krüsi and Buss constructed, first the Unity Table, and afterwards the Fraction Tables. But as Pestalozzi only allowed the scholars to go over and to repeat the exercises in their turns, and never questioned them nor set them tasks, these exercises, which were otherwise very good, remained without any great utility. He had not sufficient patience to allow things to be gone over again, or to put questions; and in his enormous zeal for the instruction of the whole school, he seemed not to concern himself in the slightest degree for the individual scholar."

The truth of the Pestalozzian maxim, that the mind grasps the concrete more readily than the abstract, has received a curious confirmation in the extensive imitation which Pestalozzi's methods, though opposed to his principles, have met with at the hands of his admirers. It is but too true that teachers, in common with other mortals, are ever more ready to adopt plans than to adopt principles. The Pestalozzian arithmetic was introduced at a very early period, into the Dublin model schools by the Irish Commissioners, who published an edition of the Manual of Exercises for the use of their teachers. A somewhat modified form of their Manual was published in 1844, under the sanction of the Committee of Council on Education, for the use of teachers in Great Britain. That work, however, was superseded by Tate's *First Principles of Arithmetic*; a work which gave a more correct and comprehensive application of Pestalozzian principles to the subject of arithmetic; and which has done much towards completing a radical reform in the teaching of this subject in our elementary schools. The Pestalozzian object-lessons have been widely imitated in this country. These lessons, however, are gradually giving place to lessons on the science of common things more in accordance with Pestalozzi's own principles. Pestalozzi's method of instruction in language does not appear to have been adopted, as a whole, by any of his followers. But the greater part of it is embodied in Scherr's method of teaching reading, which is extensively used by Swiss teachers.

While Pestalozzi's personal influence on the methods of teaching particular subjects has thus been small, he has, through his profound principles, exerted a greater influence on elementary education than any other man in recent times. That the visible improvement in teaching which has been made of late years in England is in a great measure due to his influence, there can be little doubt. At the Battersea normal school, from which much of that improvement emanated, Sir James Kay Shuttleworth propounded the general principles of a synthetic and demonstrative method, confessedly based upon the Pestalozzian idea; and those principles were ably applied to various branches of elementary instruction by his coadjutors, whose text-books are now in the hands of many teachers. The Home and Colonial School Society, also, by whom so much has been done for the improvement of infant school education, have professedly been guided by the principles of Pestalozzi.

The influence of the personal character of this great and good man has been very remarkable. His spirit has been infused into whole generations of teachers in his native land, and, through individual disciples, has been communicated far and wide over the whole civilized world. His enthusiastic love for children; his zealous devotion to the interests of his countrymen and of humanity; his unwavering faith in the efficacy of education (under God's blessing) for the regeneration of the lower classes of society; his unflinching courage in urging upon rulers and all set in authority the sacred duty of providing for the poor a more Christian institution than either the workhouse or the gaol, above all, the intense concentration of energy and purpose with which he pursued his object through a long and often unhappy life,—these features in his character demand our highest admiration, and place Pestalozzi in the foremost rank of distinguished schoolmasters. (J. T—D)

Pesth.

PESTH, or PEST, the most populous town of Hungary, capital of an administrative territory of the same name, stands on level ground on the E. bank of the Danube, immediately opposite Buda, with which it is connected by a fine suspension-bridge, 135 miles E.S.E. of Vienna. Besides the original or old town in the centre, there are four suburbs, known by the names of Leopold, Theresa, Joseph, and Francis Town respectively. The most of the town being of modern erection, is regularly and handsomely built: the streets are broad, straight, and well paved; and many of the shops, in splendour and decorations, are little inferior to those of Vienna. The principal and most frequented streets in the town are the Herren, Waitzner, Dorotheen, and Grosse-Bruck Gasse. The streets of Pesth present a strange scene, on account of the mixture of grandeur and barbarism that is to be seen in them, and the strange contrasts between the magnificent carriages, with their liveried attendants, and the troops of wild horses or herds of oxen, with their wild-looking drivers clad in sheepskins. Along the bank of the Danube runs a broad quay, which forms one of the principal ornaments of the town, as it is paved and terraced, though till recently it was little better than a muddy tract of ground. It is lined for nearly a mile and a half with lofty and handsome buildings, brilliantly whitewashed, among which is an elegant theatre. There are several squares in the town, one of which, the new market-place, is remarkable for its size, and for the elegance and regularity of the buildings that surround it. The public buildings of Pesth are not very numerous nor fine. One of the most conspicuous is an enormous edifice called the Neugebaude, erected in 1786 by the Emperor Joseph II. Its original design is not known, though it is said by the Hungarians to have been intended for the confinement of some of their chief nobles; but it is now used for barracks and artillery magazines. It is four storeys high, and incloses a central court of great extent, which has entrances at the four corners. The university building, and the church in connection with it, are worthy of notice; and the parish church is a fine edifice in the Gothic style. The churches in the town, however, are not numerous in proportion to the population, nor are they remarkable for architectural beauty. They belong to a great number of different sects; for the Roman Catholic, the United Greek, the Separatist Greek, the Lutheran, and the Reformed Church have each places of worship; and there are also several synagogues. The services in these churches are performed in the Latin, Greek, German, Hungarian, and Slavonic languages. The town-hall of Pesth, erected in 1844, has a peculiar tower; and there is a county-hall, recently rebuilt and enlarged, in which the nobles of the county used to meet for discussion and the election of magistrates. The National Museum, devoted almost exclusively to Hungarian articles, is a magnificent building, and contains a large collection of Roman and mediæval remains, arms, and other relics of distinguished persons, objects of natural history, a gallery of paintings, and a library of 20,000 vols. and 2000 MSS. Besides the university (which is described under the article HUNGARY), Pesth contains several other educational institutions. A Hungarian Academy, on the plan of the French Institute, a Lutheran and a Catholic gymnasium, an English school for young ladies, a normal

school, an institution for the blind, are the most important of these; and there is also a botanic garden, an observatory, as well as several hospitals and benevolent establishments. The Ludoviceum, a fine building at the S.E. end of the town, was erected in 1837 as a military school; but it has never been used for that purpose, and is now employed as a military hospital. Pesth contains several theatres; in one of which, the National, an elegant edifice, the performances are entirely in the Hungarian language. Besides these, the places of amusement in the town consist of coffee-houses and public walks, the principal of the latter being the Stadtwaldchen, which is situated to the north of the town. Not far from Pesth is the field of Rakos, which is famous in Hungarian history as the place where the national assembly of the Magyars was held in the open air, from the year 1268 to 1525. Horse-races are now held annually on this plain. Pesth is the seat of the principal courts of law in Hungary, though not the capital of that country. These formerly consisted of a Royal Court, having jurisdiction over the district courts, and from which an appeal lay to the Septemviral Court, the highest tribunal in the kingdom. Since 1852, however, Hungary has been made subject to the Austrian law, and the supreme courts now have their seat in Vienna, while Pesth has only an *oberlandes-gericht*, a *landes-gericht*, and a tribunal of commerce. The manufactures of Pesth are extensive, consisting of silk, cloth, leather, straw hats, gold and silver articles, and especially meerschaum pipe-bowls, which are brought in a rough form from Constantinople, and are here prepared for the German markets. The trade is very considerable, and consists principally of corn, wine, timber, cattle, and wool. Besides weekly markets, there are four annual fairs held here, which are visited by upwards of 30,000 strangers, and at which transactions to the extent of more than L.3,000,000 take place. Pesth carries on a considerable trade on the Danube by steam-boats. The modern town is believed to occupy the site of the ancient *Contra Acincum*, which is also called *Pession* by Ptolemy. Although it was built by Arpad, and walled in the thirteenth century, yet till within the last hundred years it was a place of very little importance, having met with a long series of calamities, in having been taken by the Turks no fewer than five times. It has also frequently suffered from inundations of the Danube, caused by the obstruction of the ice below the town. The most destructive of these floods took place in March 1838, when a great part of Pesth was laid under water, and 2281 houses in the town, besides 207 in Buda, and 1500 in the vicinity, were totally destroyed. That calamity has, however, given occasion for the rebuilding of the town in a much superior style to that which formerly existed. In April 1849, Pesth being in the hands of the Hungarians, while Buda was occupied with a garrison by the Austrian general Hentzi, a severe contest began between the two parties. On the 4th of May, Görgei, with an army of 40,000 Hungarians, occupied the heights above Buda, and began to bombard that town; while the Austrians, in their turn, directed their artillery against the lower city of Pesth. The latter bombardment destroyed many of the public buildings, and did so much damage that most of the inhabitants took refuge in the Stadtwäldchen. On the night of the 16th May the Hungarians made an unsuccessful attack on Buda; but on the 20th the place was taken by assault, after an obstinate and bloody struggle. Pesth is connected by railways, on the one hand with Vienna, and on the other with Debreczin, Grosswardein, and Temesvar, in the E. and S. of Hungary. Pop. (1851), exclusive of the military, 106,379.

The administrative territory of Pesth, which is bounded on the N. by those of Pressburg and Kaschau, E. by that of Grosswardein, S. by the Voivodina of Servia, and W. by the territory of Oedenburg, comprises, besides the district of Buda and Pesth, nine counties, and has an area of 14,094 English square miles.

PETALISM. See Ostracism.

PETAU, Denis (better known under the Latinized form of his name, *Dionysius Petavius*), a French Jesuit of great erudition, was born at Orleans in the year 1583. To the study of the belles-lettres he joined that of the mathematics; and afterwards applied himself to a course of philosophy, which he commenced in the college of Orleans, and finished at Paris. He subsequently maintained theses in Greek, which was as familiar to him as Latin; and the Latin, it is said, he understood better than he did his vernacular language. When he was pretty well advanced in his studies, he had free access to the king's library, which he often visited on account of the Latin and Greek manuscripts. Amongst other advantages which attended his literary pursuits, may be reckoned the friendship of Isaac Casaubon, whom Henri IV. called to Paris in 1600. It was at Casaubon's instigation that Petavius, though then very young, undertook an edition of the works of Synesius, in which he corrected the Greek from the manuscripts, translated what yet remained to be translated into Latin, and wrote notes upon the whole. He was only nineteen years of age when he was made professor of philosophy in the university of Bourges; and he spent the following years in studying the ancient philosophers and mathematicians. In 1604, when Morel, professor of Greek at Paris, published the works of St Chrysostom, some part of Petavius' labours on Synesius were added to them; and from the title we learn that he then took the name of *Pætus*, which he afterwards changed into *Petavius*. His own edition of the works of Synesius did not appear till the year 1612. He entered into the Society of the Jesuits in 1605, became a zealous advocate of the Church of Rome, and rejoiced in criticising and assailing its adversaries. He was bitter against Joseph Scaliger; nor did he even spare his friend Casaubon whenever the latter came in his way. Muratori regarded Petau as "the restorer of dogmatic theology." He excelled likewise in chronology. His great work on that subject, entitled *Rationarium Temporum*, is an abridgment of universal history from the earliest times till the year 1632, arranged in chronological order, with references to proper authorities; and it was improved by Perizonius and others, who made several additions to it after his death. Petau died at Paris in 1652, aged sixty-nine.

PETCHORA, a river of European Russia, rises in the Ural Mountains, on the borders of the governments of Perm and Vologda, flows at first westwards, and then through extensive flat moors in a curve towards the N., traversing the governments of Vologda and Archangel. After a course of 1300 miles, having acquired a great breadth, it falls into the gulf of Pustoserssk by several mouths. For nearly nine months in the year this gulf is blocked up with ice. Among the numerous affluents of the river, the largest are the Ussa from the right, and the Ishma from the left.

PETER (originally *Simeon* or *Simon*, שמעון, called also, by a rendering of the Greek Πετρος into the corresponding word in the Aramaic dialect spoken in Palestine in the days of our Lord, *Cephas*, כיפא, John i. 42), one of the twelve apostles, and author of two Epistles in the inspired canon. He was a native of Bethsaida in Galilee, and was the son of a certain Jonas, or John; whence he is named on one occasion in the gospel history *Simon Barjona*, that is, son of Jona (Matt. xvi. 17). At the time of his introduction to Christ he was married, and was resident at Capernaum with his family. Along with his brother Andrew, he followed the occupation of a fisherman on the Sea of Galilee. It is probable that before they became known to Christ they were both disciples of John the Baptist. That Andrew was so, we are expressly informed by the

St. Peter. evangelist John; and as his brother seems to have been much of the same mind with him on religious matters, it is extremely likely that he was so likewise. Their becoming known to Christ was owing to John's pointing him out on the day after his baptism to Andrew and another disciple (probably the evangelist John), as "the Lamb of God," on which they immediately followed Christ, and spent some time in receiving his instructions. Shortly after this, Andrew finding Simon, carried him to Christ, who, on receiving him as his disciple, bestowed upon him that surname by which he has since that time been most commonly designated: "When Jesus beheld him he said, thou art Simon the son of Jona; thou shalt be called Cephas, which is by interpretation a stone (πετρος)." After this interview the two brothers seem to have returned to their usual occupation for a season, as we have an account in Matthew (iv. 18–20) of their being summoned from that occupation by Christ on a subsequent occasion, posterior to his temptation in the wilderness, and to the commencement of his public ministry as a religious teacher. From this time forward they were his devoted and admiring followers. In the course of the evangelical history several anecdotes of Peter are incidentally recorded, for the purpose, doubtless, principally of illustrating the character and teaching of our Lord, but which tend also to throw light upon the history and character of his attached disciple. Such are the accounts furnished by the evangelists of his walking upon the agitated waters of the Sea of Galilee to meet his master (Matthew xiv. 22, ff.; Mark vi. 45, ff.); of his bold and intelligent avowals of the undoubted Messiahship of Jesus, notwithstanding the difficulties which he, along with the rest of the disciples, felt in reconciling what they saw in him with what they had fondly expected the Christ to be (Matthew, xvi. 13–20); of his rash but affectionate rebuke of his Lord for speaking of suffering and death as in prospect for him, and as forming a necessary part of his mediatorial work (Matthew xvi. 21–23); of his conduct in first rejecting, with an earnestness bordering on horror, the offer of Christ to wash his feet, and then, when the symbolical nature of that act had been explained to him, his over-ardent zeal that not his feet only, but also his hands and his head, might be washed (John xiii. 4, ff.); of his bold and somewhat vaunting avowal of attachment to his Master, and his determination never to forsake him, followed by his disgraceful denial of Jesus in the hour of trial (John xiii. 36, 37; Mark xiv. 29, &c.); of his deep and poignant contrition for this sin (Matthew xiv. 72); and of his Lord's ample forgiveness of his offence, after he had received from him a profession of attachment as strong and as frequently repeated as his former denial of him (John xxi. 15–18). From these notices it is easy to gather a tolerably correct conception of the predominating features of the apostle's character up to this period. He seems to have been a man of undoubted piety, of ardent attachment to his Master, and of great zeal for what he deemed his Master's honour, but at the same time with a mind rather quick than accurate in its apprehensions, and with feelings rather hasty in their impulse than determined and continuous in their exercise. Hence his readiness in avowing his opinions, and his rashness in forming them; and hence also the tendency which beset his honest openness to degenerate into bravado, and his determinations of valour to evaporate into cowardice at appalling forms of danger. His fall, however, and his subsequent restoration, connected as these were with the mysterious events of his Master's crucifixion and resurrection, and with the new light which had by them been cast around his character and work, produced a powerful change for the better upon the apostle's mind. From this time forward he comes before us under a new aspect. A sober dignity and firmness of purpose have displaced his former hasty zeal; sagacity and prudence characterize his conduct; and whilst his love to his Master shows no symptom of abatement, it displays itself rather in active labour and much-enduring patience in his service, than in loud protestations or extravagant exhibitions of attachment. In the subsequent Scripture history he is presented to us as the courageous herald of the kingdom of Christ, by whose mouth the first public declaration of salvation through the crucified Jesus was made to the people; by whose advice and counsel the early churches were planted and governed; and by whom the prejudices of Judaism were first fairly surmounted, and the gospel preached in all its universal freeness to the Gentile world. The Acts of the Apostles contain recitals of many interesting incidents which befell him whilst engaged in those efforts. Of these, the chief are his imprisonment and trial before the Sanhedrim, for preaching Christ, and his bold avowal of his determination to persist in that work (Acts iv. 1–22); his miraculously inflicting the punishment of death on the infatuated couple who had dared to try an experiment upon the omniscience of the Holy Ghost (v. 1–11); his visit to Samaria, and rebuke of Simon Magus, who deemed that the miracles of the apostle were the work of some deep magic spell of which he had not yet become possessed, and which consequently he was desirous of purchasing from Peter (viii. 14–24); the vision by which he was taught that the ancient ritual distinctions between clean and unclean had been abolished, and thereby prepared to attend on the summons of Cornelius, to whom he preached the gospel (x. 1–48); his apprehension by Herod Agrippa, and his deliverance by the interposition of an angel, who opened for him the doors of his prison, and set him free (xii. 3–19); and his address to the council at Jerusalem, on the occasion of a request for advice and direction being sent to the church there by the church in Antioch, in which he advocated the the exemption of Gentile converts from the ceremonial institutes of the law of Moses (xv. 6–11). In all these incidents we trace the evidences of his mind having undergone an entire change, both as to its views of truth and impressions of duty, from what is displayed by the earlier events of his history. On one occasion only do we detect something of his former weakness, and that strangely enough in regard to a matter in which he had been the first of the apostles to perceive, and the first to recommend and follow, a correct course of procedure. The occasion referred to was his withdrawing, through dread of the censures of his Jewish brethren, from the Gentiles at Antioch, after having lived in free and friendly intercourse with them, and his timidly dissembling his convictions as to the religious equality of Jew and Gentile. For this Paul withstood him to the face, and rebuked him sharply, because of the injury which his conduct was calculated to produce to the cause of Christianity. With this single exception, however, his conduct seems to have been in full accordance with the name which his Master had prophetically bestowed on him when he called him Simon the Rock, and with the position which Paul himself assigns to him, at the very time that he recounts his temporary dereliction, as one of the "pillars of the church."[1]

Thus far we are enabled, from the inspired documents,

[1] Gal. ii. 9–14. The circumstance of Peter's having submitted to a rebuke from Paul is so fatal to the pretensions which have been urged in favour of his supremacy over the other apostles, that from a very early age attempts have been made to set aside its force by the hypothesis that it is not of Peter the apostle, but of another person of the same name, that Paul speaks in the passage referred to. (*Conf.* Euseb. *H. E.* i. 13.) This hypothesis, however, is so plainly contradicted by the words of Paul, who explicitly ascribes apostleship to the Peter of whom he writes, that it is astonishing how it could have been admitted even by the most blinded zealot. See ver. 8, 9.

St. Peter.

to trace the history of this apostle; but for what remains we must be indebted to evidence of a less explicit and certain character. The testimony of several of the ecclesiastical writers, corroborated by the phraseology employed by the apostle himself in the salutation of his first Epistle, makes it highly probable that at some period of his official life he performed an extensive missionary tour throughout those districts, to the converts to which his Epistles were addressed. "It appears," says Origen, "that Peter preached to the Jews in the dispersion, in Pontus, Galatia, Bithynia, Cappadocia, and Asia."[1] A less certain tradition reports the apostle as having, towards the close of his life, visited Rome, become bishop of the church in that city, and suffered martyrdom in the persecution raised against the Christians by Nero. The importance of these points in connection with the claims urged by the Catholics on behalf of the supremacy of the Pope, has led to a careful and sifting examination of the accuracy of this tradition, the result of which seems to be that, whilst it is admitted as certain that Peter suffered martyrdom, in all probability by crucifixion,[2] and as probable that this took place at Rome, it has, nevertheless, been made pretty clear that he never was for any length of time resident in that city, and morally certain that he never was bishop of the church there.[3] By some an attempt has been made to obtain the support of the apostle's own testimony in favour of his having at one period resided at Rome, by interpreting the words "the church that is at Babylon," the salutations of which he sends to those to whom he wrote his first Epistle, as applying to the church at Rome; an attempt which Dr Campbell justly stigmatizes as "poor, not to call it ridiculous." Even if we admit that at the time when this Epistle was written it was understood amongst the Christians that Babylon was the prophetical name for Rome, an admission, however, which is entirely unsupported by evidence, it would remain unexplained why the apostle, in such a mere matter-of-fact affair as the communication of the friendly salutations of one church to another, should have employed the obscure and symbolical language of prophecy, when his meaning could have been so much more distinctly conveyed by a simple statement. This would be the more inexplicable, that the style of Peter is remarkably plain and perspicuous throughout the entire Epistle. It seems much more consistent, therefore, with rational principles of interpretation, to understand the statement literally of Babylon in Egypt, in which city, as we learn from Josephus, there was a great multitude of Jews (ἐνθα και πληθος ἦν Ἰουδαιων, *Ant. Jud.*, l. xv., c. ii., sect. 2; see also c. iii., sect. 1), and to which, consequently, it is almost certain, that at some period of his life, "the apostle of the circumcision" (Gal. ii. 8) must have paid a visit.

The assertion, that St Peter was bishop of Rome, is connected with another by which the claims of the Papacy are sought to be established,—namely, that to him was conceded a right of supremacy over the other apostles. In support of this, an appeal is made to those passages in the Gospels where declarations supposed to imply the bestowal of peculiar honour and distinction on Peter are recorded as having been addressed to him by our Lord. The most important of these are, "Thou art Peter, and on this rock will I build my church" (Matt. xvi. 18); and "Unto thee will I give the keys of the kingdom of heaven," &c. (Matt. xvi. 19). At first sight these passages would seem to bear out the assumption founded on them; but upon a more careful investigation it will be seen that this is rather in appearance than in reality. The force of both is greatly impaired for the purpose for which Catholics produce them, by the circumstance, that whatever of power or authority they may be supposed to confer upon Peter must be regarded as shared by him with the other apostles, inasmuch as to them also are ascribed in other passages the same qualities and powers which are promised to Peter in those under consideration. If by the former of these passages we are to understand that the church is built upon Peter, the apostle Paul informs us that it is not on him *alone* that it is built, but upon *all* the apostles (Ephes. ii. 20); and in the book of Revelation we are told, that on the twelve foundations of the New Jerusalem (the Christian church) are inscribed "the names of the *twelve apostles of the Lamb*" (chap. xxi. 14). As for the declaration in the latter of these passages, it was in all its essential parts repeated by our Lord to the other disciples immediately before his passion, as announcing a privilege which, as his apostles, they were to possess in common (Matt. xviii. 18; John xx. 23). It is, moreover, uncertain in what sense our Lord used the language in question. In both cases his words are metaphorical; and nothing can be more unsafe than to build a theological dogma upon language of which the meaning is not clear, and to which, from the earliest ages, different interpretations have been affixed. And, finally, even granting the correctness of that interpretation which Catholics put upon these verses, it will not bear out the conclusion they would deduce from them, inasmuch as the judicial supremacy of Peter over the other apostles does not necessarily follow from his possessing authority over the church. On the other side, it is certain that there is no instance on record of the apostle's having ever claimed or exercised this supposed power; but, on the contrary, he is oftener than once represented as submitting to an exercise of power upon the part of others, as when, for instance, he went forth as a messenger from the apostles assembled in Jerusalem to the Christians in Samaria (Acts viii. 14), and when he received a rebuke from St Paul, as already noticed. Whilst, however, it is pretty well established that Peter enjoyed no judicial supremacy over the other apostles, it would perhaps be going too far to affirm that no dignity or primacy whatsoever was conceded to him on the part of his brethren. His superiority in point of age, his distinguished personal excellence, his reputation and success as a teacher of Christianity, and the prominent part which he had ever taken in his Master's affairs, both before his death and after his ascension, furnished sufficient grounds for his being raised to a position of respect and of moral influence in the church and amongst his brother apostles. To this some countenance is given by the circumstances, that he is called "the first," πρωτος, by Matthew (chap. x. 2), and that apparently not merely as a numerical, but as an honorary distinction; that when the apostles are mentioned as a body, it is frequently by the phrase, "Peter and the eleven," or, "Peter and the rest of the apostles," or something similar; and that when Paul went up to Jerusalem by Divine revelation, it was to Peter particularly that the visit was paid. These circumstances, taken in connection with the prevalent voice of Christian antiquity, would seem to authorize the opinion that Peter occupied some such position as that of προεστως, or president in the apostolical college, but without any power or authority of a personal kind over his brother apostles.[4]

St. Peter

The extant writings of the apostle Peter are confined to two brief Epistles, of which the former has been universally admitted as genuine, whilst the latter has by many been re-

[1] *In Genesin*, lib. iii., ap.; Euseb. *H. E.* iii. 1. See also Euseb. iii. 4.

[2] "Petrus Passioni Dominicæ adæquatur." (Tertull. *De Præscrip.* 38.) See also Lactant. *De Mortibus Persec.*, c. ii.

[3] See Barrow's *Treatise on the Pope's Supremacy* (Works by Hughes, vol. vii., p. 207, ff.); Campbell's *Lectures on Eccl Hist.*, lect. xii.; Neander's *Geschichte der Pflanzung und Leitung der Christ. Kirche*, p. 479, Eng. trans., vol. i., pp. 377–383; Winer's *Biblisches Realwörterbuch in Petrus*, &c.

[4] Campbell's *Eccles. Hist.*, lect. v. and xii.; Barrow's *Treatise, ut sup.*, Works, vol. vii., p. 144, ff. &c.

jected as spurious. The grounds of this rejection, however, are extremely insecure, as they depend chiefly upon nice distinctions and analogies of style between the two Epistles, which are seldom drawn with such unerring accuracy as to induce us to attach very much weight to them.[1] The persons to whom these Epistles were addressed were converted Jews scattered over the districts enumerated by the apostle in the commencement of the first of them. The Epistles themselves are characterized by great vigour of conception, warmth of feeling, and force of eloquence. The style is glowing and rapid, approaching at times to vehemence; and the sentiments are of the most elevated description. The exhortation to holiness with which the second chapter of the first Epistle concludes is perhaps unequalled in the New Testament for the appropriateness of its sentiments, the beauty of its appeals, and the concentrated energy and rapid flow of the style; nor would it be easy to find any passage, either in sacred or profane literature, that should surpass in vividness of description and power of expression the prophetic view of the end of the world with which, towards the conclusion of the second Epistle, he enforces his exhortation to holy conversation and godliness. In both Epistles we trace the characteristic ardour and the elevated piety of their author, and of both we may justly say, in the language of the excellent Leighton, that they are eminently adapted "to establish Christians in believing, to direct them in doing, and to comfort them in suffering, often setting before them the matchless example of the Lord Jesus, and the greatness of their engagement to follow him." "Peter," says a recent German writer, "has, according to his own fundamental trait, conveyed the character of enduring firmness from the life of Christ to the church. The shadow sides of this fundamental trait have been represented in the Romish hierarchy; the light sides in the pure form of the church confessions, the church institution, order, discipline, and manifestations." (Lange, *Das Apostol. Zeitalter*, i. 357. See also Neander, *Gesch. d. Pfl. und Leit. der Christ. Kirch.*, p. 443-463, Eng. tr., vol. i., p. 368-383; Hug's *Introduction* by Fosdick, p. 635; Davidson's *Introduction to the New Testament*, vol. iii., &c.) (W. L. A.)

Peter *the Hermit*, the apostle of the first Crusade, was descended from a good family, and was born at Amiens in France about the middle of the eleventh century. The first part of his career was passed in obscurity. He served without distinction in the army of the counts of Boulogne, and then retired into the privacy of married life. It was not until 1095, after he had kindled and fostered a fanatical zeal in the solitude of a hermitage, that the real force of his character began to appear. Happening about that time to be on a pilgrimage to the Holy Sepulchre, and feeling enraged at the indignities offered by the Moslems to the scenes of sacred history, he formed the arduous project of wresting Palestine from the infidels. To return to Europe and lay his plan before the Supreme Pontiff was his first measure. The Pope approved of the enterprise, and sent him forth to preach a *crusade*. A bare-headed, bare-footed, little, shrivelled old man, mounted on an ass, wrapped in a coarse garment, girded with a rope, and bearing a heavy crucifix in his hand, Peter the Hermit rode forth to summon Christendom to arms. As he addressed the people that everywhere thronged his path, he rose to the highest fervour of enthusiasm. His lively imagination conjured up the scenes of profanity transacted in the Holy City; his keen eye kindled martial fire among the populace; he burst out at intervals into wrapt ejaculations to heaven; he drowned his voice betimes in a tempest of sighs and tears. How he succeeded in raising the first Crusade, and how he failed in conducting the expedition, is given under Crusades. The subsequent part of the Hermit's career is merged in obscurity. He died in 1115 in a monastery which he had founded in the diocese of Liège. (See Gibbon's *History*.)

Peter *of Blois* (better known under the Latin form of his name, *Petrus Blesensis*), a learned man of the twelfth century, was born about the year 1120, at the city of Blois in France, from which he derived his name. He studied first at the university of Paris, where he displayed a fondness for poetry and rhetoric. From Paris he proceeded to Bologna to study civil and canon law, a branch of knowledge in which he very much excelled. A long-lost work of Petrus Blesensis on canon law and process was discovered some years ago, and an account of it published in the *Zeitschrift für Geschichtliche Rechtwissenschaft*, vol. vii. From his writings it appears that he cultivated medicine, and several branches of the mathematics, with no little care and success. But the study of theology formed the chief delight and business of his life. Unfortunately, however, the theology he studied was of that scholastic kind which consisted in vain attempts to explain and prove by logic the many absurd opinions which then prevailed. In attempting to explain the doctrine of the real presence, as held by the Latin church, he was the first who employed the famous term *transubstantiation*, which was soon afterwards adopted by the church, and has ever since been retained. Being appointed preceptor to William II., King of Sicily, in 1167, he obtained the custody of the privy seal; and, next to the Archbishop of Palermo, who was the prime minister, he had the greatest influence in all affairs. His power, however, was not of long duration; for the archbishop being banished in 1168, Peter soon afterwards left the court of Sicily, and returned into France. But in a short time he found another royal patron, having been invited into England by Henry II., who employed him as his private secretary, made him archdeacon of Bath, and gave him some other benefices. Having spent a few years at court, however, he got tired of that way of life, of which in one of his letters he has drawn a very unpleasing picture, and retired into the family of Richard, Archbishop of Canterbury, who had made him his chancellor about the year 1176. In this station he continued until the death of the archbishop in 1183, enjoying the highest degree of favour with that prelate, though he used much freedom in reproving him for his remissness in the government of the church. He continued in the same station in the family of Archbishop Baldwin, who succeeded Richard, acting both as his secretary and as his chancellor. In 1187 he was also sent by the latter prelate on an embassy to Rome, to plead his cause before Urban III. in the famous controversy between him and the monks of Canterbury respecting the church of Hackington. After the departure of his friend and patron Baldwin for the Holy Land in the year 1190, Peter was in his old age involved in various troubles, the causes of which are not distinctly known; and he died in England in 1200. He appears from his works, which may be justly reckoned amongst the most valuable monuments of the age in which he flourished, to have been a man of great integrity and sincere piety, as well as of a lively, inventive genius, and uncommon erudition. His printed works consist of a great number of letters, which he collected together at the desire of Henry II., and of sermons and tracts. The best edition of his works is that of Pierre de Goussainville, Paris, 1667, fol.

Peter I., Czar of Russia, usually syled "The Great," was born in 1672, succeeded to the undivided sovereignty in 1689, and died in 1725. (See Russia.)

Peter II., Czar of Russia, grandson of the preceding, was born in 1715, ascended the throne in 1727, and died in 1730. (See Russia.)

Peter III., Czar of Russia, another grandson of Peter

[1] Horne's *Introduction*, vol. iv, p. 434, ff.; Sherlock's *Dissertation on the Second Epistle of Peter.*

the Great, was born in 1728, succeeded to the throne in 1762, and was strangled in the same year. (See RUSSIA.)

PETER'S PENCE, the name applied to an annual tribute of one penny formerly paid to the Pope at the festival of St Peter. In England every family possessed of twenty pennyworth of any sort of goods was considered liable. Ina the Saxon king, when he went in pilgrimage to Rome about the year 740, paid this contribution to the Pope, partly as alms and partly in recompense of a house erected in Rome for English pilgrims; and the same continued to be paid generally until the time of Henry VIII., when it was enacted that henceforth no person should pay any pensions, Peter's pence, or other impositions, for the use of the bishop or see of Rome.

PETERBOROUGH, a parliamentary borough of England, the county town of Northamptonshire, stands on the left bank of the Nen, here crossed by a wooden bridge, 40 miles N.E. of Northampton, and 76 N. by W. of London. It consists of several streets, close to the river, straight, well paved, and lined with good houses. To the west a suburb has been erected, which contains many handsome houses. The most important public building is the cathedral, a fine old specimen of Norman and early English architecture. It is in the form of a cross, of the following dimensions,—length, 476 feet; breadth of the nave and aisles, 78 feet; height of the ceiling, 78 feet; breadth at the transepts, 203 feet; breadth of the transepts, 69 feet; height of the central tower, 150 feet. Its most striking feature is the west front, which is an addition to the nave, and consists of three pointed arches 80 feet high, supported by clustered pillars, and surmounted by lofty pediments and pinnacles, while at each end rises a turret with a spire. The interior is beautiful and well proportioned, but contains few monuments or shrines, as it was stripped of most of its ornaments during the civil wars. Katherine of Aragon and Mary, Queen of Scots, were both buried in Peterborough cathedral; but no monuments mark the places; and the remains of the latter were afterwards removed to Westminster Abbey. At the west front of the cathedral is a court, containing various well-preserved remains of ancient monastic edifices. Besides the cathedral, Peterborough contains several handsome public buildings. The parish church is a large stone edifice; the town-hall is small but neat; and the corn exchange, built in 1848, is a handsome specimen of the Italian style, and contains a large market-room lighted from the roof. There is also a jail, and house of correction of Norman architecture. The Dissenting places of worship include Wesleyan, Independent, Baptist, and Primitive Methodist chapels. There is an endowed cathedral grammar school, which had, in 1854, thirty-three scholars; another endowed school, a national school, infant schools, a mechanics' institution with a library, and a savings-bank. The benevolent establishments comprise a dispensary, an infirmary, alms-houses, &c. The trade of Peterborough consists chiefly of corn and malt, brought down the Nen from the interior for export; and of coal, timber, bricks, and stone, which are imported. The principal manufactory is a large steam flour-mill recently erected. Peterborough is the seat of a bishop; and the dean and chapter have a certain jurisdiction over the town, as there is no corporation. Since the time of Edward VI., the borough has returned two members to Parliament. An abbey was founded here by Peada, the son of Penda, King of Mercia, during the time of the Heptarchy. Its original name was *Medeshamstede;* but this was changed to that of *Burgh*, *Gildenburgh*, or *Peter-burgh*, in the time of Edgar, when it was restored, after having been destroyed by the Danes in the ninth century. A village soon began to rise around it; but in 1116 this, as well as a large part of the abbey, was destroyed by fire. The restoration of the monastic buildings was soon commenced, and gradually carried on for a long time; and it was not till the beginning of the sixteenth century that the cathedral assumed its present aspect. At the time of the Reformation, Peterborough was one of the most magnificent of the ecclesiastical establishments, and was chosen by Henry VIII. as the seat of one of the new bishoprics. The monastic buildings were then preserved; but they were destroyed in the time of Charles I., and the cathedral itself much injured. Pop. 8672.

PETERBOROUGH, EARL OF. See MORDAUNT, *Charles.*

PETERHEAD, a parliamentary and municipal burgh and seaport of Scotland, in the county of Aberdeen, stands on a peninsula, forming the most easterly promontory of the mainland, 33 miles N.N.E. of Aberdeen, and 146 from Edinburgh. The streets are for the most part broad; and being exposed to the bracing breezes of the ocean, it is peculiarly exempt from epidemical diseases. It is well supplied with excellent spring water, brought from about 3 miles inland. The houses are built of the fine red granite which is quarried in the vicinity, and which takes its name from the town. Among the public buildings, the most important is the town-house, which has a handsome spire 125 feet high. The parish church, built in 1803, near the west end of the town, is also surmounted by a lofty granite spire of the height of 118 feet There are also places of worship belonging to the Free Church, the Scotch Episcopal Church, the United Presbyterians, Independents, Methodists, and Roman Catholics. The market-cross, erected in 1833, consists of a Tuscan column of granite, having on the top the armorial bearings of the earls marischal, surmounted by the Scottish lion. The principal educational establishments of the town are the parish school, the Free Church school, the academy, the Episcopal Church school, and the union or industrial school; and there are also a news-room and an extensive circulating library. There is a museum and a cabinet of coins of considerable value, the gift of the late Adam Arbuthnot, Esq.; but from want of adequate accommodation, these collections have not yet been rendered properly available. There is a sick benefit institution, and several friendly societies. The manufactures are not extensive; but there are large bone and saw mills, an iron foundry, a woollen cloth manufactory, a rope-work, breweries, and a brick and tile work, besides extensive premises for oil-boiling and the other processes connected with the extensive fisheries which are carried on. Peterhead ranks high as an enterprising commercial and seaport town. Here the Greenland whale and seal fisheries have been carried on since 1788. At present there are 28 vessels employed in that trade, of 7885 registered tons, and manned by 1385 seamen. This number exceeds that of all the vessels in the trade from the other ports in Great Britain. During the nine years from 1849 to 1857 there were brought to Peterhead the produce of 651,474 seals and 207 whales, which, besides the seal-skins, yielded 10,863 tons of oil and 2783 cwt. of whale-bone, and the value is estimated at L.550,398. The herring fishery is also extensively carried on, the number of boats commonly ranging from 230 to 400 annually, ranking in this respect second only to Wick among the stations on the coasts of Scotland. The white fishery is actively carried on at the villages in the neighbourhood, and the fish is brought to Peterhead for shipment to the London and other markets. Besides the exports arising from the fisheries and the agricultural produce of the district, there is a considerable export of granite from the extensive quarries in the vicinity. It may be obtained in very large blocks, and when polished is very beautiful. The pillars in the British Museum, the docks at Sheerness, the York column in London, and many other public works, are of Peterhead granite; and in a polished state it has been used in many ornamental designs. The principal imports consist of British and foreign timber, tar, hemp, coals, lime,

manure, salt, iron, wool, soft goods, groceries, flour, and wooden hoops. Peterhead has a custom-house on the full establishment for the district, which includes Fraserburgh and Boddam. Ship-building is carried on to some extent. The number of sailing-vessels registered as belonging to the port on December 31, 1857, was 74, tonnage 13,419; steam-vessels 2, tonnage 327. During 1857 there entered the port 544 sailing-vessels, tonnage 59,389; and 26 steam-vessels, tonnage 3978; while there cleared 406 sailing-vessels, tonnage 18,827; and 26 steam-vessels, tonnage 3978. Peterhead possesses two harbours, the north and the south, which communicate by means of a canal; and thus vessels may enter and leave the one or the other in any wind. That portion of the peninsula thus formed into an island is called Keith Inch, and is connected with the mainland by an excellent swing-bridge with a double roadway. The south harbour has a depth of 11½ feet of water at medium spring-tides, and the north harbour 16½ feet. They have together an area of about 17 imperial acres, and are protected by substantially-built breakwaters, within which are commodious quays and piers. There are also two excellent graving-docks, where repairs can be speedily made on vessels under 600 tons. The south breakwater was constructed in 1773, according to a plan by the late Mr Smeaton, engineer; and the north breakwater in 1818, according to a plan by the late Mr Telford. About L.105,000 have been expended on the building and improving of these harbours and docks since 1773, of which L.15,000 was obtained from government by grants from the forfeited estates fund. The harbour revenue amounted for the year 1857–8 to L.4392. The importance of the harbours is enhanced by their being situated near the outer extremity of the south bay, a beautiful sheet of water, nearly 2 miles across, and extending more than a mile inland. It has ample depth of water for a fleet of the largest vessels, and its anchorage is of a very superior description. To protect this bay with proper breakwaters is all that is necessary to make it a national harbour of incalculable value. So long ago as the reign of Charles II. the importance of the harbours of Peterhead as a port attracted the attention of the legislature, and an act was passed for their improvement; and since then, from time to time, public attention has been directed to them. At present they are being made the subject of inquiry by a royal commission appointed to report on the best site for a harbour of refuge on the east coast of Scotland. For this purpose, from what has been said, it will be seen that Peterhead offers many advantages. It is also nearly midway between the firths of Forth and Cromarty, it occupies a salient position on the coast, and is the nearest point of Britain to the Baltic. About 240 vessels take shelter annually in these harbours, and about 600 in the south bay, in its present unprotected state, which prevents its being available in the winter months. A railway between Aberdeen, Peterhead, and Fraserburgh is about to be constructed, which will materially contribute to the prosperity of the town. Peterhead was for upwards of two centuries a favourite watering-place, and its mineral waters were in repute for stomach and bowel complaints, nervous affections, and general debility. Sea-bathing is also to be had here, either on the shores of the open sea, or in the baths, of which there are two for the different sexes, with hot-water vapour baths, &c. Peterhead was erected into a burgh of barony by George, earl marischal, in 1593, previously to which it was an unimportant fishing village. A large portion of the lands in the parish continued to belong to the marischal family till 1715, when they were forfeited to the Crown, the then earl having actively espoused the cause of the Stuart family. The estate was then purchased by the York Building Company, who sold it in 1728 to the governors of the Merchant Maiden Hospital of Edinburgh, who still continue to be the superiors of the town. By the original charter in 1593, the earl marischal established a municipal government in the town, and the system continued till the passing of the Burgh Reform Act in 1833, which conferred on the town the privilege of electing a provost, three bailies, and a treasurer, out of a body of twelve councillors appointed by the electors. Peterhead unites with Elgin, Cullen, Banff, Inverury, and Kintore in returning a member to Parliament; and its constituency amounts to 250. The population of the burgh in 1851 amounted to 7747, besides about 500 absent seamen. The rental of property within the burgh amounts to L.14,081. The assessment for poor in the parish in 1858 was L.2200. The remains of two ancient small forts, and the ruins of Ravenscrag, and of the castle of Boddam, are in the vicinity. Ravenscrag is a fine specimen of an old baronial castle, not in a very dilapidated state. The walls are in many places 11 feet in thickness; and the date of its erection is assigned to the eleventh or twelfth century. The ruins of Boddam Castle stand on a narrow promontory immediately south of Buchanness, on each side of which there is a deep chasm, forming precipices of great height. A good many relics of antiquity have at different times been found in the neighbouring parishes.

PETER-LE-PORT, or St Peter Port, the chief town of the island of Guernsey, on a bay on the east coast. It is built on the slope of a hill, and extends nearly a mile along the shore, presenting a very fine appearance from the sea, as the houses rise one above the other along the slope. In the Old Town, the streets are narrow, irregular, and steep, and the houses old and gloomy-looking; but the New Town, as the upper part of St Peter Port is called, and especially Hauteville, which lies to the S.W., are more modern, and much better built; while the neighbouring country is extremely beautiful, and is studded with villas belonging to the gentry, who seldom reside in the town itself. Among the public edifices, one of the most important is the government-house, a large though somewhat heavy building. Near it stands Elizabeth College, founded in 1563 by that queen, and rebuilt (1826–30) in the Tudor style; and not far off is Victoria Tower, erected in honour of the Queen's visit to the town in 1848. St Peter's church, built in 1312, has a tower with a low spire in the centre, and is a good specimen of the flamboyant style of architecture; and there are in the town a number of other churches and chapels belonging to Methodists, Independents, Baptists, Quakers, Roman Catholics, and Plymouth Brethren. The town has also a neat court-house, custom-house, prison, public library, assembly-rooms, and theatre. Besides the college, which has three fellowships and five scholarships at Oxford, there are several schools, as well as a mechanics' institution, with a library of 3000 volumes. The principal charitable establishment is the town hospital for the sick and destitute. The harbour of St Peter Port, formed by two piers 80 feet apart at the entrance, is hardly large enough for the trade of the place. The roadstead, however, affords good anchorage, and is sheltered from the S.W. Two forts, Castle Cornet, an ancient and picturesque structure on a small island within half a mile of the shore, and Fort George, on the heights about half a mile south of the town, form the defences; and the latter is a place of great strength. The articles manufactured in St Peter Port are tobacco, snuff, soap, candles, bricks, ropes, cordage, cider, and spirits. The principal exports are granite, bricks, cement, potatoes, fruit, and vinegar; the imports, grain, fish, and other articles. St Peter Port sends seventy members to the States of Election, and six to the States of Deliberation. Pop. of parish (1851), 16,778.

PETERS, or Peeters, Bonaventura, a Dutch artist, was born at Amsterdam in 1614. He soon attained great excellence as a marine painter. His storm-pieces repre-

Petersburg. senting a ship foundering upon a rock, and sailors clinging to spars amid the raging surf, were executed with great truth and originality. Scarcely less successful were his pictures of a calm sea-shore, with towns and castles on the coast, and of a sluggish river, with boats and barges sailing before a gentle breeze. He might have risen to still greater proficiency had he not died prematurely in 1652. Bonaventura Peters had a younger brother Jan, who imitated him both in style and in the choice of subjects.

PETERSBURG, or more correctly *St Petersburg*, at present the capital of the Russian empire, the residence of the sovereign, and the official centre of the administration, occupies the most northern position of any large place upon the globe, being in 59. 56. N. Lat., and 47. 58. E. Long. It stands about 20 miles above the mouth of the Neva, on a species of alluvial delta formed by the division of the main current into a multitude of smaller branches, and so exceedingly low as to have been originally almost on a level with the surface of the Gulf of Finland. It is only by the artificial elevation of its marshy soil to from 2 to 5 feet above its original level, that it has been effectively drained, and rendered comparatively free from inundations.

The capture, from the Swedes, in 1702, of Noteburg (now Schlusselburg), a fortress situated at the point of exit of the Neva from Lake Ladoga, together with the taking, in the following year, of the fort of Nyenschantz, by making Peter the Great master of the whole course of the river, seem first to have inspired that active prince with the idea of establishing here a strong military post and a commercial port. On the 16th May 1703, he laid, with his own hands, the foundation of the fortress which still exists in the centre of the city, and to which he gave the name of Petersburg. It is, however, highly improbable that the gigantic project of founding here the capital of an extensive empire could have at first possessed his mind; and it was not till the great victory of Poltava, in 1709, had made him master of the whole southern shore of the Gulf of Finland, that he ultimately determined upon the violent and entirely artificial creation of a city which has been well styled "a loophole by which the light of western trade and civilization was to be admitted into the darkness of half-oriental barbarism" in which Russia was then buried. In a letter written by Peter on the field of battle, announcing to Count Apraxin the important victory he had just gained at Poltava, he significantly says:—"The foundation-stone of Petersburg, which has been for some time ready, is this day, with the blessing of God, definitely laid."

The construction of the city once determined on, Peter proceeded to execute his project with a barbaric energy and ardour which no obstacles could check or abate. The workmen first employed were Finns from the neighbouring districts, Swedish prisoners of war, and criminals condemned to hard labour; but in the end of the year 1709 orders were given to assemble from all parts of the empire, and even from Siberia, skilled workmen and labourers, in two divisions, each consisting of 20,000 men, which relieved each other in spring and summer. Exclusive of these, a large body of masons and bricklayers was separately organized for the purpose, and a forced levy was imposed upon the whole district in the vicinity of Moscow, of 3000 men with axes, of whom every tenth man was to be supplied with carpenter's tools and a horse. This levy amounted to 1 person on every 35 families; and the remaining 34 houses were obliged to give a money contribution, amounting to 2 *altūins* (equivalent to 15d. of our money), in lieu of personal service. During the first four years, it is calculated that 150,000 men were sent to the works at St Petersburg; and in order still further to accelerate its construction, Peter forbade, under the severest penalties, the erection of any brick or stone buildings throughout the empire. By means of this species of impressment, which continued uninterruptedly for nine years, the works rapidly advanced; but at a terrible cost of human life, caused by the unhealthy climate and the nature of the labour. At length it was found expedient to change the system of obtaining labour; and in 1718 the works were distributed among private contractors, and the compulsory impressment was replaced by a pecuniary impost.

Nor were less severe and arbitrary measures employed for peopling the infant capital. The first inhabitants of the city consisted of the labourers collected from the interior of the empire, whose number, in 1713, amounted to 2500 persons, not including 1100 immediately attached to the imperial residences. No voluntary settlers making their appearance, Peter decreed—1. That all persons under age, of noble condition, who were not receiving a public education or attached to the public service, should be obliged to reside in St Petersburg. 2. That all persons attached to the court, and other nobles proprietors of 30 serfs and upwards, should likewise be obliged to immigrate to the new city, and should erect houses there. 3. That a colony of 300 persons from the mercantile community of Moscow, and 300 artificers from the same city, should be transplanted to Petersburg, and 4. In 1717 orders were given to the provincial municipalities, under pain of the severest punishments, to select from the mercantile and artizan classes a certain number of respectable and wealthy families, and to transfer them without delay to St Petersburg. These severe and violent expedients, however, were not always successful in attaining their object: the nobility, under various pretexts, evaded an order which forced them to inhabit a region buried in dreary forests and pestilential marshes; and the settlers from the inferior classes profited by every opportunity to escape. But no obstacles could arrest the indomitable will of Peter: his severe regulations still continued to be enforced, though occasionally with some relaxation (thus, for example, in 1719 the nobles were permitted to absent themselves from St Petersburg, and to visit their estates, but only for five months at a time), and it was not until 1721 that the public offices and state tribunals were transferred from Moscow to the new capital.

The construction of Petersburg began with that portion of the present city which lies in the immediate vicinity of the fortress, on the northern or right bank of the Neva The founder's intention was to cover the Vassílievskii Island with streets and houses, to surround it with defences, and to intersect the whole with numerous canals, like Amsterdam and other towns, which he had doubtless admired, in Holland This project, however, was not executed. During the reign of Peter some portions of the Admiralty quarter (on the southern bank) began to be built upon; and it is to this period that we must ascribe the erection of the following important edifices, some of which either no longer exist, or have been transformed to other purposes:—The four palaces (the Summer Palace, the Winter one, that of the Tsarévitch Alexéi, and that of the Tsarévna Natália), the cannon foundry with its village of habitations for the workmen, the admiralty, the galley-wharf, the Gostíinnui Dvor or bazaar, and several residences of high functionaries. Some of the measures adopted by Peter to make his new capital the principal seat of foreign trade with the countries lying on or beyond the Baltic were as arbitrary as those by which he built and peopled the city; for example, in 1717 the port of Archangel was forbidden to export more than one-third of the whole amount of its goods, while the remaining two-thirds were to be sent to Petersburg. In consequence of these protective measures, the foreign trade of the new city soon began to exhibit a rapid development; so much so, that in the last years of Peter's reign the number of foreign vessels that entered at Cronstadt (which was founded at the same time with Petersburg, and of which it forms the port) had risen to 120, or at least one-tenth of the amount at the present day.

The death of Peter the Great was followed by the abandonment or the neglect of those energetic measures which were indispensable for the prosecution of a task so artificial as the construction of a capital in an unfavourable site; and the inhabitants, under various pretexts, left unfinished the erections they had begun. To complete the disorganization, a number of fires occurred in 1736 and 1737, unquestionably the work of incendiaries, whose obstinacy could scarcely be overcome by the severest punishments. Many spots thus became unoccupied, and multitudes of families remained without a shelter, the devastated ground being allotted, without regard to the rights of the former occupants, only to such persons as would undertake to build without delay. To put a stop to these irregularities, the Empress Anna Joánnovna ordered the formation of a committee, of which Münich was president, charged with superintending the rebuilding and extension of the city. In general, it may be said that the town began to improve again during this reign: it was divided into five wards; and about 1737 it numbered more than twenty churches and 70,000 inhabitants.

Under the Empress Elizabeth Petróvna, the violent measures employed to secure the peopling of Petersburg began gradually to be modified and relaxed. The inhabitants acquired the right of purchasing and selling houses, and all classes now exhibited a gradually increasing willingness to settle in the new capital. Towards the end of this reign the population reached 150,000. Among the skilful architects invited from foreign countries to contribute to the adornment of the city was the famous Rastrelli, who constructed the Winter and Anitchkoff palaces, the beautiful church of the Smolnoi monastery, and the houses belonging to Count Strógonoff, to Voronzóff (now the Page-Corps), Razumóffskii, and Bóbrinskii (at present the Foundling Hospital). To this reign also belongs the erection of the cathedral of St Nicholas of the Sea, the church of the Annunciation in the Haymarket, the brick bazaar, or Góstinnoi Dvor, and many other edifices which still adorn the city.

The Empress Catherine II. exhibited an enlightened policy in

abolishing all the oppressive regulations which had been intended to promote the development of St Petersburg, and succeeded in attracting thither considerable numbers of the middle and industrious classes, by the advantages and privileges she accorded to such as were willing to settle there; so that towards the end of her reign the population had reached 220,000, and the town was divided into ten wards, containing 4600 houses, one-fifth of which belonged to the state. Among the remarkable edifices of this epoch we may specify the cathedral of the Alexander-Névskii monastery, the Marble and Tauride palaces, the Hermitage, and the Academy of Arts.

During the short reign of Paul considerable attention was given to the more equable allotment of the municipal imposts, and to the relief of the inhabitants from the billeting of troops: for the latter object several barracks were constructed; and the reforms begun in this reign were carried out by the emperor's successor, Alexander I. Few important additions were made to the architectural beauty of the city,—the most considerable being the castle or palace of St Michael, then strongly fortified, and surrounded by a fosse. It is to the reign of Alexander I. that Petersburg owes the regularity of its appearance, as well as a number of its most ornamental edifices; among which we may particularize the cathedral of Kazán, the Preobrajènskii church, the palace of the late Grand Duke Michael, the vast *Etat-Major*, the Great Theatre, the Exchange, and others. Towards the end of this reign the city contained 7600 houses and 400,000 inhabitants.

During the administration of the late Emperor Nicholas many new edifices and monuments were added to those already existing; as the cathedral of the Holy Trinity, the Senate, the cathedral of St Isaac, the custom-house, two theatres, the offices of the departments of the interior and public instruction, the Technological Institute, a number of vast barracks, the Alexander column, &c. At the commencement of the present reign Petersburg may be regarded as covering a space of more than 80 square versts (26 square miles), as containing 8230 houses and 480,000 inhabitants.

The river flows through a space of about eight miles within the city, and divides, at nearly the centre of this part of its course, into three principal branches,—the Great Nevà, the Little Nevà, and the Névka, separating the town into four districts or "sides;" that of the Admiralty (lying on the left bank), that of the Vassílievskii Island (in Russian, *Ostroff*), that of Petersburg, and that of Viuborg. The width of the Great Nevà varies extremely in different parts of the city: at its broadest point, a little above the fortress, where it is crossed by the Tróitskii (Trinity) Bridge, it is 2100 feet from bank to bank; while at other points it varies from that to about 1000 feet. The banks of the principal arm, during its passage through a great portion of the city, are on both sides lined with most magnificent granite quays, of a truly Roman grandeur and solidity of construction. The latter being furnished with an almost uninterrupted *trottoir* for foot-passengers, and broad roads for carriages, give to the city that monumental character of regularity and splendour which renders this capital in some respects the most imposing in Europe. The intensely blue colour and purity of the waters of the Nevà, and the rapidity of the current, give to this beautiful river the appearance of being always full, and render it a main ornament to the capital. The rapidity of the current is indicated by the number of cubic feet of water flowing in one second at the following places:—Above the Nevskii monastery, 114,659½; below the Okhta, 115,103¼; at the Summer Garden, 89,932⅔; opposite Baird's foundry, 73,983½. The depth of the stream is also extremely unequal; being greatest within the limits of the city, generally diminishing after the principal stream divides into branches, and below the town having its bed so encumbered with sand-banks as to leave but a very narrow and winding channel for allowing vessels—and only those of very moderate burthen—to come up to Petersburg, where are situated the custom-house establishments. All large ships are thus obliged to discharge at Cronstadt, where they remain, while their cargoes are carried up and down the Nevà by lighters. The expense and inconvenience of this trans-shipment is great; and the delay so considerable, that a cargo is often longer in its transit from Cronstadt to Petersburg than in its voyage from London to Cronstadt in a sailing-vessel. Steam-tugs have only been for a comparatively recent period employed on the river. Men-of-war, all vessels of large size, built at Petersburg, have to be transported, even when empty, by means of "camels," over the shallows which obstruct the navigation below the city. The water of this river is unusually pure, light, and transparent, and is found to be very wholesome; but when used by strangers for the first time it not unfrequently produces a slight derangement of the digestive organs. A chemical analysis of the water, made by Hess, established the fact of its remarkable purity, 109 lb. giving only 47·2 grains of foreign ingredients.

Petersburg being far above any tidal influence, the destructive inundations which from time to time have occurred arise from the direction and long continuance of violent winds, combined in some cases with the melting of the ice in Lake Ladoga. Strong southerly gales, afterwards veering to the S.W. and W., by driving a large body of water up the gradually-narrowing bed of the Gulf of Finland, have on many occasions raised the level of the water in the Nevà 7, 9, 10, or more feet, causing it to overflow its banks, and spread devastation and ruin over the low-lying quarters of the city. Since the foundation of Petersburg, thirty-five considerable inundations have been recorded, the most violent and disastrous having taken place on the 10th September 1777, and 7th November 1824. On the former of these dates the water rose to 10½ feet, and on the latter to 14 feet above its ordinary level. The western quarters, or those lying nearest the sea, suffer most from these calamities; those quarters which lie farthest from the sea having never been at all damaged. It is probable that these inundations will become gradually less and less frequent, partly from the silting up of the mouths of the river, and also partly from the upheaval which the bed of the eastern portions of the Baltic is gradually undergoing.

The Nevà, from the rapidity of its current, would probably never be frozen over but for the immense quantity of ice floated down from the Ladoga, which, after covering the river for a longer or shorter time in drifting masses, is ultimately frozen into a solid mass, sometimes attaining, in prolonged seasons of severe frost, a thickness of 3 or more feet, and supplying the inhabitants with excellent sledge-roads, as well as a large course for trotting matches, which is annually erected in view of the Winter Palace. The surface, however, is usually at first very uneven, presenting huge blocks of ice of the most irregular and fantastic shapes; and it is not till all the inequalities are levelled by a thick coating of snow, that a sledge, much less a skater, can make its way among its jagged edges.

The period at which the Nevà is definitively frozen over varies from the latter half of October to the first half of December: in general, however, it is covered with ice about the middle of November. The ice remains without breaking up in general to about the middle of April, though there have been years when the opening of the river occurred as early as the 20th of March, and as late as the end of April, O.S. (*i.e.*, the 12th of May). The mean duration of the time during which the river remains covered may be said to be 146 days. There have been years—as 1816—when the river, after the breaking up of the ice, has been again frozen over; but such events are rare. About a week or a fortnight after the breaking up of the ice upon the river itself, large masses of that which covered the lake begin to come down; and this lasts for a considerable time. The processes of freezing and of breaking up of the ice are of longer or shorter duration according to the state of the weather; and while the ice is passing, the bridges of boats being necessarily removed, the only communication with the opposite shore was formerly by means of small boats somewhat resembling the caiques of the Bosphorus. Occasionally even this mode of transit was rendered impossible by

Petersburg. the density of the floating stream ice, and then all communication whatever was interrupted for hours, and even in some instances for a whole day. The completion, however, of the handsome new bridge—of cast-iron, resting upon granite piers—projected and terminated in the reign of the late emperor, has in some measure remedied this inconvenience; but Petersburg is still very deficient in bridge accommodation of a permanent character.

Independently of the arms or branches into which the Nevà divides, the city is intersected by a number of canals. Of these, the most considerable is the Fontânka, which has a general depth of 11 feet, and a breadth of about 180 feet, admitting a multitude of the rude and cumbrous barges or "barks" which bring firewood, hay, grain, &c., from the interior of the country. Watermen also ply for hire upon these canals; and at short intervals large roofed and windowed barges are permanently moored, serving as floating shops for the sale of fish, which are kept alive in boats alongside sunk almost under water, and thus can be supplied even in the severest winters. Besides the Fontânka, five other canals might be mentioned, but they are all much inferior to it both in depth of water and in breadth. They for the most part follow a more or less curved direction, communicating at both extremities with the Nevà; and thus all possess some degree of current, though generally of a force insufficient to secure them from silting up, unless periodically deepened by artificial means. They unquestionably add much both to the beauty and the salubrity of the town, though they are hardly rapid enough for perfect drainage; and in the intense heats of a Petersburg summer the effluvia from them are sometimes disagreeable. They are crossed by about 170 bridges, generally of stone piers with a drawbridge, to allow the passage of vessels; but as masted craft now never enter them, the latter arrangement is rapidly giving way to the use of iron, and several of them are on the suspension principle. The number of these canals, which in traversing the city in any direction the traveller is perpetually crossing, gives to St Petersburg an appearance quite original and characteristic, unlike that of Venice, and no less dissimilar to that of the great cities of Holland, but still very striking and remarkable. The great feature of the canals is the interminable lines of majestic granite quays with which these avenues are everywhere lined and bordered, in nothing inferior to the noble structures of the same kind with which the Nevà is bound in during so large a portion of its course within the city. The water in the canals, from the sluggishness of the current, and the great amount of sewerage delivered into it from the houses, is of no very inviting purity. All the drinking-water of the inhabitants is supplied from the river, and is taken through the town in barrels placed upon wheels and drawn by horses. The employment of the steam-engine and high-pressure service-pipes has not yet been generally adopted.

For purposes of police and administration, Petersburg is divided into thirteen quarters (*tchast*) as follows:—The four Admiralty quarters, Litêinaia (Foundry), Moscow, Narva, Karétnaia (Carriage), Rojéstvenskaia, Vassílevskii Island, Petersburg, Wyborg, and Okhta. Each of these is subdivided into from three to six wards (*kvartál*), with the exception of the last, which has only two.

Of these it may be remarked that, generally speaking, the four Admiralty quarters, and that of the Litéinaia, all lying on the southern or left bank of the Nevà, are more particularly inhabited by the richer and fashionable classes, and by the higher order of government officials, and are the seat of the principal public buildings and most imposing monuments; while the Vassílievskii (Ostroff) is the chief centre of commerce and of learning (containing the exchange, the custom-house, the academies of arts and sciences, and the university); and the Petersburg, and still more the Wyborg quarters, must be looked upon as the poorest and most remote districts. The various branches of the Nevà form a considerable number of islands, some of which are covered with country houses and gardens, the summer residences of the higher classes. The principal of these are the islands of Yelâghin (where there is a summer palace of the emperor), Kâmennii, Krestóvskii, Petróvskii, and Aptékarskii, or Apothecary Island, so called from the botanic garden which has been established on it. Most of these are laid out in a park-like manner; and in summer, when their numerous fantastic villas are inhabited, they present an animated and beautiful appearance.

The general disposition of the streets in the Admiralty district of St Petersburg is monotonously symmetrical. The central point is the enormous square, or "place" (for it is far from being a square), of St Isaac, on which stand the Winter Palace, the Admiralty, the Senate, the cathedral of St Isaac, and other important monuments and public buildings. From this square, diverging like radii of a circle, the centre of which is the chief entrance of the Admiralty, crowned with a lofty gilded spire, visible from every point of the city, run three great principal streets or *prospekts*, forming a small angle with each other, and extending, in perfectly straight lines, to a great distance. Of these, the widest and handsomest in the town is the famous Névskii Prospect, not much less than 3 miles in length from its origin to its termination at the monastery of St Alexander Nevskii; the next is the Gorókhovaia (Pease Street); and the third the Voznessénskaia (Street of the Ascension), each about half the length of the Nevskii, and large and busy thoroughfares, though inferior to the first both in width and in the number and splendour of the houses which line them. These three main avenues are themselves traversed, nearly at right angles, by a number of transverse streets, among the principal of which are the Great Morskâia, the Great Garden Street (Sadóvia), the Vladimirskaia, and others. All the streets, with the exception of a few in the remoter and poorer quarters, are paved with small stones; but some of the principal ones are laid down with wooden hexagon blocks, as was tried some years back in London; and provided with flagged footways. The latter are in the Nevskii of ample, and even almost superfluous width; but in the more busy and less fashionable quarters they are much cramped by frequent openings to steps leading downwards to cellars and underground shops.

The Vassílievskii Ostroff, the next important quarter of the town, is laid out with mathematical and almost fatiguing regularity. Running parallel with the Nevà, and with each other at equal distances, are three prospects, the Great, Middle, and Little, and these are intersected at exactly equal distances, and at right angles, by a great number of streets called lines, known by their successive numbers up to nearly thirty. The word "line," as here used, indicates not the whole street, but only the row of houses forming one side of it; so that each street consists of two "lines." The roadway of all the streets, instead of, as in England, forming a rounded surface, which is highest in the middle, slopes downward from each side towards the centre, which being the lowest part, forms a channel along which the rain or melted snow is directed. The streets of the city present in general a showy, and even grand appearance; the great height and immense size of the houses, and the uniformity of their appearance,—the police regulations obliging each proprietor to employ stucco or whitewash in which only a moderate selection of tints is permitted,—all contribute to confirm the appropriateness of the title of "City of Palaces" which travellers have given to St Petersburg. But after a short residence, the impression of magnificence which this capital at first excites gives way to an overpowering feeling of monotony and artificial, or rather *mili-*

 tary formality and stiffness; and the "City of Palaces" seems gradually to have transformed itself into a city of barracks. The eye and the imagination seek in vain for that stamp of individuality, that atmosphere of national character, which gives a kind of mingled strangeness and homeliness to cities much inferior to St Petersburg in architectural pretension, and which forms, so to speak, the *physiognomy* of a place. Here all seems obtrusively to assert that the whole was a creation of yesterday, the effort of single will; and the stranger cannot refrain from feeling that, as a mighty individual breath called up from the swamps of Ingria this wondrous exhalation of artificial magnificence, it might again pass into nothingness without occasioning any void among the nations of Europe. The total number of streets in Petersburg is rather above 450. They are tolerably well lighted—the principal thoroughfares with gas, the others with lamps. For the protection of the city and the preservation of order, Petersburg is under the charge of a military and civil governor, and of a grand master of police, who has under him the chiefs of the quarters (*tchástnii prístav*), and their subordinates the ward-officers (*kvartálnii*), each of whom has a certain fixed extent of jurisdiction. In each quarter there is an office for the transaction of police business, having among others a bureau for the registration of passports, &c., a tribunal, a lock-up house for criminals and disorderly persons, and a station for firemen, who are all soldiers; and indeed the whole of the police are organized in military fashion, the officials wearing the military uniform and enjoying military rank. The police-station of every quarter is furnished with a lofty tower, in which a sentinel is continually on the look-out for the first indications of a fire. Signals are immediately given by a certain number of black balls by day, or lanterns by night, hoisted on an iron frame, which crowns the look-out tower; and the point where the fire has occurred being instantly communicated to all the stations, a large number of men and engines are speedily on the spot. By one of the curious half-oriental customs which abound in this country, the emperor, when in Petersburg, or at all events some member of the imperial family, is almost invariably present at any fire that breaks out. The corps of firemen consists of about 950 persons, with 52 engines, to which, in case of need, could be added a large number of men and engines belonging to the regiments of the guard. At frequent intervals, generally at the corners of the streets, are erected small wooden watch-houses, called "búdkas," at the door of which stands a sentinel, till lately armed with a species of halberd or battle-axe. Of these erections there are altogether 310 in the city, to each of which are attached three watchmen, who relieve each other in mounting guard day and night. In spite of the number of its functionaries and the elaborateness of its organization, the police of St Petersburg is one of the worst and most inefficient in Europe; and the rarity of any important disturbance of public tranquillity is to be attributed rather to the extreme docility of the national character, than to the ability or intelligence of the police. The salaries allotted by government being in most cases ludicrously inadequate either to the securing of personal integrity, or even to enable the various functionaries to maintain the style of living which it is nevertheless expected they will keep up, have rendered the Russian police notorious for corruption and dishonesty, and the bad reputation of the body—bad even in a country where the plague-spot of official peculation is so widely spread—has tended to exclude from its ranks not only men of comparatively respectable position and education, but even all such as set much store by the good opinion of society in general.

Petersburg is remarkable not only for the width and regularity of its streets, but for the number and occasionally the enormous extent of its squares, a few of which have a central inclosure planted with trees, as in London, but the greater number corresponds rather to the French "place," being properly squares neither in regularity of form nor in possessing the ornament of gardens. Many of them are so vast and empty as to destroy all impression of grandeur by leaving no proportion between the height of the buildings that surround them and the huge desert of their expanse. The largest and most imposing of them all is the enormous irregular space made up of the different squares respectively styled those of the Winter Palace, bounded by that edifice, the Etat-Major, and extending along one end of the palace to the river; of the Admiralty, giving off the Nevskii Prospect and the Gorokhováia opposite the centre of the last-named building; of St Isaac; and of the Senate. Vast and striking as are the numerous edifices which line various parts of this great inclosure, they fail to produce their full effect upon the eye, and they appear insignificant in comparison with the extensive desert amid which they rise. Of the other squares, the most important are the Sennáia, or Haymarket, which is the largest and best-frequented mart for provisions, and where the frozen animals, skinned and preserved whole, form in winter a spectacle so new and curious to the stranger in Russia. The Champ de Mars, as it is generally called, though its proper name is Tsarítzin Lug, is a vast and very beautiful inclosure for the parading of troops, and is rendered more attractive to the eye by being bounded on two sides by the lofty trees of the summer garden, and the grounds of the palace of the late Grand Duke Michael. What adds to the beauty of this parade-ground is its being close to the Marble Palace, the Place of Suvoroff (where is a bronze statue of that distinguished general), the handsome barracks of the Pávlovskii regiment, and the castle of St Michael. The two squares which most accurately correspond to the idea conveyed to an Englishman by that term are those in front of the Alexandra Theatre, and of the principal façade of the Michael palace. We may also mention the Rumiántzoff square on the Vassílievskii Ostroff, adorned by an obelisk dedicated to the memory of that marshal; the square in which stand the great theatre and the new circus (a very graceful and ingeniously-planned building); and the numerous extensive parade-grounds in different parts of the town, generally in the immediate vicinity of the barracks of those regiments for whose use they are designed. Among these, the most important are the exercising-grounds of the Preobrajênskii regiment (470 by 350 yards), of the Semeónovskii (700 by 470 yards), and of the Izmáilovskii regiment, of dimensions hardly inferior. The Champ de Mars, of which we have already noticed the position, is a rectangle of 525 yards in length by 290 in width; and here take place, particularly on the 1st May, those great parades of the guard in which as many as 60,000 troops, of all arms, are sometimes assembled in one evolution. At the barrier on the Narva and Moscow roads are erected very imposing triumphal arches, the former to commemorate the exploits of the Russian guard during its campaigns against the French, and the second in celebration of the services of the Russian troops in Persia, Turkey, and in the pacification of Poland during the reign of the late emperor.

The general proportion of brick to wooden dwellings in St Petersburg is as 3 to 5; but this ratio varies exceedingly in the different quarters,—in the wealthier being as high as 4 to 3, while in one of the poorer and more remote districts there is only one brick house to 23 wooden dwellings. Generally, also, the size of the houses, and consequently the average number of inhabitants to a house, increases in a direct ratio to the opulence of the particular quarter we may be examining: thus the highest average number of dwellers under one roof is found in the three first Admiralty quarters, the most fashionable portion of the city, where the ratio varies from 115 to 150, and

even as high as 200 individuals to a single house. Many of these residences are therefore of very great extent; and they are generally built round one or even several court-yards, with a carriage-entrance, or *porte-cochère*, from the street, and a multitude of staircases, similar to the arrangement of the inns of court in London, leading to the various apartments. It is consequently very rare to find a single family occupying a whole house; and it is only a few great aristocratic families of unusual wealth whose means enable them to monopolize an entire dwelling. By far the greater number of persons in the upper and richer classes of society rent lodgings or "apartments," as they are called by the French, of a style and extent commensurate with their means. These are generally all on one floor, or "flat;" and the rooms being generally *en filade*, are at once showy on ceremonial occasions and sufficiently convenient in ordinary life. The kitchen and other offices are for the most part on the same floor. Stables and coach-houses are in most cases constructed in the lower storey of the house, opening on the interior court-yard. Shops are common enough even in the largest and most splendid houses; and it is only in comparatively few instances that the proprietor refuses to allow a shop to be established even in a dwelling which has in other respects almost the aspect of a palace. The rooms are almost universally heated by large stoves of white earthenware tiles, or cast-iron painted to imitate marble. The fuel is wood; though an increasing taste for the use of the English grate, and the gradually-growing adoption of coal, together with the increasing dearness of firewood, seems to indicate that in course of time the latter combustible will come into general use. Russia possesses extensive deposits of coal; but the great expense of transport renders it much cheaper to purchase English coal, which is generally imported by ships coming out in ballast.

The number of churches in St Petersburg is 196; of which the Russian-Greek faith has 54 parish churches, 118 domestic chapels, and 2 monasteries. There are also 15 Lutheran places of worship, 6 Roman Catholic, and 1 Arminian. The British factory in Petersburg maintains a handsome and well-frequented chapel of the Church of England; and there is a small congregation of Dissenters connected with the United States mission.

The Russian churches in general never fail powerfully to attract the attention of the stranger by their striking though barbarous architecture, the style being mostly an attempt to reconcile the corrupt Byzantine forms with the details of more classical models. They have uniformly an assemblage of five domes or cupolas—a large one in the centre, surrounded by four smaller ones; these portions of the edifice being in most cases gilded, and glittering in the sun. The tall and not ungraceful campanile, or bell-tower, is usually, as in Italy, detached altogether from the main body of the edifice. The most curious and interesting of the religious edifices of St Petersburg is the monastery of St Alexander Nevskii, considered the third in rank among the numerous *lauras* of the Russian empire. Its superior is the metropolitan or archbishop of St Petersburg and Novgorod, one of the three highest prelates, the other two presiding over the dioceses of Moscow and Kieff. It is dedicated to the saint whose name it bears, and whose relics are deposited in a rich shrine of silver. Here are interred many members of the imperial house, as well as several persons illustrious for their genius or services; as Suvóroff, the historian Karamzín, and the poets Kruilóff and Zukóvskii. The buildings are of great extent; and the conventual precinct, surrounded by a wall, contains a cathedral and five other churches, the residence of the metropolitan, and the cells of the monks, together with the theological academy, a seminary, and the consistory. Divine service is performed here with great magnificence, and the choir (whose voices in the Russian churches are not assisted by any instrumental accompaniment) is celebrated for its perfection.

The cathedral of St Peter and St Paul, in the fortress, on an island on the north side of the Nevà, is surmounted by a slender gilt spire 360 feet in height, which forms a conspicuous object visible from almost every point in and near the city. In it may be seen the tombs of the more recent sovereigns of Russia, together with many trophies won by Russian valour,—as the keys of Warsaw delivered to Suvóroff in 1794, and the colours of the Capudan pasha's flag-ship, taken in 1770, and deposited by Catherine II. with her own hand at the foot of the tomb of Peter the Great. Not far from the fortress, on the banks of the Nevà, is carefully preserved the small one-storied wooden cottage inhabited by Peter the Great, in which may be seen his boat, turning-lathe, many articles of dress worn by him, and a multitude of objects exhibiting his remarkable skill as a turner, joiner, and carpenter. Near this is the curious little wooden church of the Trinity, first constructed by Peter in 1703, in memory of the foundation of the city.

The cathedral of Our Lady of Kazán was erected in memory of the defeat of Napoleon in 1812. It stands on the Nevskii Perspective, and is a clumsy and ungraceful imitation of St Peter's at Rome, consisting of a central building approached in front by a simicircular colonnade, before the extremities of which stand bronze colossal statues of Barclay de Tolly and Kutúzoff. The interior is of great magnificence, the *ikonastás* or screen in front of the high altar being composed of silver (4000 lb. weight) recovered by the Don Kazaks from the French troops, who had plundered it in 1812 from the various churches of Moscow. But the most precious ornament of this cathedral, in the opinion of the superstitious Russian, is the so-called miralous image (picture) of the holy virgin of Kazán. The walls are hung with trophies and colours taken from the French in the course of that important campaign, and with the keys of fortresses occupied by the Russian troops in the years 1812, 1813, and 1814. Among these reposes also the dust of Kutúzoff, who so powerfully contributed to the triumphs of that great national struggle. But the largest and most splendid of the sacred edifices is unquestionably the cathedral of St Isaac of Dalmatia, begun in 1818, and consecrated with great ceremony May 30, 1858. It stands on the Admiralty Square, and is, like all churches of the Greek denomination, in the form of an equal-limbed cross, the centre surmounted by a dome round which four smaller cupolas are disposed at the angles. It is built of granite, highly polished, and the four faces are furnished with as many porticos resting upon gigantic columns of the same stone, the shaft of each being in a single piece. The pediments and the drum of the great dome are richly adorned with bas-reliefs in bronze, colossal statues of angels, &c. &c. This edifice is among the very largest cathedrals of Europe; and its height to the summit of the cross is 317 feet. Nor is it less remarkable for solidity of construction, high finish, and beauty of materials, than for its colossal dimensions or richness of decoration. It is, however, to be regretted that the general appearance is heavy and ungraceful; the different masses are ponderous without dignity, and vast without grandeur; and it is perhaps only the splendid effect of the gilding of the dome and surrounding cupolas that saves the general aspect from being sombre and unmeaning. Nothing can exceed the magnificence of the interior. Enormous columns, entirely incrusted with the most costly malachite, gold, silver, and precious stones, are employed everywhere with the most dazzling prodigality. Many distinguished artists, both Russian and foreign, as Neff and Bruni, have executed frescoes of great size, with which the interior of the dome is profusely decorated; and the general impression of the work—though of course not

to be compared for architectural grandeur either to St Peter's at Rome or St Paul's in London—is unquestionably one of overwhelming magnificence. The construction of this vast and costly edifice was entrusted to a French architect, M. Montferrant, who was fortunate enough to survive to witness the consecration of the cathedral in 1858, but who died a few days after the ceremony. Among the other ecclesiastical edifices may be mentioned the beautiful church of the convent of Smolnoi, constructed by the celebrated Rastrelli; the church of St Nicholas Morskói, both remarkable for their graceful proportions; and the church of the Izmäiloff regiment, deserving of notice for its vast dimensions.

St Petersburg, a city of comparatively recent existence, cannot be expected to possess a very great number of monuments, but those that do exist will stand comparison with the most majestic objects of which any modern capital can boast. The chief are the colossal equestrian bronze statue of Peter the Great erected by Catherine II., and the granite monolithic column raised in memory of Alexander I. Both these monuments stand, in admirable sites, on the Isaac Place,—the former in front of the new cathedral, and between the façade of the Senate-House and the western wing of the Admiralty; and the latter on the space between the front of the Winter Palace and the semicircle formed by the immense building of the Etat Major. The statue is of colossal dimensions, representing the creator of Petersburg in the act of curbing his rearing steed on the very summit of an enormous block of granite which serves as a pedestal, and stretching out his right hand with gesture indicative of sovereign power. The hind legs of the horse are trampling upon a serpent,—the emblem of the ignorance and barbarism over which the hero triumphed in his great work of regenerating an empire; and the reptile, together with the flowing tail of the quadruped, are most ingeniously contrived to add to the equilibrium and stability of the group. The pedestal is a real boulder, brought with immense difficulty from Finland, and on which the emperor is related to have actually stood during his life; and if the stone had been left entirely in its natural state, the work, whether for sublimity or originality, would have left nothing to be desired. Unfortunately, however, it was thought necessary to dress and cut away a considerable portion of the front of the block, so as to give more abruptness to the supposed precipice; but the effect has been to deteriorate very much the grand simplicity of the whole. The inscription consists merely of the following words in Latin on one side of the pedestal, and in Russian on the other:—PETRO : PRIMO : CATHARINA : SECVNDA.

The Alexander column is, we believe, the largest monolithic shaft in the world; it is, altogether, with the bronze pedestal on which it stands, 155 feet in height, of dark granite brought from Finland, and the capital is surmounted by a bronze figure of an angel supporting and pointing to a cross. The latter portion is of no great beauty or significance, nor indeed are the bas-reliefs which ornament the base; but the effect of the simple shaft of stone, unbroken by fluting or any other decoration, is majestic in the highest degree. The diameter of the shaft at the base is 14 feet, and the length of the shaft or monolith itself, 84 feet.

Of the numerous palaces in Petersburg, occupied by various members of the imperial family, the most extensive and splendid is indubitably the Winter Palace, which, with the Hermitage, to which it is united by a bridge over a canal and a series of galleries, forms an uninterrupted line of buildings extending along the Nevà for a distance of above a third of an English mile. The Winter Palace is the actual residence of the emperor, and the present edifice was entirely rebuilt after a fire which destroyed the former building on the same spot in 1838. The general style of the architecture is Italian, and three sides being situated on large open spaces,—the river and its quay, the parade-ground, and the great square on which the Alexander column stands,—presents an imposing effect from many points. The principal apartments are of great magnificence; the hall of St George, the famous "Salle Blanche," the hall of the marshals, the Great chapel, &c., are of noble proportions; the former, at least, adorned with numerous pictures, representing the triumphs of Russian arms by sea and land, and portraits of the sovereigns and illustrious warriors of the empire. Here, too, the stranger is struck by the modest little cabinet in which the Emperor Nicholas passed the working hours of his indefatigable life, the simple and scanty furniture, and the plain iron camp-bed on which he slept and on which he died, covered by the gray military cloak that he always wore. But by far the most interesting portion of the palace is the Hermitage, originally erected by Catherine II. as a place of retreat from the wearisome ceremonial of royalty. This building, to which considerable additions were made by the late emperor, is now transformed into one of the most magnificent museums of art in Europe; and the new buildings, by the skilful manner in which they are lighted, and the indescribable splendour of their fittings-up,—the floors being of the richest parquet-work, and the ceilings (of iron to diminish the danger of fire) most magnificently painted and gilded, form a casket in every way worthy of the treasures they contain. The paintings are arranged in schools; and the gallery is eminently rich in various departments of art. The old pre-Raphaelite painters are well-represented; there are capital works, in the finest condition, of Salvator Rosa, and indeed of all the great Italian masters, with the exception of Raphael himself, and a multitude of works equally valuable for their intrinsic merit and for the light they throw on the history of art. The Spanish subdivision abounds also in *chefs-d'œuvre:* the famous "Christ with the Lamb," and the equally famous "Ascension of the Virgin" of Murillo, together with many interesting though less splendid works of that great painter; a number of most admirable examples of Velasquez, among which may be noticed the two incomparable full-length portraits of Philip II. and Olivarez, together with the finished studies of the heads of the same works, and a crowd of other productions of high interest. Many of these pictures were obtained from the Soult collection. Vandyck is also richly represented, as a very large portion of the Houghton gallery was purchased by the court of Russia. The German, Dutch, and Flemish schools may be studied here with extraordinary success; the collection of Rembrandt alone filling one large hall almost entirely; while the finest works of Teniers, Douw, Wouvermans, Van Ostade, Paul Potter, Terburg, Mieris, not to mention the great landscape-painters—as Berghem, and above all, Ruysdael—cover the walls with a truly imperial profusion. Besides these treasures of painting, the Hermitage now contains a collection of coins and medals, recently augmented by the acquisition of the famous cabinet formed by the late M. Reichel, which for the rarity and beauty of its pieces and the completeness of its historical series, is perhaps without a superior in Europe. An account of the curiosities preserved in the Hermitage would be imperfect without at least a passing mention of the portrait-gallery of the Russian sovereigns, as well as of a very singular collection of objects belonging to or connected with Peter the Great, exemplifying his skill in works of mechanical dexterity.

Many of the educational establishments of St Petersburg excite the surprise of the stranger, from the enormous scale on which they are maintained, as well as—to the honour of the government be it said—for the liberality with which they are administered. The Foundling Hospital, now rather a school for poor children than a receptacle for infants abandoned by their parents, is one of the largest establishments in Europe. The convent of Smolnoi, devoted

Petersburg.

to the education of young ladies of the noble and middle classes of society, is maintained in a great measure at the expense of the state. The special military schools, or cadet-corps, are also of extraordinary extent, some being devoted to particular branches of the service, as the artillery, the engineer department, roads and communications, mining (for everything in Russia is organized more or less on a military footing) the naval service, &c. &c. Of institutions of a purely civil nature and of the higher order, we may specify the university (now, 1858, numbering about 800 students), the law college, the Alexander Lyceum (the two latter devoted to the education of boys of the higher class, and together containing 400 pupils), 5 gymnasia (intended principally as preparatory to the university course, and numbering about 1250 scholars). In all these, as well as in the more special military schools, the pupils, and even the professors on ceremonial occasions, wear a military uniform, with the sword and cocked hat; though in the civil establishments, drilling and the use of arms do not form an indispensable part of the education.

The hospitals of St Petersburg are numerous and tolerably well administered; some of them are supported by the crown, and others founded by private charity, and devoted to particular classes of suffering humanity. The Academy of Medicine gives regular instruction to 450 students, who, after receiving a medical education at the expense of the state, are in some cases obliged to serve for a certain period in the interior and with the troops.

Among the more prominent scientific and literary institutions are the Academy of the Fine Arts, the Academy of Sciences, and in particular the Imperial Public Library, which contains upwards of 450,000 volumes of printed books, and more than 20,000 MSS., many of them of great rarity, particularly an immense number of autographs of illustrious persons, and works relating to oriental literature. This library has recently undergone great reforms in its administration, and is, like almost all collections, museums, &c., in Russia, opened to the public with great liberality.

The manufactures of St Petersburg are numerous and extensive. Some of them are carried on by the government, but the majority are in the hands of private individuals. Among the former are manufactories of gunpowder, tapestry, plate-glass and porcelain, and a cannon foundry. Of the other manufactures the principal are silk, cotton, and woollen goods, sailcloth, leather, glass, jewellery, paper, tobacco, mathematical and surgical instruments, &c.

The following table gives the movement of shipping at the port of St Petersburg during the last five years, together with the declared value of exports and imports, and the amount of the customs-duties collected during that time:—

Year.	Ships.	Tonnage	Imports.	Exports.	Customs from		
					Imports.	Exports.	Bridges.
			L.	L.	L.	L.	L.
1853	1,921	357,548	11,173,739	8,327,471	1,908,915	124.222	37,377
1854	17	3,490	3,827,080	1,498,543	1,023,573	6,736	20,287
1855	...	...	2,485,525	451,205	523,564		10,187
1856	3,374	519,710	10,766,949	8,586,775	1,384.254	13,288	26,602
1857	2,723	456,464	13,899,404	9,660,839	1,901,526	133,539	37,828

The principal countries trading with St Petersburg, with the numbers of vessels belonging to each, in 1857 were—England, 902 (tonnage 209,352); Holland, 549; Denmark, 212; Sweden, 150; Prussia, 141; Hanover, 139; Russia, 130; France, 128; Lubeck, 92; Norway, 90; Oldenburg, 62; America, 43; Naples, 35; Mecklenburg, 28; Bremen, 11; Hamburg, 7; Belgium, 2; Portugal, 2. Of the total number of vessels, 478 were steamers; and of these, 171 were English. The principal articles of import in 1857 were—gold and silver, L.488,773; sugar. 65 979.307 lb ; coffee, 6,716,676 lb.; tobacco, 2,163,494 lb.; wine in cask, 13,240,597 lb.; ditto in bottles, 978,794; olive oil, 13,256,739 lb.; dye-stuffs, 42,848,450 lb.; salt, 20,872,357 lb.; coal, 23,351 tons; raw cotton, 65,413,914 lb.; cotton yarn, 10,481,324 lb.; silk, raw and spun, 144,222 lb.; wool, spun, 2,394,454 lb.; cotton goods, 947,417 lb.; flaxen goods, 249,123 lb ; silk goods, 161,844 lb.; woollen goods, 525,147 lb. The chief articles of export during the same year were—gold and silver, L.167,414; hemp, 56,869,697 lb.; potash, 21,857,816 lb.; tallow, 97,228,918 lb ; raw hides, 6,034,558 lb., Russian leather, 894,010 lb., iron, 13,618,922 lb ; copper, 5,576,106 lb ; bristles, 2,503 289 lb.; cordage, 15,311,470 lb.; linen, 42,350 pieces; grain, 8,817,864 bushels.

Petersburg.

The population of the city, according to the census of 1856, was 490,808. The proportion of males to females is as two to one, arising from the great number of soldiers (principally the guard, which alone amounts to about 60,000 men) permanently stationed in and about St Petersburg, and the large population of peasants and workmen who come from the interior for a time, and return to their families after a longer or a shorter absence. The peasants, workmen, servants, and soldiers together constitute about three-fifths of the whole population; the nobles and *employés* about 44,000, the foreigners 16,000, the merchants 12,500, and the clergy 2500 The nobility form therefore about one-tenth of the total population; and it may be calculated that to every noble there are rather more than three servants. (T. B. S.)

PETERSBURG, *St*, a government of European Russia, lying between N. Lat. 58. and 60. 30.; and between E. Long. 27. 30. and 33. 30., bounded on the N. by the gulf and archduchy of Finland and by Lake Ladoga, E. by the government of Novgorod, S. by that of Pskov, and W. by Lake Peipus and the government of Esthonia. Length from N.E. to S.W., 265 miles; breadth, about 90 miles: area, 20,749 square miles. The surface is almost entirely level, and a great part of it is occupied with lakes and morasses. From a branch of the Valdai Hills, which occupies the S. of the government, the country slopes gradually downwards towards the N.W., and in this direction most of the rivers flow. The chief of these are the Nevà, flowing from Lake Ladoga to the Gulf of Finland; the Luga, which crosses the country from S.E. to N.W.; the Pliussa, flowing northwards, and falling into the Gulf of Finland near the mouth of the Luga; and the Volchov, by which the waters of Lake Ilmen in Novgorod are conveyed to Lake Ladoga. Besides the large lakes of Ladoga, Peipus, and Pskov, which lie on the frontiers of the government, there are many others of a smaller size in the interior. The soil is sandy, and the climate cold, moist, and unfavourable to agriculture. The forests of the government are of great extent, but carelessly managed. St Petersburg contained in 1849, 1,466,931 acres of arable land, 473,969 of meadows, 7,405,114 of wood, and 3,781,156 of waste land. In the same year the government produced 9,465,522 bushels of corn, and 1,463,278 of potatoes; and it possessed 118,849 horses, 183,783 horned cattle, 51,649 sheep, 20,666 swine, and 1075 goats. Rye, barley, oats, and wheat are the principal crops raised, but the produce of corn falls short of the demands of the people. Flax and hemp are also cultivated; and there are many kitchen gardens for the supply of the capital. Poultry of various kinds are kept, and fish are by no means scarce. The chief wealth of the country, however, depends on its timber, which forms an important article of export. Granite, limestone, marl, clay, and other minerals, are obtained in the government. Manufacturing industry is in a flourishing condition in St Petersburg; but this, as well as the commerce of the country, is for the most part confined to the capital. The government contained in 1849, 463 manufactories, employing 23,963 hands. Of the manufactories, the most important were 50 of tobacco, 47 of machines and hardware, 34 of silk, 23 of sugar, 27 of cotton cloth, 13 of woollen fabrics, 19 of glass and crystal, 15 of chemical substances, and 20 of leather. For the purposes of education the country belongs to the circle of St Petersburg, and contained in 1854, besides gymnasia and other superior institutions, 39 village schools, with 1220 scholars. The prevailing religion is that of the Greek Church; but there are 130,205 Protestants, 27,239 Roman Catholics, and a few Armenians, Mohammedans, and Jews among the population. In respect of race, the bulk of the people are

Russians, though there are also in the country many Germans, Finns, and others. For administrative purposes it is divided into 8 circles, and except the capital, it has no town of any importance. Pop. (1851) 566,409.

PETERSBURG, a town and port of the United States of North America, state of Virginia, on the right bank of the Appomattox, 10 miles above its confluence with the James river, and 22 S. of Richmond. It is handsomely built, principally of brick, and is a place of much commercial importance, being, in respect to size, the third town in the state. Among the public edifices are a court-house; a jail; eight churches, belonging to Presbyterians, Methodists, Episcopalians, Baptists, and Roman Catholics; and three banks. The manufacturing establishments are several cotton and one woollen factory, two rope-walks, an iron furnace, six forges, and several mills. A great amount of water-power for these works is furnished by the falls of the river just above the town. A canal has been made round the falls, by means of which small boats are enabled to ascend for about 100 miles higher. Vessels of 100 tons burden come up to the town, and those of a larger size discharge their cargoes at City Point, the point of confluence of the Appomattox and the James, whence there is a railway to Petersburg. The aggregate tonnage of the vessels registered at the port, June 30, 1852, was 484; of those enrolled and licensed, 2110. In that year there entered 16 vessels, tonnage 10,147; and there cleared 10, tonnage 5102. The principal exports are flour and tobacco, in large quantities. A great fire took place here in 1815, when nearly 400 houses were destroyed. Pop. (1850) 14,010, (1853) about 15,000.

PETERSFIELD, a parliamentary borough and market-town of England, county of Hants, stands near the Loddon, 18 miles E. by S. of Winchester, and 15 N.N.E. of Portsmouth. Though small, it is clean and neat, and the main street crosses nearly at right angles the London and Portsmouth road. The parish church is a large and ancient brick edifice, with fine Norman arches, and a low square tower. Petersfield has a town-hall, and a handsome statue of William III. on horseback. Churcher's College, an endowed charity school, founded in 1722, affords board, clothing, and education to twelve boys. There is also a library, a reading-room, and a savings-bank. A county court is held here. Besides weekly markets, there are two annual fairs for cattle and sheep. Petersfield never had any extensive trade, and what little it possessed was chiefly derived from its position on the London and Portsmouth road; but of even this advantage it has been deprived, by the construction of the railway between these places. The borough now returns only one member to Parliament; but previous to the passing of the Reform Act it sent two. Pop. (1851) 5550.

PETERSWALDAU, a town of Prussia, province of Silesia, government of Breslau, and 32 miles S.W. of that town. It consists of four parts—Royal, Middle, Lower, and Upper Peterswaldau. Of these the second is the largest, and contains a fine castle, one Roman Catholic, and two Protestant churches. It is a considerable manufacturing town, having tile-works, saw and other mills. Pop. of town, 6480, among whom are many Moravians.

PETERWARDEIN, or PETERVAR, a frontier town of Austria, capital of the Servian Military Frontier, stands on a promontory on the right bank of the Danube, which is here crossed by a bridge of boats, leading to Neusatz on the opposite side, 45 miles N.W. of Belgrade. It is one of the strongest places in the empire both by nature and art, as it occupies a high escarped rock, washed on three sides by the river, and has two fortresses, the one on the top of the rock, and the other, which incloses the town proper, on a gentle slope to the north. It presents a formidable appearance both from the river and the land, on account of the walls, pierced with port-holes, and the tiers of turf-covered bastions by which it is defended. The town, which consists of one main street, with two others parallel to it, contains an arsenal with many Turkish trophies, the parish church of St George, which has several interesting tombs, and other buildings. The lower fortress has large moats, which can be filled with water from the Danube. Peterwardein is said to derive its name from Peter the Hermit, who marshalled here the army of the First Crusade. The garrison amounts to about 3000 men, though it is capable of being augmented to 10,000. Pop. (exclusive of garrison), about 5000.

PETHERTON, NORTH, a town of England, in the county of Somerset, 7 miles N.E. of Taunton. It has one long street, and a large market-place. The parish church is a fine building, with a lofty tower. There is also a chapel of ease, and an endowed school for 20 boys. The people are for the most part employed in farming and retail trade. Though the market formerly held here is now discontinued, there are still two annual fairs. Pop. (1851) 3845.

PETHERTON, *South*, a market-town and parish of England, in the county of Somerset, 14 miles S.S.E. of Taunton. The church is large and elegant, in the form of a cross, and there are several Dissenting chapels. Sail-cloth and kid gloves are made here in small quantities. Pop. (1851) 2606.

PETHORA GURH, a military cantonment of British India, district of Kumaon, N.W. Provinces, about 10 miles from the right bank of the Kali, and 1200 N.W. of Calcutta. N. Lat. 29. 35., E. Lon. 80. 16. Attached to the cantonment is a bazaar and a large stone hospital, roofed with slates; and the whole place is commanded by Fort Loudoun, a hundred yards to the west.

PÉTION DE VILLENEUVE, JEROME, a leader of the French Revolution, was born at Chartres about 1753, and practised for some time at the bar. His first appearance on the stage of politics was in the character of deputy from the commons of his native town to the Estates-General in 1789. He then showed himself to be well fitted to walk circumspectly among the besetting perils of those troublous times. His political creed was liberal and settled, his disposition phlegmatic, his appearance imposing, and his elocution ready. Accordingly, in all the high and critical offices to which he was called during the Revolution, his character was notable for its cool consistency. As president of the National Assembly and of the Criminal Tribunal, he acted in such a straightforward manner that he acquired the surname of "the Virtuous." When he was sent to conduct the royal family home from their arrested flight, this want of respect of persons was carried even to an extreme. He "ate his luncheon, comfortably filled his wine-glass in the royal Berline, flung out his chicken-bones past the nose of royalty itself; and on the king's saying, 'France cannot be a republic,' answered, 'No, it is not ripe yet.'" Nor did his coolness forsake him during 1791 and 1792, when, in the capacity of mayor of Paris, it was his duty to guard the safety of the city. Raised aloft on the shoulders of two grenadiers, he quieted and dispersed the insurrectionary populace on the famous 20th of June. Mingling also with the bloodthirsty mob, he tried, with "the austere language of the law," to check the reckless massacres of September. At length, however, the dangers which Pétion had with stoical countenance outfaced so long, became too pressing for him. The proscription of his party by the Jacobins on the 31st May 1793, drove him and ten of his fellow Girondins to escape for their lives. As the eleven skulked through the country towards Bourdeaux, their enemies beset them at every turn of the road. At last the ever-thickening perils compelled them to separate, and hide their heads wherever they could. On a July morning of 1794, the dead body

of Pétion, along with that of Buzot, was found in a corn-field near Bourdeaux half-eaten by wolves. (See Carlyle's *French Revolution;* and *Biographie Universelle.*)

PETIS DE LA CROIX, FRANÇOIS, a great oriental scholar, was the son of François Petis, the French king's interpreter for the Oriental languages, and was born in Paris in 1653. His education was conducted with the view of fitting him for succeeding his father. He was first instructed in mathematics, astronomy, geography, design, and the eastern languages. Then the famous minister Colbert despatched him, when only sixteen, to complete his education in the East. He sojourned for three years and a half at Aleppo, familiarizing himself with the language and literature of the Arabs. The next two years were spent at Ispahan in the study of the Persian dialects, politics, arts, and sciences. He wound up this long and thorough course of training by applying himself for four years at Constantinople to the language and diplomacy of the Turks. Soon after his return to France in 1680, Petis entered upon a new career as secretary-interpreter to the marine. In this capacity his aid was employed in all the negotiations which France at that time transacted with the Eastern courts. He was engaged in forming treaties with Algiers in 1684, with Tunis and Tripoli in 1685, and with Morocco in 1687. The closing, like the opening part of Petis' career, was devoted to linguistic pursuits. He began to officiate as Arabic professor to the Collège Royal in 1692, and as Oriental interpreter to the king in 1695. At the same time his pen was actively employed in connection with his favourite studies. He published *Histoire de la Sultane de Perse et des Vizirs,* a translation from Sheikh Zadeh, in 12mo, 1707; and *Les Mille et Un Jours,* a translation from the Persian, in 5 vols. 12mo, Paris, 1710–12. Another translation, entitled *Histoire de Timur Bec,* in 4 vols. 12mo, appeared in 1722, nine years after his death. He also left behind him in manuscript several works on history, geography, and the Oriental languages, a list of which is given in Goujet's *Mémoire sur le Collège Royal.* (See *Biographie Universelle.*)

PETIT, JEAN-LOUIS, an eminent French surgeon, was born in Paris in March 1674. His love for his favourite science was early in action. When a mere child he began of his own accord to attend the lectures of Littre, the anatomical professor; not long afterwards he was surprised one day in a granary in the act of dissecting a rabbit; and at the age of twelve he had made such progress in his class, that he was entrusted with the care of the anatomical theatre. This precocious boyhood was the prelude to a manhood of great professional eminence. After practising for eight years with marked ability in the army, he returned to Paris in 1700, and took a high position as a promoter of surgical science. His *Traité sur les Maladies des Os,* published in 1705, originated a new branch of pathology. His appointment to the office of lecturer in the School of Surgery in 1724, and to the directorship of the Royal Academy of Surgery in 1731, inaugurated and established a new system of chirurgical instruction. His numerous pupils, also, carried his principles to the most remote countries. He died in 1750, the most famous surgeon in Europe. An extensive work on surgery, which Petit left unfinished, was completed and published by Dr Lesné, under the title of *Traité sur les Maladies Chirurgicales,* Paris, 1774. His other productions are contained in the Memoirs of the Academy of Surgery, and in those of the Academy of Sciences.

PETIT, *Pierre,* a French mathematician, was born at Montluçon in 1594, and removed from his native place to Paris in 1633. His apitude for the exact sciences soon opened up for him a career of distinction. The French government employed him to inspect the seaports of France and Italy, and appointed him provincial commissary of artillery and intendant-general of fortifications. Several scientific works in the meanwhile proceeded from his pen, and increased his reputation as a man of learning. He was also honoured to take part in the celebrated discussions touching the "Dioptrics" of Descartes, and to assist Pascal in making experiments on the phenomena of the common pump. The death of Petit took place at Lagny, on the Marne, in 1677. The following is a list of the most important works of Petit: *L'Usage du Compas de Proportion,* 8vo, Paris, 1634; *Observations touchant le Vide,* 4to, Paris, 1647; *Dissertation sur la Nature des Comètes,* 4to, Paris, 1665; and *Dissertation sur la Nature du Chaud et du Froid,* 12mo, Paris, 1671.

PETIT-CANAL, a town of the island of Guadaloupe, on a bay of the same name on the W. coast, about 9 miles N.E. of St Louis. Sugar is exported in great quantities; and in the surrounding country large herds of cattle are fed. A large proportion of the inhabitants are slaves. Pop. 7600.

PETITIO PRINCIPII. See FALLACY.

PETITOT, JEAN, a great improver of the art of painting in enamel, was the son of a sculptor and architect, and was born at Geneva in 1607. A series of incidents gradually led him to his famous improvement. Becoming an apprentice to a jeweller named Bordier, he was employed in painting enamels for jewels. His success soon became so great, that his master set him to draw miniature portraits on the same substance. Several colours were the only things wanting to enable the two to carry on their new profession. They found some of these colours on going and making application to the chemists of Italy. Then repairing to London, they obtained the rest from Sir Theodore Mayern, first physician to Charles I. Having thus perfected the art of painting portraits in enamel, Petitot entered upon a successful career as an artist. Many of Vandyck's pictures were given to him to be copied; that illustrious painter himself became his friend and adviser; the royal family sat to him; and the king attached him to his person, and gave him apartments in Whitehall. Even after the outbreak of the civil war had blighted his prospects in England, his prosperity still continued. He was retained for some time in the suite of the exiled Prince of Wales. He was then taken into the service of the French King, Louis XIV., and introduced into a new scene of professional success. A pension was bestowed upon him, and a lodging in the Louvre was allotted to him. He was employed in copying some of the celebrated pictures of Mignard and Lebrun, and in painting the portraits of King Louis XIV., and the Queens Anne of Austria and Maria Theresa. This sunshine of court favour lasted until he had amassed an immense fortune, and nearly reached the age of fourscore. The path of Petitot then began to be beset by troubles. Being a Protestant, he was alarmed at the revocation of the edict of Nantes, and became eager to return to his native country. On attempting to escape without the consent of the king, he was thrown into prison, and the eloquent Bossuet was employed to convert him to Popery. It was only after his health was undermined by imprisonment, and the ineffectual attempts to make him a proselyte, that his release was obtained. He had not been long in Switzerland when a stroke of apoplexy cut him off in 1691, in the act of painting a portrait of his wife. Fifty-six of the portraits of Petitot are preserved in the museum of the Louvre. His masterpiece, however, is the full-length portrait of Rachel de Rouvigny, Countess of Southampton, in the collection of the Duke of Devonshire.

PETIVER, JAMES, an eminent English botanist, born about the middle of the seventeenth century, but in what year is not known. His profession was that of an apothecary, which he exercised in Aldersgate Street, London, during the whole of his life. His business was extensive,

Petra.

and he afterwards became apothecary to the Charter-House. Excepting Sir Hans Sloane and Courten, he was the only person after the Tradescants who made any important collections in natural history, previously to those of the present day. He employed the captains and surgeons of different ships to bring him home specimens; and by means of printed directions he enabled them to select proper objects. In this manner his collection soon became so valuable, that, some time previously to his decease, he was offered L.4000 for it by Sir Hans Sloane, by whom it was purchased some time after Petiver's death. Both at home and abroad his fame was extended by his valuable museum. He was chosen a fellow of the Royal Society; and having become acquainted with Ray, he assisted him in arranging the second volume of his *History of Plants*. He died on the 20th of April 1718; and his funeral was honoured by the attendance of Sir Hans Sloane, and other eminent men, as pall-bearers. He published several works on different subjects of natural history, particularly *Musci Petiveriani Centuriæ decem*, 1692-1703, 8vo; *Gazophylacii Naturæ et Artis, Decades decem*, 1702, folio, with a hundred plates; *A Catalogue of Mr Ray's English Herbal*, illustrated with figures, 1713, and continued in 1715, folio; many small publications, which may be found enumerated in Dr Pultney's book; many papers in the *Philosophical Transactions*, and a valuable article in the third volume of Ray's work, entitled "Plantæ Rariores Chinenses, Madras-patanæ et Africanæ, a Jacobo Petivero ad opus consummandum collatæ." Many of his small tracts having become scarce, his *Opera Omnia* were collected and published, exclusively of his papers in the Transactions, 1764, in two vols. folio.

PETRA, the capital of Arabia Petræa, was situated between the Dead Sea and the Ælanitic Gulf. In the times of the Old Testament history it was called Selah, a word which, like Petra, its Greek name, means "a rock." It is recorded that Amaziah, king of Judah, "slew of Edom in the valley of Salt ten thousand, and took Selah by war, and called the name of it Joktheel unto this day." (2 Kings xiv. 7.) This name seems, however, to have passed away with the Hebrew rule over Edom, for no further trace of it is to be found; and it is still called Selah by Isaiah (xvi. 1). We next meet with it as the Petra of the classical writers. Strabo, writing of the Nabathæans in the time of Augustus, thus describes their capital:—"The metropolis of the Nabathæans is Petra, so called; for it lies in a place in other respects plain and level, but shut in by rocks round about, but within having copious fountains for the supply of water and the irrigation of gardens. Beyond the inclosure the region is mostly a desert, especially towards Judæa." (*Geog.* xvi.) Pliny more definitely describes Petra as situated in a valley less than two miles (Roman) in amplitude, surrounded by inaccessible mountains, with a stream flowing through it. (*Hist. Nat.* vi.) About the same period it is often named by Josephus as the capital of Arabia Petræa, with which kingdom it passed under the immediate sway of the Romans in the time of Trajan. In the fourth century it is several times mentioned by Eusebius and Jerome; and in the Greek ecclesiastical Notitiæ of the fifth and sixth centuries it appears as the metropolitan see of the third Palestine. From that date not the slightest notice of the city is to be found in any quarter until modern times. It was Burckhardt who first ventured to assume that the wonderful remains in Wady Musa were the ruins of the ancient capital of Arabia Petræa. His view was amply developed in his *Travels in Syria*, p. 431, published in 1822, and was supported and incontestably established by his editor, Col. Leake. (Leake's Preface to Burckhardt's *Travels in Syria*, pp. vii.–ix.) The ruined city lies in a narrow valley, surrounded by lofty, and, for the most part, perfectly precipitous mountains. The ancient and more interesting entrance is on the eastern side, through the deep narrow gorge of Wady Syke. A river, or rather mountain torrent, flows through this gorge and passes out into the valley nearly opposite to the point of entrance on the western side. The chief public buildings occupied the banks of the river and the high ground further south, as their ruins sufficiently show. One sumptuous edifice remains standing on the south bank, near the western side of the valley, and seems to have been a palace, rather than a temple. It is called Pharaoh's house, and is thirty-four paces square. A little east of this, and in a range with some of the most beautiful excavations in the mountain on the east side of the valley, are the remains of what appears to have been a triumphal arch. A few roods south are extensive ruins, which probably belonged to a temple, and which contain fragments of columns five feet in diameter. Still further south are other piles of ruins —columns and hewn stones—parts no doubt of important public buildings which occupied what may be called the central parts of Petra. A large surface on the north side of the river is covered with substructions, which probably belonged to private habitations. An extensive region still farther north retains no vestiges of the buildings which once covered it.

Petra.

The attention of travellers has however been chiefly engaged by the excavations which have more successfully resisted the ravages of time. These excavations, whether formed for temples, tombs, or the dwellings of living men, surprise the visitor by their incredible number and extent. They not only occupy the front of the entire mountain by which the valley is encompassed, but of the numerous ravines and recesses which radiate on all sides from this enclosed area. They exist, too, in great numbers along all the approaches to the place, which in the days of its prosperity were perhaps the suburbs of the overpeopled valley. At the same time they are often seen rising one above another in the face of the cliff to the height of from two hundred to three or four hundred feet above the level of the valley. By far the largest number of these excavations were manifestly designed as places for the interment of the dead; and thus exhibit a variety in form and size, of interior arrangement and external decorations, adapted to the different fortunes of their occupants, and conformable to the prevailing tastes of the times in which they were made. Some consist of a single chamber, 10, 15, or 20 feet square by 10 or 12 in height, containing recesses in the wall large enough to receive one or a few deposits. Others are enriched externally with various ornaments, representing columns of different orders, graceful pediments, broad, rich entablatures, and sometimes statuary, and transforming the base of the mountain into a vast, splendid pile of architecture. The magical effect of some of these monuments is greatly heightened by the rich and various colours of the rock out of which, or more properly in which, they are formed. The mountains that encompass the vale of Petra are of sandstone, of which red is the predominant hue. Many of them are adorned with such a profusion of the most lovely and brilliant colours as it is scarcely possible to describe. Red, purple, yellow, azure or sky blue, black, and white, are seen in the same mass distinctly in successive layers, or blended so as to form every shade and hue of which they are capable—as brilliant and soft as they ever appear in flowers, or in the plumage of birds, or in the sky when illuminated by the most glorious sunset. In fact, it is more easy to imagine than describe the effect of tall, graceful columns, exhibiting these exquisite colours in their succession of regular horizontal strata. They are displayed to still greater advantage in the walls and ceilings of some of the excavations where there is a slight dip in the strata.

Detailed descriptions of the principal monuments have been furnished by Laborde, *Voyage dans l'Arabie-Petrée*), Robinson (*Biblical Researches*), and Olin (*Travels in the*

East, from which the above description has been chiefly taken). Interesting notices of Petra may also be found in the respective Travels, Journeys, &c., of Burckhardt, Macmichael, Irby and Mangles, Stephens, Lord Lindsay, and Schubert.

PETRARCA, Francesco, one of the greatest poets and most celebrated men of whom Italy can boast, was born at Arezzo on the 20th of July 1304. His baptismal name was *Francesco di Petracco* (a form of Pietro), but the poet afterwards changed it into the more euphonious name by which he is always known. His father, the friend of Dante, and, like him, of the Ghibelin party, had been banished from Florence, where he filled a respectable situation confided to him by the republic; and having taken refuge in Pisa, he committed the education of his son, then in his seventh year, to an old grammarian of that city named Convennole da Prato. Two years afterwards, when the death of the Emperor Henry VII. had destroyed the hopes of the Ghibelins, the father of Petrarca removed his family to Avignon, whither Clement V. had transferred the pontifical court, and his son resumed his studies at Carpentras, under his former master. It was then that Francesco visited for the first time the fountain of Vaucluse; and the rural beauties of this celebrated spot left an indelible impression upon his mind. He passed four years at the university of Montpellier, whither he had been sent to study law, but not relishing legal literature, he devoted his days and nights to Cicero and to Virgil. But whilst engaged in these seducing pursuits, he was disturbed by the arrival of his father, who, greatly incensed at what he conceived to be a gross misapplication of time, consigned to the flames the little library of his son, and was with difficulty induced to restore to him Cicero and Virgil, after they had been half consumed. Being now sent to the university of Bologna, to receive the instructions of Giovanni d'Andrea, the most learned canonist of that age, Petrarca soon formed a connection there with Cino da Pistoia, a Florentine like himself, whom Bartolo cites as his master in the science of law, and who deserved to become that of Petrarca and Boccaccio in poetry. At the age of twenty-two he lost his father, and being ruined by faithless tutors, he returned to Avignon, where he took up his residence, appeared with distinction in the most brilliant society, and found himself at liberty to apply to his favourite pursuits. Mathematics, history, antiquities, and philosophy occupied, each in its turn, a mind thirsting for knowledge. The first poetical attempts of Petrarca, like those of Dante, were made in the Latin language; but, happily, his muse soon ventured to confide her inspirations to the vulgar tongue, the only one, besides, which the women understood.

About this time he renewed his acquaintance with one of his school companions, Jacopo Colonna, the youngest son of Stefano Colonna, the head of the illustrious family of that name. In the society of the Colonnas, the poet became known to the most illustrious strangers who visited the pontifical city; whilst the noble frankness of his manner, his mild yet sprightly physiognomy, the graces of his mind, and his unaffected anxiety to please, secured him a remarkable ascendancy in this select circle. When Jacopo Colonna was called to the bishopric of Lombes, his friend accompanied him to his diocese, and in their way they stopped at Toulouse. The seven Maintainers of the Gay Science were then beginning to diffuse a taste for the vulgar poetry, and to bring into notice those little effusions of song unknown to the ancients, and some of which have still remained peculiar to the literature of the troubadours. A submissive and unfortunate lover, Petrarca, like them, sought to console himself by singing at once the charms and the cruelty of his beloved. On the 6th of April 1327 he had seen, in a church of Avignon, the daughter of Audibert de Noves; and the passion he conceived for this lady occupied the remainder of his life, over which it diffused an air of poetry and romance. Laura was united to Ugo de Sade, a young patrician, and a native of Avignon; and faithful to her duties as a wife and a mother, she forbade Petrarca to indulge the slightest hope. Incessantly haunted with this beautiful vision, the poet visited in succession the south of France, Paris, and the Low Countries. The forest of the Ardennes re-echoed in turn his verses and his lamentations; he traversed Burgundy, the Lyonnais, Dauphiné, and, after an exile of eight months, returned to bury himself in the delightful solitude of Vaucluse.

Pope John XXII. was then meditating a new crusade, and, to further his object, he led the Romans to hope that he would re-establish the chair of St Peter in Italy. This double project excited the imagination of Petrarca, and inspired his beautiful ode to his friend the Bishop of Lombes, *O aspettata in ciel*, &c. The following year (1335) we find him expressing, in elegant Latin verses addressed to Benedict XII., his earnest desire to see the Holy See re-established in the eternal city; and to this patriotic aspiration the Pope replied by appointing him canon of Lombes, with the hopes of a prebend. The same year was marked by an event unique in the life of Petrarca. A recent and close connection attached him to the interests of Azzo da Corregio, one of the principal Lords of Italy, who was then prosecuted before the papal courts at the instance of the family of the Rossi. In the hope of serving his friend, the poet resolved to plead his cause at the bar; and this he did with so eminent success that it proved to both a day of triumph. Since he had first beheld Laura, he sought occupation everywhere without being able to fix himself anywhere. After visiting Rome, he returned to Avignon, and finally shut himself up in his retreat at Vaucluse, where he made the acquaintance of Filippo di Cabassole, Bishop of Cavaillon, whom the poet calls a little bishop and a great man.

Meanwhile he commenced writing in Latin the History of Rome from the foundation of the city to the reign of Titus. But in collecting materials for this work he was much struck with the grandeur of the events which had marked the termination of the second Punic war; and suddenly conceived the design of giving to his age a regular epic, of which Scipio should be the hero. Before the end of the year, the poet was in a condition to submit to his friends the greater part of his work, which they received with the most flattering encomiums. But a more grateful distinction awaited him. His Sonnets and his *Canzoni* had filled France and Italy with the name of Laura and that of her lover; in fact, these pieces were universally read and admired. Of the impression produced by his poetical genius he had soon the most convincing evidence. On the 23d of August 1340, he received at Vaucluse two letters, one from the Roman senate, which invited him to accept the poetical laurel, and be crowned in the capitol, and the other from the chancellor of the university of Paris, which offered him the same triumph. Petrarca had long coveted the poetic laurel, and even made known his wishes to Robert of Anjou, King of Naples, whose influence had stimulated the admiration, and hastened the decision, of the Roman senators. This prince cultivated letters with enthusiasm, and protected them in a manner worthy of a king. Wishing to appear indebted to him for the crown which had been offered to him, Petrarca embarked for Naples, carrying with him his epic poem, which he had entitled *Africa*. The king and the poet had repeated conferences upon the subjects of poetry and history; and at his audience of leave, Robert, divesting himself of his robe, put it on Petrarca, at the same time requesting him to wear it on the day when he was to receive the laurel crown.

The poet then repaired to Rome, and on Easter-day (the 8th of April 1341) ascended the Capitol, in the midst

Petrarca.

of the principal citizens; received the crown from the hands of the senator Orso, Conte di Anguillara; recited a sonnet upon the heroes of ancient Rome; was conducted to the church of St Peter, where he deposited on the altar the laurel which encircled his brow; and then set out for Avignon by land, as if to enjoy more leisurely his renown. He carried with him the title of almoner to the king of Naples, and letters-patent giving him, as well by the authority of King Robert as by that of the senate and people of Rome, full and free permission to read, vindicate, and explain the ancient books, to make new ones, compose poems, and on every occasion to wear the crown of laurel, ivy, or myrtle, at his pleasure.

Azzo da Corregio having just usurped the sovereignty of Parma, on the pretext of freeing it from thraldom, urgently pressed Petrarca to spend some time with him; and, captivated by the attentions paid to him, the poet soon accepted the situation of archdeacon of the church of Parma, caused a house to be built there, and then employed himself in completing his poem of *Africa*. Glory had now begun to console him for his labour and anxiety, when envy, awakened by unexampled success, attempted to disturb his repose; and at the same time the hand of death had stricken the bishop of Lombes, his best friend and warmest admirer. The accession of Clement VI. to the triple crown, in 1342, revived in the mind of Petrarca hopes which had already been twice disappointed. At the request of the Romans, he accompanied to Avignon the deputation they had sent for the purpose of soliciting the new pope to fulfil the promises made by John XXII., and, in this matter, he acted as the organ of the deputation. The pontiff received him with marked distinction, appointed him prior of Migliorino, in the diocese of Parma, and treated him with the greatest familiarity, but made no answer to the petition of the deputation, beseeching him to remove to Italy. At the same time, however, his holiness, anxious to testify the confidence he reposed in Petrarca, intrusted him with a delicate mission, namely, that of obtaining from the regency of Naples a recognition of the rights of the Holy See, during the minority of the grand-daughter of King Robert. Meanwhile, the celebrated Cola di Rienzi, having made himself master of Rome, cited kings to appear before him, and loudly proclaimed that his fellow-citizens were about to resume, in the fourteenth century, their ancient dominion over the world. All the illusions of Petrarca immediately brightened into realities. An ardent defender of the tribune even in the midst of the pontifical court, he now congratulated the popular leader on his success, exhorted him to persevere, and, impatient to counsel him on the spot, set out immediately for Italy. The news of the massacre of the Colonnas reached him at Genoa, and struck him with consternation; but still he felt disposed to pardon Rienzi, provided Rome had become republican. The sway of the tribune, however, was short-lived, and with his fall disappeared that wild phantom of liberty which had deceived Petrarca.

Scarcely a year had elapsed when the poet had to bewail a loss still more painful. Laura was no more. The pestilence of 1348, which Boccaccio has described with such terrible truth, had carried her off on the 6th of April that year. The last half of the *Canzoniere* is an immortal monument of the long regret of Petrarca. But although his verses had not made us aware of the sincerity of his grief for his mistress, the touching note which he inscribed upon his copy of Virgil would still attest the profane homage which he paid to her memory.[1] Yielding to the repeated instances of Luigi Conrado, lord of Mantua, Petrarca now repaired to his princely residence, in the hope of finding consolation; and it was during his stay there that he addressed to the Emperor Charles IV. an eloquent letter, in which he exhorted him to restore peace to Italy. The publication of the jubilee in 1350 drew almost all Christian Europe to Rome. Petrarca, participating in this pious impulse, set out for Rome, and in passing through Florence, visited Boccaccio, one of those whom he had particularly noticed at the court of Naples, and who now became his friend. At Rome he found the jubilee commenced, and the ceremonies of the occasion seem to have made a deep impression on his mind. His habits became more grave, his manners more austere; and from this time his thoughts assumed a character of severity, the impress of which is visible in his later compositions. At the same time he everywhere received honours which had never before been bestowed on any private individual.

The friendship of the Carraras having induced Petrarca to visit Padua, he had scarcely arrived when Boccaccio came to announce to him, in the name of the senate of Florence, that he had been re-established in his rights as a citizen, as well as in the patrimony of his family, and also to offer him the directorship of the university recently founded in the first city of Tuscany. This honourable appointment, however, had no attraction for Petrarca. His books awaited him in his transalpine Parnassus, as he called Vaucluse; and his cisalpine Parnassus was his house at Parma. He accordingly declined accepting the proffered appointment, and hastened to bury himself in his favourite retreat. About the same time, Rienzi, having fallen into the hands of the emperor, was delivered up to the pope, and brought before a judicial commission, against the legality of which he vehemently protested. It is said that Petrarca wrote to the Roman people, warmly exhorting them to interpose in favour of his old friend; and, in fact, this exhortation is found in his works. But there is nothing to show that it was sent according to its address; on the contrary, almost every circumstance leads us to believe that his imagination alone had prompted him to write this letter, rather to console than to save Rienzi.

On his return to Vaucluse, he engaged in the composition of the "Epistle to Posterity," in which he gives an account of the principal events of his life, until his departure from Italy, about the middle of the year 1351.[2] Some months afterwards, Innocent VI. was called to the government of the church,—a man of an irreproachable life, but of little knowledge, and the only pontiff from whom Petrarca did not receive some mark of favour. The poet, after having twice, under Clement IV., refused the office of apostolical secretary, was now suspected of magic by his successor, and he took no pains to dispel the prejudices of the new pontiff. His regret for Italy was only increased; and he repassed the Alps, uncertain where to fix his abode, although prepared to adopt as his country any place where he might live in tranquillity and independence. He had long wished to visit Milan, and, on this occasion, he proceeded no farther. Charmed with the reception he met with from a man of power, who knew well how to exhibit himself to the poet in an amiable light, and admitted to the counsels of Giovanni Visconti, archbishop and lord of Milan, Petrarca accepted a mission having for its object to bring about a reconciliation between the republic of Genoa, which had just given itself up to Visconti, and that of

[1] The authenticity of this note is still disputed by those who wish to overturn the whole history of Laura. Mr Whyte, a learned Englishman, who discovered at Florence an inedited life of Petrarca, written soon after his death, by Luigi Peruzzi, who had known him, also rejects the evidence of this note. But it is written in a tone which ought to silence incredulity, because feigned emotions never bear the stamp of nature and reality. The Virgil of Petrarca has long been in the royal collection at Paris.

[2] Ginguené (*Histoire Littéraire d'Italie*, tom. ii., p. 582) shows, contrary to the opinion of Badelli, that the "Epistle to Posterity" was written in 1352, and not in 1372.

Petrarca.

Venice, elated by recent and apparently decisive successes. Three years before, Petrarca had endeavoured to prevent a war which presaged long and bloody divisions in Italy. Connected with the Doge Andrea Dandolo, one of the greatest men of his age, in politics, in war, and in letters, the poet appealed to the patriotism of his friend, and the latter replied by praising the eloquence of Petrarca, but without deferring to his counsels. Hence this new attempt proved not more fortunate than the previous one; but events soon showed on which side lay the want of foresight. Venice was reduced to the necessity of purchasing peace; Dandolo died of grief, and Visconti survived him little more than a month. Nevertheless, after a silence of three years, the emperor replied to the letter in which Petrarca had called upon him to restore peace to his country, an appeal which he had several times renewed. But the avarice of Charles IV. furnished a more powerful motive to appear in Lombardy than the patriotic addresses of Petrarca. By his orders the poet proceeded to meet him at Mantua, full of confidence in his wisdom, and hoping that, as the friend of the Holy See, he would for ever banish from Italy the names of Guelf and Ghibelin, which had caused the effusion of so much blood, and fomented such fierce animosities. But in this monarch he discovered only a weak and avaricious prince, who mistook treachery for talent, and exhibited the strange spectacle of an emperor of Germany in the pay of the Venetians. The poet presented him with some rare and valuable medals of Augustus, of Trajan, and the Antonines. "These," said he, "are the great men whose place you occupy, and who ought to be your models." During eight days which he spent in familiar intercourse with the emperor, Petrarca discovered the mean, narrow, and grovelling character of his mind, and refused to enter Rome in his train, or to be a witness of his coronation. He then attached himself more than ever to the three nephews of Giovanni Visconti, whom the emperor had loudly menaced, with the view of enhancing the price to be afterwards exacted for confirming them in the usurpations of their uncle. At this period, the public hatred had accused them of fratricide. Petrarca, afflicted with a rumour which he could not believe, repaired to Pavia, where he was employed by Galeazzo Visconti to dissuade Charles IV. from undertaking a new expedition beyond the Alps. This embassy proved more successful than the former, apparently because the proceedings of the malcontents in Germany had produced a change in the versatile policy of the emperor. On his return to Milan, the ambassador received from him the diploma of Count Palatine, in a gold box of considerable value. Petrarca accepted this new honour, but returned the box to the chancellor of the empire.

Fatigued with the agitation of courts, the poet now fixed upon a new retreat on the banks of the river Adda, in a pretty country-house, which he called Linterno, in honour of his hero Scipio. Literary projects and researches, religious exercises, and frequent visits to the charter-house of Milan, now occupied his leisure. All the great lords of Italy had disputed with pontiffs and kings the honour of his presence and conversation. But a goldsmith of Bergamo, named Capra, solicited and obtained a sort of preference. At the approach of Petrarca all Bergamo went out to meet him, whilst Capra received him with a magnificence almost royal, and proved by his enthusiasm, not less than by the number and quality of his books, that he was worthy of his guest. In 1360 a new diplomatic mission led Petrarca to France, whither he went to compliment King John on the recovery of his liberty; and this prince, who had formerly made vain attempts to prevent his return to Italy, now renewed his efforts to retain him. But the envoy of Galeazzo returned to Milan, without suffering himself to be moved either by the presents of the monarch or by the entreaties of the dauphin; and those of the emperor, backed by the transmission of a gold cup of curious workmanship, found him equally inflexible. But never had a residence in Italy presented fewer attractions. The foreign companies who infested that land of discord forced him to seek an asylum at Padua, whence he was soon afterwards expelled by the pestilence. He proceeded to Venice, accompanied with his books, which he always carried along with him, and, on his arrival, he presented his library to that hospitable republic, by a writing dated in 1362, on condition that so rare a collection should neither be divided nor sold. By a decree of the senate, a palace was assigned for the reception of Petrarca and his books; and it is, doubtless, this circumstance which has made him be regarded as the original founder of the celebrated library of St Mark.[1] The Abate de Sade is therefore mistaken in supposing that all these manuscripts had perished. Tomasini, who made a search for them in the year 1635, discovered them in a small dark chamber, situated near the four bronze horses; and there they remained until the year 1739, when permission was at length given to the public to consult them.[2]

This residence at Venice, indeed, is doubly memorable in the life of Petrarca. It was here that, when driven by the plague from Florence, Giovanni Boccaccio came to share his asylum, and presented to him Leontius Pilatus of Thessalonica, who was then teaching him Greek. Petrarca, though now past sixty, resumed the study of that language, and found, even in the difficulties which opposed his progress, sufficient enjoyment to mitigate the affliction caused by the loss of many valued friends. It was the fortune of Petrarca to survive all those whom he loved. Under the depression occasioned by the loss of his best friends, he became more sensitive to the criticisms which, notwithstanding his reputation, were freely made on his Latin eclogues, and on some parts of his *Africa*. It was then that the poet wept over his laurels, and, in the bitterness of a wounded spirit, confessed that his crown had been to him a crown of thorns.

The homage which was paid to him at Venice might, however, have afforded him some consolation, had not a new revolt in the island of Candia created serious alarm in the mother country. The senate, confiding in the military reputation and experience of Luchino del Verme, a Milanese general, the friend of Petrarca, appointed him to the command of the expedition fitted out against the rebels; and the poet consented to support the application made by the doge to that officer. Luchino put down the insurrection; and Petrarca had a place assigned him on the right hand of the doge, at the equestrian games which were celebrated, in the manner of the ancients, in honour of this victory. Urban V., a virtuous and enlightened pontiff, now attempted to recall the poet to his court, by conferring upon him a canonship at Carpentras,—a favour which he repaid by urging the holy father, in a long and vehement letter, to put an end to celibacy in the Roman Catholic church. Meanwhile, the

[1] Morelli, *Della Publica Libreria di S. Marco*, p. 4, et seq., Venice, 1774, in 4to.

[2] Several of these books, which had lain forgotten for nearly three centuries, fell to dust when touched, and others were found, as it were, petrified. Tomasini, in his *Petrarcha Redivivus* (p. 65), gives a list of those which, in 1635, were found in good condition. Amongst these he remarked a Polyglot Vocabulary in Latin, Persian, and Turkish (*Comanicum*), written in the year 1303, of which he transcribed a small specimen.

Morelli, in the work already referred to, gives a detail of several of these manuscripts, which are still to be seen in the library of St Mark, and accounts for the oblivion into which they had been allowed to fall during so long a period, from the enthusiasm which the acquisition of the Greek manuscripts of Cardinal Bessarion excite in the fifteenth century.

cry of hatred raised everywhere against the Visconti had armed against them the new pontiff, and with him the half of Italy, now menaced by their ambition. Much less alarmed at this danger, however, than apprehensive of a war which would expose his country to the ravages of a foreign soldiery, Petrarca was employed by Galeazzo Visconti to endeavour to avert the storm; and this, which proved the last, was also the most fruitless of all his missions. But the warmth with which he defended the Visconti family in no degree diminished the favour he enjoyed at Rome. Urban wished to see him: and Petrarca was preparing to respond to an invitation conceived in terms the most urgent and flattering, when he was seized with a terrible malady at Ferrara. But though saved by the care of the Este family, who governed that country, he did not recover sufficient strength to continue his journey; and having returned to Padua, reclining upon a couch in a boat, he established himself 4 leagues from that city, at the village of Arquà, situated in the Euganean hills, so celebrated by the Romans for the salubrity of the air, the richness of the pasturages, and the beauty of the orchards. There the poet resumed, with his labours, all the imprudence of his usual course of life. Employing at once as many as five secretaries, he exhausted himself with austerities, restricted himself to a single repast composed of fruits or pulse, abstained from wine, fasted often, and, on days of abstinence, allowed himself only bread and water. An unforeseen event also served to retard his convalescence. Urban V., preferring the peaceful abode of Avignon to the tumultuous agitations of Rome, had returned to die in France. He was succeeded by Gregory XI., who, equally well affected towards Petrarca, chose, as his legate in Italy, Philippo di Cabassole, now cardinal and archbishop of Jerusalem. But this prelate died soon after reaching Perugia, and Petrarca never more beheld the beloved friend of his youth.

Francesco da Carrara, abandoned by his allies, had just concluded a humiliating peace with Venice. Being obliged to send his son to ask pardon and swear fidelity to the republic, he entreated Petrarca to accompany the youth, and address the senate in his behalf. Though sick and old, the poet only recollected his ancient friendship for the lords of Padua, and repaired with young Carrara to Venice. The day after their arrival they had an audience; but the old man, overcome with fatigue, and perhaps awed by the majesty of the assembly, could not utter a word. The following day, however, he took courage, and his harangue was warmly applauded. But this effort proved his last; it was the song of the swan when dying. He returned to Arquà, feeble, exhausted, and as indocile to the counsels of physicians as ever. Boccaccio, who now seemed to supply the place of all the friends he had lost, having sent him the *Decameron*, which had just been completed, Petrarca read it with enthusiasm; got by heart the novel of Griseldis, which he translated into Latin; and transmitted to Boccaccio this version, accompanied with a letter, which appears to have been the last he ever wrote. On the 18th of July 1374, he was found dead in his library, with his head resting upon an open book, an attack of apoplexy having seized him in that attitude. All Padua came to assist at his obsequies. Francesco da Carrara conducted the funeral ceremonies, attended by the nobility and the people; and the family of the poet caused a mausoleum of marble to be erected to his memory before the gate of the church of Arquà.

The illustrious subject of this notice was connected with all the celebrated men of the fourteenth century; he took part in almost every event by which that memorable age was distinguished; and in a life so full of trouble and agitation, the only reproach which he incurred constitutes the finest eulogium on his character. He was born a poet, and always continued so, in his studies, his political missions, his love, his conversation, and his letters. The love of his country was no doubt in him little more than a poetical dream, but it was the dream of his whole life. In the intoxication of glory, as well as in the midst of the most cruel afflictions, ancient Italy was ever present to his thoughts. In the glorious recollections of the past he sought to console himself for the disorders of his own age, and from his worship of antiquity he derived generous inspirations and innocent illusions. That these illusions sometimes misled him in the choice of his friends, cannot reasonably be questioned. His candour exposed him without defence to the calculations of an astute policy, which, masking its real designs under the captivating name of Italy, completed the deception by the interested benefits which it conferred upon letters; but he passed through the courts of the petty Italian tyrants without any one having impeached his character, or cast a shade of suspicion on his memory. In his youth he had a natural daughter, near whom he died soon after her marriage; and his son, whom he survived, was cherished with an affection and bewailed with a sorrow that long served to keep alive the regret which the remembrance of his weaknesses had left in his mind. He seems to have been impressed with a deep sense of religion; and, amongst the habits of a simple and studious life, it is related that he rose regularly at midnight for prayer. Superior to the pedantry which then and long afterwards clung to learning, this great poet was also an amiable man. His conversation was confiding and animated; his manners were frank and polished. His soul, ardent, but open to all the gentler affections, had a natural craving for friendship, which was to him a necessary of life; and he had many friends, all of whom appear to have been faithful to him, and equally swayed by the double authority of his counsel and his example. Boccaccio, whose benefactor he had been, and who had previously been little else than a man of pleasure, became irreproachable, if not austere, in his morals, after his acquaintance with Petrarca. It was by means of his friends that Petrarca exercised a kind of literary dictatorship in France, in Spain, and in England; it was through his friends that he was enabled to carry on that European correspondence which everywhere rekindled the study and admiration of the ancients. He represented in his own person the republic of letters, and his life forms a grand epoch in their history.

He studied with diligence alchemy, astrology, scholastic theology, and Aristotle, with his interpreter Averroes. Even at the time when, by his advice, Galeazzo Visconti founded the university of Pavia, he himself directed the course of study, and formed the mind of Malpighino, who afterwards became so famous amongst the restorers of letters by the name of John of Ravenna. His letters *De Scriptis Veterum Indagandis* and *De Libris Ciceronis* attest the extent of the researches he made to recover manuscripts of the ancient authors, which he then copied with his own hand. It was thus that he restored to the literary world the *Oratorical Institutions* of Quintilian, though incomplete and mutilated, and the letters of Cicero, the manuscript of which is preserved in the Laurentian Library at Florence, with the copy which he had made from it. He equally recovered some of Cicero's orations which had been lost; and it is further known that he had preserved the famous treatise *De Gloria*; but having lent it to his master Convennole, this old man sold it for subsistence, and Petrarca afterwards attempted in vain to trace it out, as well as the *Antiquities* of Varro, which he had seen in his youth, and a book of letters and epigrams ascribed to Augustus. It was he also who first made Sophocles known in Italy; and his avidity for manuscripts had become so generally understood, that he received from Constantinople a complete copy of the poems of Homer. After the gift which he made to Venice, as already mentioned, he lost no time in

forming another library. In an age when chronology and geography were still unknown, he had made a chronological collection of imperial medals, and got together a very considerable number of geographical charts. He himself was the author of a map of Italy, which continued to be consulted a century after his death; and all his biographers have mentioned his researches respecting the island of Thule.

The rest of Europe did not then possess men who had attained the same splendour and universality of fame. France, which had received from her troubadours the oldest modern literature, could only boast of a few learned men; such as Nicolas Oresme, Pierre Berchoire, and Froissart. Chaucer, who was preparing to found a literature in England, saw Petrarca in Italy, and was perhaps indebted to him for the acquaintance of Boccaccio, whom he has so frequently imitated in his works. Another Englishman, Richard de Bury, one of the correspondents of Petrarca, founded a library at Oxford, and diffused throughout his country a taste for books. As yet Spain had only her early historical romancers, and some theologians; but two centuries later, the poetical admirer of Laura found in Boscan an imitator at the court of Castille; whilst Bembo, Tarsia, Molsa, and many others, opened in Italy the dangerous school of the Petrarchists.

The letters of Petrarca, which were printed for the first time in 1484, are now regarded as the most curious portion of his Latin works. These letters, which were not written exclusively, for his friends, contain valuable details in regard to his life, as well as the manners and the history, literary, and political, of the fourteenth century. The court of Avignon is by no means spared; and the author was too good an Italian not in some instances to overcharge a little his portraits. His expression is animated, but not always natural, and his prose often betrays the poet. His books of moral philosophy somewhat resemble those commonplaces which were treated by the Greek rhetoricians of the middle age. The treatise *De Otio Religiosorum* was a tribute of complaisance to the Carthusian friars of Montrieu, amongst whom his brother had taken the habit of the order;[1] and it was at the request of Francesco da Carrara that he collected the principal maxims of Plato and Cicero on politics, under the title of *De Republica optime administranda.* The compilation in question, and his treatise *De Officio et Virtutibus Imperatoris*, were printed separately at Berne, 1602, in 12mo. In his retreat at Arquà, he also wrote a philosophical work against the disciples of Aristotle, under this piquant denomination, *De Ignorantia sui ipsius et multorum.* His Historical Essays, of which some fragments have been preserved, entitled *Rerum Memorandarum libri iv.*, in addition to the facts which he has borrowed from preceding writers, contain some particulars belonging to contemporaneous history, which are nowhere else to be found. The perusal of the Confessions of St Augustin appears to have suggested to him the most singular of all his compositions, namely, the three dialogues, *De Contemptu Mundi*, to which he attached so much importance as to call them "his secret."

The harangues of Petrarca are not always exempt from declamation, and, more than any of his other productions, betray the influence of the false taste against which he so successfully strove. But his Latin poetry has particular claims to the attention of men of letters. His poem of *Africa* is a detailed recital of the second Punic war, but almost always cold and colourless. It is a chronicle rather than a poem, and appears as if it had been left unfinished. The *mens divinior* is wanting; invention there is none; and we are astonished to find that the poetry of Virgil produced so little inspiration. His eclogues, like those of Boccaccio, are almost always satirical allegories, having reference to contemporaneous events. The tenth is consecrated to the memory of Laura. In his three books of *Epistles*, versified with more facility than might have been expected in that iron age, there are some interesting and instructive details. In fact, the Latin diction of Petrarca, on which, curious to say, he founded his claims to distinction as an author, though generally superior to the bald and rude style of his contemporaries, is nevertheless far below that of his models.

But Petrarca's best title to distinction rests upon his *Canzoniere.* It is there that he shows himself truly inspired, and displays in profusion all the riches of his original genius. The ancient erotic poets, strangers to any ennobling sentiment, had celebrated pleasure rather than love. Petrarca was the first, and for a long time the only poet, who made a virtue of love. He formed for himself a language, as Dante had done; his turns of expression are almost as bold; above all, he reproduced those graces of colouring and that delicious harmony with which Dante had related the misfortunes of his Francesca; and, after the publication of the *Canzoniere*, the Italian idiom ceased to have in it anything barbarous. When we read the verses of Petrarca, we can almost fancy that we hear the sound of his lyre, from which, on every occasion, he extracts sounds of ineffable sweetness. His sonnets, from their form, frequently remind us of some of the smaller odes of Horace, and, for grace as well as simplicity of details, recall the manner of Anacreon. For this kind of poetry Petrarca was indebted to his predecessors; but it was he who rendered these little poems more perfect and more difficult; and the laws which his example prescribed have not yet been abrogated.

The *Canzoni* of Petrarca are odes the form of which he borrowed from the troubadours, whilst to the substance he imparted the elevation and dignity of epic composition. The Italians have exhausted all the prescriptive terms of admiration upon those which Petrarca appears to have preferred, and which he called the *Three Sisters*, odes which his commentators have since called the *Three Graces.* But whatever may be the perfection of style for which they are distinguished, a reader of the present day will always find difficulty in comprehending the long literary idolatry of which they have been the object. He is often more ingenious than natural, and more elaborate than correct; but a re-perusal of the second half of the *Canzoniere*, which is very generally preferred to the first, must satisfy any reader that nothing short of extreme injustice or inveterate prejudice can construe into a mere play of words or sport of ingenuity a grief which is stamped with all the characteristics of truth, deep feeling, and sincerity.

The most complete edition of the works of Petrarca is that of Basel, 1581, in folio, which wants only a certain number of Letters, comprised in that of Geneva, 1601. The most ancient edition of his Latin works also bears the name of Basel, where it appeared in 1496, in folio. But it is in the libraries of Italy that his Letters and his Autograph Manuscripts must be sought for. The treatise *De Remediis utriusque Fortunæ* was printed at Cologne, 1471, in 4to, and has been thrice translated into French; and the historical work entitled *Vite de' Pontefici et Imperadori Romani*, which has now become exceedingly scarce, appeared at Florence, 1478, in folio, and is still much sought after, as one of the most ancient specimens of Italian prose. In later times, his Italian poems alone have been reprinted. The first edition, containing the Sonetti and the Trionfi, is that of Venice, 1470, in large 4to. Amongst the subsequent editions, the most esteemed are,—*Le Cose Volgari*, by Aldo Manuzio, Venice, 1501, in 8vo, *Il Petrarca*, Lyon, 1574, in

[1] Several biographers have given Petrarca a sister, who, they say, was beloved by Pope Benedict XII. This fable, which has been received without question by many, is disproved by the fact, which Ginguené has clearly established, namely, that Petrarca never had a sister.

16mo; *Le Rime di Petrarca*, Padua, 1722, in 8vo; a reprint of the same, with notes by Muratori, Venice, 1727, in 4to; the editions of Bodoni, 1799, in two vols. folio and 8vo; that of Morelli, the librarian, with remarks by Beccadelli, Verona, 1799, in two small vols. 8vo, that which forms part of the *Biblioteca Poetica Italiana*, published by Buttura, and printed by Didot the elder, Paris, in three small vols.; and the edition, with commentaries, published by Biagioli in 1822, in 8vo. Of the 300 and more editions of the *Canzoniere*, the best is that of Professor Marsand, two vols. 4to, Padua, 1819-20. A careful bibliography of the works of Petrarca, their various editions, commentaries, &c., was published by Domenico de' Rosetti, Trieste, 1828. Petrarca is said to have been the subject of twenty-five distinct biographies, exclusive of the sketches of his life given in collections. (J. B—E.)

PETRIFACTION. See PALÆONTOLOGY.

PETRINIA, a town of Austria, in the Croatian Military Frontier, on the Kulpa, 27 miles S.E. of Agram. It is built chiefly of wood, and has a square planted with mulberries. There are here two churches, two schools, and an hospital. Pop. about 4000.

PETROLEUM. See MINERALOGY, § 499; also BITUMEN.

PETRONIUS, ARBITER, the author of a kind of romance, flourished, if we may judge from the character of his style, in the first or second century. Who he really was has been much disputed, and has never been satisfactorily determined. The only historical personage who seems to have any marks of identity is a certain Caius or Titus Petronius who lived at the court of Nero. This individual, as described by Tacitus, was famous for turning the pursuit of pleasure into a professional art. He slept all day that he might be able to discharge with vigour his voluptuous avocations during night. His great aim was to grovel in sensuality in the most æsthetical manner, and to move under the stiff uniform of a fop, with the simplest and easiest bearing. It is true, indeed, that his mind was for a while engaged with the graver duties of proconsul of Bithynia and of consul; but he returned with fresh eagerness to take a more leading part in his former profession. Promoted to the office of "arbiter elegantiæ," or "umpire of fashion," he daily occupied himself in deciding with pompous gravity what frivolities ought to be introduced at court. Even after another courtier, named Tigellinus, had supplanted him in Nero's favour, and his doom appeared to be fixed, he resolved to remain true to his calling till the last, by departing from the world in as easy and elegant a manner as possible. Continuing at his summer quarters at Cumæ, where he then happened to be, he caused one of his veins to be opened, and bandaged up at intervals. While his heart's blood was thus dripping slowly away, he listened to giddy songs; he sauntered forth among the gay pleasure-seekers on the beach; he returned to his villa, and, reclining on a couch, discussed with his friends the gossip of the day. In this manner the heartless epicure ended his mockery of a life.

The supposed work of this Petronius, which is entitled *Satiricon*, and which now exists only in fragments, is to a considerable extent accordant with the character which we have just drawn. It is the narrative of the adventures of a certain Encolpius and his fellow-debauchees in their travels in the south of Italy. The coarse and vicious personages whom the tourists everywhere encountered are described with great humour and dramatic propriety. The luxurious and licentious scenes which they everywhere witnessed are depicted with minute and shameless fidelity. That part especially which is known as the *Supper of Trimalchio* presents a vivid picture of the profligacy of a Roman gourmand. In fact, there is everywhere throughout the descriptions an obscenity of thought expressed in an elegant and graphic form of diction, which may reasonably be supposed to have proceeded from a professed and accomplished sensualist. The best edition of Petronius is that of Burmann, in two vols. 4to, Amsterdam, 1743. The works of Petronius have been frequently translated into English. The translation of Addison (1736), and that in "Bohn's Classical Library," edited by W. Kelly (1854), deserve special mention.

PETROPAULOVSKI, or "*The Harbour of St Peter and St Paul*," a small town of Asiatic Russia, capital of the territory of Kamtschatka, on the Bay of Awatska, on the S.E. coast of the peninsula; N. Lat. 53. 1., E. Long. 158. 43. There are two good streets; but the general appearance of the town is not fine, as the houses, which are scattered, are built for the most part of wood, and thatched with reeds or dried grass. Many of the houses have gardens, in which a few vegetables are grown; and, except in the governor's house and public buildings, plates of mica are used in the windows instead of glass. There are several government offices, a Greek church in the oriental style, a school, and an hospital. The harbour, which is very good, and capable of containing six or eight ships of the line, is defended by two forts, and has a lighthouse. Fish are caught and dried here, and form the principal article of export. Petropaulovski is the principal military station in this province. It was bombarded by British and French fleets, September 1854. Pop. (1850) 975.

PETROPAULOVSKI, a town of Siberia, in the government of Tobolsk, stands on the Ishim, 160 miles W. of Omsk, on the great post route of Siberia, and on the borders of the country of the Kirghises. A considerable trade is carried on by barter, not only with the other parts of Siberia but with Turkestan and the western part of the Chinese Empire. Petropaulovski, Orenburg, and Troizk are the principal stations by which the commercial intercourse is carried on between Russia and Central Asia. Pop. (1842) 4127.

PETROVSK, a town of European Russia, capital of a circle in the government of Saratov, stands on both sides of the Medveditza, 70 miles N.N.W. of Saratov. It has a ruined castle, seven churches, a convent, two schools, and a benevolent institution. Many bees are reared in the vicinity. Pop. (1848) 7631.

PETROZAVODSK, a town of European Russia, capital of the government of Olonetz, stands on a bay on the west shore of Lake Onega, near the confluence of the small rivers Lossossinka and Neglinka, 192 miles N.E. of St Petersburg. It is meanly built; but is the seat of the governor and of the archbishop of Petrozavodsk and Onega. There are six churches and several schools, an imperial cannon factory, employing about 700 hands, a copper foundry, and other manufactures. There are produced here nearly 3000 tons of iron annually, reckoned the best in Europe. The manufactures of the town are conveyed for sale to St Petersburg. Pop. (1849) 7567.

PETSH, or IPEK, a town of European Turkey, province of Albania, on both sides of the Bistrizza, 56 miles E.N.E. of Scutari. The river, which here flows rapidly in several channels, and turns numerous mills, divides the town into two parts, called respectively Jarin and Csenevia, which are united by a high bridge of five arches. Petsh contains a bazaar with 960 shops, numerous mosques, and the residence of a pasha. Arms of a good quality are largely manufactured here; and a kind of apple of an excellent flavour is raised in the vicinity, and sent to Constantinople. Pop. said to exceed 12,000.

PETTY, SIR WILLIAM, a distinguished political economist, was the eldest son of Anthony Petty, a clothier at Rumsey, in Hampshire, where he was born on the 16th of May 1623. After receiving the rudiments of his education at the grammar-school of Rumsey, he removed to the university of Caen, in Normandy, where he perfected himself in Latin and French, acquired enough of Greek "to serve his turn," studied the arts, and extended his knowledge of the mathematics. On his return from France, he was appointed to some post in the navy, which

Petty.

he soon gave up, and took to the study of medicine. With this design he, in 1643, visited Leyden, Utrecht, and Paris, where he studied anatomy, and read Vesalius with Hobbes, whom he in turn assisted by drawing optical diagrams for the philosopher. Having from his earliest years displayed a decided taste for mechanical invention, Petty, on the 6th of March 1647, patented a sort of copying machine, by means of which "any man, even at the first sight and handling, may write two resembling copies of the same thing at once, as serviceably and as fast as by the ordinary way." But this machine having been found not to promote expedition in writing, Petty did not reap much profit by his invention. His next production was a pamphlet entitled *Advice to Mr Hartlib for the Advancement of Learning*, containing some sensible remarks on national education. In 1648 he went to Oxford, where he gave private instructions in anatomy, became assistant to Dr Clayton, the professor of anatomy, and also practised physic with considerable success. Here he acquired such reputation, that the philosophical meetings which led to the institution of the Royal Society were for the most part held at his lodgings; and, by a parliamentary recommendation, he obtained a fellowship in Brazen-nose College, and was created doctor of physic on the 7th of March 1649. In June 1650, he was admitted a member of the College of Physicians. In 1651 he was appointed professor of anatomy, and soon afterwards professor of music at Gresham College; and in 1652, he went to Ireland as physician to the army in that country, where he served under three successive lords-lieutenant, namely, Lambert, Fleetwood, and Henry Cromwell.

In 1654 Dr Petty was appointed to survey the Irish forfeited lands adjudged to the soldiers after the suppression of the rebellion of 1641. In 1655 Henry Cromwell assumed the lord-lieutenancy of Ireland, and soon afterwards appointed Petty his secretary; in 1657 the viceroy further appointed him clerk of the council, and got him elected to serve as burgess for West Love, in Cornwall, in Richard Cromwell's Parliament, which assembled on the 27th of January 1658. But this last honour speedily involved him in trouble. On the 28th of March following he was impeached of high crimes and misdemeanours in the execution of his office, and obliged to proceed to England. His case was taken up in the House of Commons, but as the Parliament was suddenly dissolved, it never came to an issue. He was removed, however, in the following June from all his employments. He defended himself from the charges of bribery, fraud, &c., which were urged against him, by ingeniously arguing that he might have acquired as large a fortune by other means as by having to do with the Irish lands. At the Restoration he was graciously received by Charles II., and, having resigned his professorship at Gresham College, was appointed one of the commissioners of the Court of Claims. In April 1661 he received the honour of knighthood, with the grant of a new patent constituting him surveyor-general of Ireland; and he was at the same time chosen a member of the Irish Parliament. Being one of the founders of the Royal Society, he was elected a member of the first council; and although he had left off the practice of physic, his name appears in the list of fellows of the College of Physicians in 1663. About this time he invented a double-bottomed ship, which was to sail against both wind and tide, though we are not told by what means; and in 1665 he communicated to the Royal Society, along with a model of his invention, a *Discourse about the Building of Ships*.

Petty.

In 1666 Sir William Petty drew up his treatise, entitled *Verbum Sapienti*, containing an account of the wealth and expenditure of England. In 1667 he married Elizabeth, daughter of Sir Hardresse Waller, and widow of Sir Maurice Fenton. This matrimonial connection, however, did not for a moment distract his attention from his favourite pursuit of money-making; for immediately afterwards he established iron-works and a pilchard-fishery, opened lead mines, and commenced a trade in timber at Kerry, all of which turned to good account. To vary his pursuits, he also composed a piece of Latin poetry, which he subsequently published under the title of *Colloquium Davidis cum Anima sua!* In 1680 he gave to the world his *Politician Discovered*, intended to expose the sinister practices of the French; and afterwards wrote several essays on *Political Arithmetic*, of very great ability. Lord Macaulay remarks of them that "Sir William Petty created the science of political arithmetic, the humble but indispensable handmaid of political philosophy." (*Hist. of England.*) He assisted at the formation of the Dublin Philosophical Society, and in November 1684 was chosen president of that association. On this occasion he drew up a Catalogue of Cheap and Simple Experiments, which was soon afterwards followed by his *Suppellex Philosophica*, containing a description of forty instruments which he deemed necessary to carry forward the design of the institution. He died in London, on the 16th of December 1687, in the sixty-fifth year of his age. His will is perhaps the most curious and characteristic composition of the kind in our language, illustrating at once the habits of thinking and feeling peculiar to the man, and the mode in which he realized the enormous fortune which he left to his descendants.[1]

A few particulars of the personal history of Sir William Petty may be gleaned from Aubrey, who appears to have lived with him on terms of intimacy. He possessed strong, shrewd, natural good sense, flavoured with a tincture of humour, and had a most convenient way of shaking himself rid of the trammels of party when it suited his interest to do so, changing sides with a facility that is altogether edifying. His qualifications were indeed various and peculiar. As a specimen of his fondness for drollery, we are told that, on one occasion, he proposed to fight Sir Jerome Sankey, who had challenged him, in a dark cellar with carpenter's axes; but the soldier knight did not deem it prudent to acquiesce. He would also preach extempore, which Aubrey says he did "incomparably," and that, too, in almost any style, "either in the Presbyterian way, Independent, Capuchin friar, or Jesuit." He had "an admirable inventive head, and practical parts," which he turned to good account, as far as his own interest was concerned; and, like his friend Hobbes, he boasted that he had read but little since he was twenty-five, declaring that "had he read as much as some men have, he had not known so much as he does, nor should have made such discoveries and improvements." He told Aubrey that he had "hewed out his fortune for himself;" and he even managed to obtain a patent

[1] Here is a specimen of this extraordinary composition:—"As for legacies for the poor, I am at a stand; as for beggars by trade and election, I give them nothing; as for impotents by the hand of God, the public ought to maintain them; as for those who have been bred to no calling or estate, they should be put upon their kindred; as for those who can get no work, the magistrate should cause them to be employed, which may be well done in Ireland, where is (are) fifteen acres of improvable land for every head; prisoners for crime, by the king; for debts, by their prosecutors; as for those who compassionate the sufferings of any object, let them relieve them, and relieve themselves by relieving such sufferings, that is, give them alms *pro re nata*, and for God's sake relieve those several species above mentioned where the above-mentioned obligers fail in their duties: Wherefore I am contented that I have assisted all my poor relations, and put many in a way of getting their own bread, and have laboured in public works, and by inventions have sought out real objects of charity; and do hereby conjure all who partake of my estate, from time to time to do the same at their peril. Nevertheless, *to answer custom, and to take the surer side*, I give L.20 to the most wanting of the parish wherein I die."

Petworth || Pewter.

of nobility as Earl of Kilmore, which, however, he suppressed, to avoid envy. The variety of pursuits in which he was engaged shows that he had talents capable of achieving anything to which he chose to apply them; and it is certainly not a little remarkable, that a man of such an active and enterprising disposition should have found time to write so much as he did in the course of his busy life.

The following is a list of the works which appeared in his lifetime:—*Advice to Mr Samuel Hartlib*, 1648, in 4to; *A Brief of Proceedings between Sir Jerome Sankey and the Author*, 1659, in folio; *Reflections on Some Persons and Things in Ireland*, 1660, in 8vo; *A Treatise of Taxes and Contributions*, 1662, in 4to, republished in 1690, with two other pieces, *Apparatus to the History of the Common Practice of Dyeing*, 1667; *A Discourse concerning Duplicate Proportion*, 1674, in 12mo; *Colloquium Davidis cum Anima sua*, 1679, in folio; *The Politician Discovered*, 1681, in 4to; *An Essay on Political Arithmetic*, 1682, in 8vo, *Observations upon the Dublin Bills of Mortality in* 1681, 1683, in 8vo; "Some Experiments relating to Land-carriage," *Phil Trans.*, No 161; "Queries on Mineral Waters," *Ibid.*, No 166; "A Catalogue of Experiments," *Ibid*, No 167; *Maps of Ireland, being an actual Survey of the whole Kingdom*, 1685, in folio; *An Essay concerning the Multiplication of Mankind*, 1686, in 8vo, "A further Assertion concerning the Magnitude of London," *Phil Trans*, No 185; *Two Essays in Political Arithmetic*, 1687, in 8vo; *Five Essays in Political Arithmetic, English and French*, 1687, in 8vo; *Observations upon London and Rome*, 1687, in 8vo. His posthumous productions are:—*Political Arithmetic*, 1690, in 8vo, and 1775, with a Life prefixed, and a Letter never before printed; *The Political Anatomy of Ireland*, to which is added *Verbum Sapienti*, 1691, 1719; *A Treatise of Naval Philosophy*, in three parts, printed at the end of an *Account of Several New Inventions*, 1691, in 12mo; "What a Complete Treatise of Navigation should contain," *Phil Trans.*, No. 198, drawn up in 1685. In Birch's *History of the Royal Society* are contained, "A Discourse of making Cloth and Sheep's Wool," including the History of the Clothing Trade, and also that of Dyeing; and *Suppellex Philosophica*, already mentioned. Many of Sir William Petty's manuscripts are to be found in the British Museum. (J. B—E.)

PETWORTH, a market-town of England, in the county of Sussex, on a branch of the Arun, 14 miles N.E. of Chichester, and 49 S.W. of London. It is irregularly built, though clean and neat; and contains a market-house; court-house; cruciform church, in the perpendicular style, with many relics of the Percies of Northumberland; Independent and Methodist places of worship; several schools, alms-houses, and savings-bank; and a literary institute. Fairs are held here three times a year. In the vicinity of the town stands Petworth House, in the midst of a beautiful and well-wooded park, with a sheet of water in front of the mansion. It is a magnificent edifice, and contains a very fine collection of books, paintings, statues, and busts. The sword used by Hotspur at Shrewsbury is kept here. Pop. (1851) 2427.

PETZKA, or PECSKA, a market-town of Hungary, county of Arad, on the Maros, 10 miles W. of Arad. It consists of two parts, Magyar and Raitzisch Petzka; and contains a Roman Catholic church. The neighbourhood is fertile, producing wine in large quantities; and some trade is carried on in horses, cattle, sheep, and tobacco. Pop. (1846) 13,900.

PEWTER. The theoretical composition of common pewter is 80 parts tin and 20 of lead; but as the manufacturers consider that a better alloy is formed by melting up old pewter with new ingredients, the composition is uncertain. The French legislature sanctions the use of 82 parts tin and 18 of lead, as forming an alloy which is quite harmless in vessels used for wine and vinegar. Antimony is sometimes added for hardening the tin, and for giving a more silvery colour. Zinc is also used to diminish the oxidation; a small lump of that metal being allowed to float on the fluid pewter during the casting; or the fluid is occasionally stirred with a strip composed of equal parts of zinc and tin. The finest pewter, called *tin-and-temper*, consists mostly of tin, with a small proportion of copper, which makes it hard and somewhat sonorous; but the copper is apt to impart a brown colour. The temper is formed by melting the copper, and adding twice its weight of tin, and from $\frac{1}{2}$ lb. to 7 lb. of this alloy is added to each block of tin, which weighs from 360 to 390 lb.

Pezenas.

In the year 1772 the Pewterers' Company made an attempt to regulate the quality of pewter-wares by establishing "A Table of the Assays of Metal, and of the Weights and Dimensions of the several sorts of Pewter Wares." The assay was directed to be made by casting a small button of the metal, to be tried in a brass mould so proportioned that such a button of *pure tin* should weigh 182 grains. All the metals added to the tin being heavier than tin, the buttons would be heavier in proportion as they contained less tin. On these data the following scale was founded:—

	Grains.
Assay of pure tin.	182
„ *fine* or *plate* metal $1\frac{1}{2}$ grains heavier than tin, or	$183\frac{1}{2}$
„ *trifling* metal $3\frac{1}{2}$ grains heavier than tin, or	$185\frac{1}{2}$
„ *ley* metal $16\frac{1}{2}$ grains heavier than tin, or	$198\frac{1}{2}$

Pewters formed of equal parts tin and lead are about 50 grains heavier than tin, or 232 grains. Such pewters, when cast, are black, shining, and soft; and when turned, are dull and bluish. Pewters which contain only one-fifth or one-sixth of lead, cast into wares which are white, hard, and without gloss; they form a good metal, and are but little darker than tin. The French have published a table of specific gravities for testing the quality of the alloy, the legal standard of which is 7·764. An excess of lead is detected by an increased density.

Of the three ordinary kinds of pewter distinguished in the Pewterers' Scale, *plate* pewter is the hardest, and is used for plates and dishes. The pewter called *trifle* is used for beer-pots; and *ley* for the larger wine measures. The best plate pewter is sometimes composed of 100 parts tin, 8 antimony, 2 bismuth, and 2 copper. Trifle consists of 83 of tin, 17 of antimony, and usually a large proportion of lead.

Pewter plates and dishes are formed by hammering, and measures and spoons by casting. The parts are joined together by means of soft solder, assisted by a blast of hot air from a small charcoal furnace. Pewter is also formed into sheets for printing cheap music; the softness of the metal allowing the notes to be formed by means of punches, which is cheaper than engraving with the burin. Laps and polishers of pewter are also formed for the use of lapidaries, jewellers, watchmakers, &c.

Pewter-wares are finished by burnishing with oil, and cleaning off with a rag and whiting. Pewter vessels may be cleaned by means of silver-sand and water, or with a solution of potash or of soda, to remove grease. (C. T.)

PÉZENAS, a town of France, department of Hérault, occupies a beautiful position on the left bank of the Hérault, at its confluence with the Peine, 25 miles W.S.W. of Montpellier. Many of the streets are broad, and lined with handsome and well-built houses. The old castle, now in ruins, commands a beautiful view over a country so distinguished for fertility as to be called the "Garden of Hérault." The principal buildings are the parish church and the theatre; the latter of which was originally a conventual chapel. Linens, napkins, muslin, woollen and cotton fabrics, hats, soap, brandy (for which it is one of the chief markets in Europe), and chemical substances, are among the manufactures of the place. Besides brandy, wine, and spirits, the principal articles of commerce are grain, dried fruit, oil, timber, and cotton, silk, and woollen stuffs. A great fair is held here in September, which is frequented by merchants from the whole of the south of France. It was at Pézenas that Molière wrote the play called *Les Précieuses Ridicules*, while the manager of a company of strolling players. Pop. 7375.

PFEFFEL, GOTTLIEB CONRAD, a German poet, was born at Colmar in 1736, and was educated at the university of Halle. He was destined for the legal profession; but an attack of ophthalmia, which issued in total blindness, gave a new bent to his career. He first, in 1773, established in his native town a military seminary for the education of Protestant youths. When the French revolution put a stop to that enterprise, his attention was then devoted to literature. He was engaged from that time till his death, in 1809, in writing tales, odes, ballads, and poetical epistles, and in translating dramatic pieces from the French. His *Poetische Versuche* were published in 10 vols., 1802–10; and his *Prosaische Versuche* in 10 vols., 1810–13. Pfeffel's elder brother Christian Friedrich was distinguished as a jurisconsult and diplomatist.

PFEFFERS, or PFÄFFERS (Fr. *Favière*), a village of Switzerland, in the canton of St Gall, stands in the wild valley of the Tamina, 31 miles E. of St Gall. It is chiefly remarkable for its hot baths, which are situated in a deep, narrow chasm, through which the Tamina forces its way. The mineral water, which has a temperature of about 100° Fahr., is used both for bathing and drinking, and has great reputation, though it contains but a small proportion of saline particles. The baths are capable of accommodating 200 or 300 patients at a time. Pfeffers was the seat of a Benedictine abbey, which was founded in 713, but suppressed in 1838; and the buildings are now used as a lunatic asylum. Pop. 1315.

PFORZHEIM, a town of Baden, circle of Middle Rhine, near the confluence of the navigable river Enz with the Nagold and Würm, 16 miles S.E. of Carlsruhe. It is an ancient city, inclosed by a wall and moat, outside of which are several suburbs. Pforzheim has an ancient castle, on a rising ground, the church of which contains many interesting monuments, as well as the graves of the grand dukes of Baden. There are other churches, an academy, a deaf-and-dumb institution, hospital, and other charitable establishments. Pforzheim is at present the most important manufacturing town in Baden. Watches, jewellery, cloth, leather, chemical products, and hardware are manufactured; and there are also dye-works, bleachfields, and iron and copper foundries. An active trade is carried on in timber and oil. Pforzheim was the birthplace of the celebrated Reuchlin, the patron of Melanchthon. Pop. 7951.

PFULLINGEN, a town of Würtemberg, circle of the Black Forest, stands on the Echatz, in a beautiful valley at the foot of a mountain, 3 miles S.E. of Reutlingen. It contains a castle and two large paper-mills. Weaving and lace-making are carried on; and wine and vegetables are raised in the vicinity. Pop. 4300.

PHÆDO, a native of Elis, was the founder of the Eliac sect of philosophy, and the person whose name Plato inscribed in one of his most celebrated Dialogues. The exact date of his birth and death is unknown, but he flourished B.C. 399. By the fortune of war he was taken prisoner, and reduced to a state of slavery. He was brought to Athens, where he became known to Socrates, who admired his talents so much that he induced Alcibiades or Crito, or, according to others, Cebes, to release him from servitude. He then became one of the most devoted attendants on his benefactor. It appears that he was not at all satisfied with the manner in which he was introduced by Plato into his dialogue; and he used to declare publicly that he had never spoken in that way, and that he had never heard Socrates use the language which Plato put into his mouth. He composed several Dialogues, the titles of which were, Zopyrus, Simon, and several which it was doubtful if they belonged to him; Nicias; Antimachus; Medus, ascribed by some to Æschines, by others to Polyænus; Sythici Sermones, ascribed also to Æschines; and three others quoted by Suidas. (Diogenes Laertius's *Life of Phædo.*)

PHÆDRUS, the author of five books of Fables, in Latin iambic measure, was a native of Thrace or Macedonia, and brought at a very early age to Rome, where he became the slave of Augustus, and from whom he subsequently received his freedom. The few facts that we know respecting his personal history are to be collected from his Fables, as he is noticed by no earlier writer than Avianus, unless, perhaps, Martial may allude to him in one of his epigrams (iii. 20). If he really existed at this early period, it is strange that he should have been unknown to Seneca (*Cons. ad Polyb.* 27). By his long residence at Rome, Phædrus acquired a complete acquaintance with the language, and wrote it with as much ease as he could have done that of his own country. In the reign of Tiberius, he excited the wrath of Sejanus, and was banished by him, though for what cause we are nowhere distinctly informed. Under Caligula we find him in hopes of being re-instated in his position at court, through the influence of Eutychus. Part at least of these Fables must have been written in the latter years of the poet, and not published till after the death of Sejanus. Schwabe, who has examined this point with great diligence, thinks that the first two books were written after the departure of Tiberius to Capreа, the third under Caligula, and the fourth and fifth under Claudius. One part of these Fables consists of very happy translations of the Greek Fables of Æsop into the Latin language, or imitations of them in verse, similar to that employed in the translations. The other part seems to have been orginal, or at least we have no longer the writers from whom he borrowed his subjects. The style is pure, the language remarkably correct, and the whole is written with simplicity and ease. Yet many have doubted whether these fables can be considered as the genuine productions of Phædrus, the freedman of Augustus, as we have so few manuscripts of the work, and as Seneca was evidently unacquainted with it. Some ascribe them to the pen of Nicolaus Perotti, Archbishop of Manfredonia, who lived about the middle of the fifteenth century; but, in later times, the discovery of some manuscripts, one of which is considered as of the tenth century, has proved the incorrectness of such a supposition. The best edition of the works of Phædrus is that by J. C. Orelli, Zurich, 1831, 8vo. The English translations of Phædrus are as follows:—Philip Ayres (1689), Thomas Dyche (1715), Dan. Bellamy (1734), Anonymous (1745), John Entick (1754), "A Gentleman of the University of Cambridge" (1755), Christopher Smart (poetical translation, 1765), Francis Fowke (1776), H. T. Riley, with C. Smart's metrical version in "Bohn's Classical Library" (1853).

PHAËTHON (Φαέθων, the *shining*), was, according to the most common account, the son of Helios and Clymene, one of the Oceanides, and wife of Merops. Fired by vanity and ambition, the youth had the presumption one day to request his father to allow him to drive the chariot of the sun across the heavens. Helios, after much solicitation from Clymene in her son's behalf, at last yielded; but the audacious lad not having strength sufficient to control the fiery coursers, slackened the reins, upon which Zeus, to prevent his consuming the heavens and the earth, smote him with a thunderbolt, and hurled him from his seat into the River Eridanus or Po. His sisters, called by some *Phaëthontiades*, and by others *Heliades*, who had yoked the horses to the chariot, and who now lamented his loss on the banks of the fatal river, were metamorphosed into poplars, and their tears converted into amber.

PHALANX, in Greek military organization, a close, compact mass of infantry drawn up in files, usually of eight deep (Thuc. v. 68); butt he depth was increased by the Thebans to twenty-five (Thuc. iv. 93). The pha-

lanx was subsequently brought to perfection by Philip of Macedon. But for further details of this celebrated military formation, see ARMY.

PHALARIS, a tyrant of Agrigentum in Sicily, known to fame for his cruelty and inhumanity, but of whom little is definitely known. Ancient writers are not agreed as to the precise period when he began to reign, but Eusebius fixes the commencement of it B.C. 570, and his death B.C. 555. His father's name was Leodamas, a native of Astypalæa, an island in the Ægean Sea, where Phalaris was born. A dream of his mother is said to have prognosticated the cruelty of her unborn son. (Cic. *Div.* i. 23.) When he was grown to manhood, he made an attempt to seize upon the government of his native country, but was obliged to fly. He took refuge at Agrigentum, where he contrived to ingratiate himself with the people, and by a stratagem (Polyæn. v. 1) got possession of the supreme authority, which he exercised at first with much moderation. The Agrigentines, however, refused to submit quietly to his sway, and Phalaris found himself obliged to maintain by severity that power which he had so unjustly acquired. It is not unlikely that the ancients gave an exaggerated account of his cruelties, with a view of inspiring a hatred of tyranny. Athenæus speaks of his roasting children alive, and Aristotle states that he actually ate them; but such accounts can scarcely be credited. Perillus, an Athenian artist, is said to have constructed a brazen bull, in which the victims of Phalaris might be roasted; and when he expected to have been highly rewarded, the tyrant ordered him to be shut up in his own horrible machine. This story was doubted by Timæus (*Schol. Pind. Pyth.* i. 185), but Diodorus Siculus asserts its truth (xiii. 90, xix. 108). When Agrigentum was taken by the Carthaginians, they carried the bull to Carthage, and when that city was destroyed by Scipio Africanus, B.C. 146, it was presented by him to the Agrigentines. (Cic. *Verr.* iv. 33.) Authors are not agreed as to the mode of his death, but the most probable opinion is, that the Agrigentines, tired of his cruelties, stoned him to death. (*Off.* ii. 7.) We possess a collection of letters under the name of Phalaris, which Charles Boyle, who has edited them, tries to prove the genuine productions of the tyrant; but there can be no doubt that they were written by some of the later sophists, and that Bentley was right in pronouncing them "a fardle of common places." They were published for the first time by Justinopolitanus, at Venice, 1498, in 4to. The best editions are those of Oxford, 1695, 1718, in 8vo, with a Latin translation, notes, and a dissertation of Boyle on the life of Phalaris; that of Groningen, 1777, in 4to, which was begun by Lennep, and finished by Walkenaer; and, above all, that of Schæfer, Leipzig, 1823. The Epistles of Phalaris have been repeatedly translated into Italian, French, and English. (See the Dissertation of Dodwell, *De Ætate Phalaridis;* and the Answer of Bentley.)

PHALGU, or PHALGOO, a river of British India, in the presidency of Bengal, is formed by the confluence of the Mehanee and Lilajun, two mountain streams, in the district of Ramgurh; flows through that and the district of Behar, first N., and then E.; and finally falls into the Ganges, after a course of about 246 miles. During the rainy season it has a great volume of water, which rushes with great velocity; and the numerous branches which it sends out on both sides are filled, and partially inundate the neighbouring country. The name Phalgu is properly applied only to 25 miles of its middle course, where it is considered sacred; the lower portion is known by the name of Mehanee, and the upper by those of Julwara and Kuthor.

PHANTASMAGORIA. See OPTICS, part ix.

PHARISEES (*Gr.* Φαρισᾶιοι, derived from the Hebrew *parash*, to separate), the most celebrated of all the Jewish sects. As their name implies, they were separated from all others by the assumed correctness of their opinions and the holiness of their lives. The precise origin of the sect is not known. That they, however, as well as their natural opponents, the Sadducees, existed in the priesthood of Jonathan,—that is, between 159 and 144 before Christ,—is known from Josephus, who (*Antiq.* xiii. 5) makes mention of them as well as of the sect of the Essenes. The terms he employs warrant the conviction that they were then no novelties, but established religious parties.

The same historian (who was himself a Pharisee, and who says they were "of kin to the sect of Stoics, as the Greeks call them") further describes them in the following terms:—"The Pharisees have delivered to the people a great many observances by succession from their fathers, which are not written in the law of Moses, and for that reason it is that the Sadducees reject them, and say that we are to esteem those observances to be obligatory which are in the written word, but are not to observe what are derived from the tradition of our forefathers. Hence great disputes. The Sadducees are able to persuade none but the rich, and have not the populace obsequious to them, but the Pharisees have the multitude on their side." (Joseph. *Antiq.* xiii. 10.) "The Pharisees live meanly, and despise delicacies in diet; and they follow the conduct of reason, and what that prescribes to them as good they do. They also pay respect to such as are in years; nor are they so bold as to contradict them in anything which they have introduced; and when they determine that all things are done by fate, they do not take away from men the freedom of acting as they think fit, since their notion is, that it hath pleased God to make a constitution of things whereby what He wills is done, but so that the will of man can act virtuously or viciously. They also believe that souls have an immortal vigour in them, and that under the earth there will be rewards or punishments, according as men have lived virtuously or viciously in this life. The latter are to be detained in an everlasting prison; but the former shall have power to revive and live again: on account of which doctrine they are able greatly to persuade the body of the people; and whatsoever is done about divine worship, prayers, and sacrifices, is performed according to their directions, insomuch that the cities gave great attestations to them on account of their entire virtuous conduct." (Joseph. *Antiq.* xviii. 1. 3.) "The Pharisees say that some actions, but not all, are the work of fate (εἱμαρμένη); that some of them are in our own power, and that they are liable to fate, but are not caused by fate" (Joseph. *Antiq.* xiii. 5. 9). "The sect of the Pharisees are supposed to excel others in the accurate knowledge of the laws of their country" (Joseph. *Vita.*, sect. 38). "The Pharisees have so great a power over the multitude, that when they say anything against the king or against the high-priest, they are generally believed" (Joseph. *Antiq.* xiii. 10. 5). "The bodies of all men are mortal, and are created out of corruptible matter; but the soul is ever immortal, and is a portion of the divinity that inhabits our bodies." (*De Bell. Jud.* iii. 8. 5.)

There is another source of our knowledge of the Pharisees—the books of the New Testament. The light in which they here appear varies, of course, with the circumstances to which its origin is due. The Gospels present the character of the Pharisees in a darker hue, inasmuch as here a higher standard of morality is brought into use. Here they are charged continually with the worst forms of pride, hypocrisy, avarice, and sensuality. At an early period they determined in the Sanhedrim to withstand and destroy Jesus, instigated doubtless by the boldness with which he taught the necessity of personal righteousness and pure worship. (Matt. xii. 14.)

Stäudlin, in estimating the character of the Pharisees, has the following remarks:—"The Pharisees held anxiously to the decisions of the holy writings and the older Jewish

teachers. Thus their whole system was built upon authority, and their morality was changed into a casuistry, like that of the Jesuits. To every event that happened they knew how to apply either a passage of the sacred books or an explanation of the same, or a corollary, an inference, an arbitrary extension or restriction. On this account nothing is more pitiable or more ridiculous than their exegetical theology, whence their system of morality became uncertain and unconnected, without general principles, life, and spirit. Thus arbitrariness and ingenuity, instead of reason and solidity, were applied to morals; and to a party which assumed, and by its nature must assume, dominion over the minds of men, the temptation was often too great to accommodate their principles to the passions of men, and to use for the same purpose their casuistry, dependent on authority, which so easily lent itself to this end. The persecutions of Antiochus Epiphanes, the opposition of the Sadducees, bound them only the more to their old precepts and method of teaching, and filled them with an ever-living opposition to every Gentile doctrine and custom. They considered themselves the more as the only genuine and pure Israelitish teachers of religion; they preserved the reverence for the holy books which had been of old widely spread among the people; and, aided by their principles, which were in fact very rigid, they could not fail to gain with the people a reputation for superior holiness. The greater this reputation became, the greater was the temptation to hypocrisy. The more rigorous were their principles, the more difficult was it to act entirely up to them, and the easier were they led to observe that with a holy *appearance* they could attain the power of imposing on the mass of the people and of ruling over them. This dominion of the Pharisees over the minds of the people was nourishment for their pride, and incentive enough to use it for selfish purposes. Like cunning priests and Jesuits, they played with forms and phrases, they seized a place in the hearts and consciences of men, corrupted them even by means of pious instruction, led them whither they would have them go, acquired many a fair prize, and became rulers of an earthly kingdom of darkness. (Staudlin, *Sittenlehre*, i. 431.)

We are not to suppose, however, that there were no individuals in the body free from its prevailing vices. There did not fail to be upright and pure-minded men, who united inward piety to outward correctness of conduct, and were indeed superior to the principles of their sect; such was Nicodemus (John iii. 1); such also Gamaliel may have been (Acts v. 34). Of men of this kind many were led to embrace the Gospel. (Acts. xv. 5.) In the time of our Lord there were two leading parties, that of Hillel and that of Schammai, the former representing a moderate Pharisaism, the latter "the straitest sect," to which Paul had probably belonged. (See *Trium Scriptorum Illust. de tribus Judæorum Sectis Syntagma, in quo R. Serarii, J. Drusii, J. Scaligeri opuscula cum aliis exhibentur*, found in Ugolini's *Thesaurus*, vol. xxii.; also Stäudlin's *Sittenlehre Jesu*, i. 417, sq.; Beer, *Gesch. Lehren in Meinung. aller relig. Sect. der Juden*, Brunn, 1822; and Tholuck, *Comm. de vi quam Græca Philosophia in Theologiam tum Muhamedanor. tum Judæor. exercuerit*, Hamb. 1835–7.)

PHARMACOPŒIA (φάρμακον, *a drug*, and ποιέω, *I make*), a book containing directions for the preparing and compounding of medicines. Such books are usually published under the sanction of the colleges of physicians or surgeons in the different nations of Europe.

PHARMACY (φάρμακον, *a drug*), the art of preparing and compounding substances to be employed for medicinal purposes.

PHARNABAZUS, a Persian satrap, succeeded his father Pharnaces, in the government of the Persian provinces near the Hellespont. He first appears in history as a devoted ally of the Spartans during the Peloponnesian war. His troops assisted them in capturing Abydos and Lampsacus in 411 B.C.; his aid was effectual in sheltering them after their defeat at Cyzicus in 410 B.C.; and for his attachment to their cause his province was ravaged by Alcibiades in 409 B.C. Yet, after a lapse of time, the course of events placed Pharnabazus in hostile opposition to his former friends. In 396 B.C. he defeated an invading Spartan force under Agesilaus II. In the following year he was routed in turn by that monarch. The conflict thickened immediately afterwards, when the Athenian Conon came to his aid. The two leaders in command of a fleet scoured the Ægean, expelling the Lacedæmonians from the maritime towns, until, in 393 B.C., they had overwhelmed all resistance. The rest of the life of Pharnabazus is involved in considerable obscurity. His unsuccessful expedition into Egypt, in conjunction with the Athenian general Iphicrates, in 377 B.C., is the last action of his on record.

PHAROS, a long and narrow rock, lay off the northern coast of Egypt, at the distance of 7 stadia from the ancient town of Alexandria. In early times it was merely occupied by the huts of a few fishermen. Yet no sooner had the adjacent city been founded, in 332 B.C., than the island began to assume importance. Alexander the Great turning it into a breakwater for the harbour of his new capital, connected it with the mainland by the *Heptastadium*, or Seven-Furlong Mole. Ptolemy I. began to build on its N.E. point the lighthouse of Pharos, which became one of the wonders of the ancient world. (See LIGHTHOUSES.) Meanwhile its population was steadily increasing. At length a street of houses extending along the mole formed it into a suburb of Alexandria. Pharos retained some of its importance till the time of Julius Cæsar. After that period it degenerated once more into a mere fishing station.

PHARSALUS (the modern *Férsala*), a city of Thessaly, was situated in the district of Thessaliotis, on the left bank of the Enipeus. Its position was peculiarly favourable. A gradually ascending hill, 600 or 700 feet high, formed its site; a steep precipice guarded it on three sides; numerous springs flowing out of the declivity supplied it with water; and one of the most fertile valleys in Greece lay around its base. Accordingly, from the earliest days of Grecian history, up to the time of the Romans, it was renowned as a seat of military strength. Yet Pharsalus attained its greatest notoriety when, in 48 B.C., the two stars of Cæsar and Pompey came into collision in its neighbourhood, and the fate of the world was decided in the plain below its northern wall.

PHENEUS, an ancient town in the N.E. of Arcadia, stood on an eminence in the middle of a plain which was 7 miles square, and which was inclosed on all sides by the offsets of Mount Cyllene and of the Aroanian chain. It derived its chief celebrity from the neighbouring river Olbius or Aroanius (the modern *Foniatiko*). That stream, after being formed by torrents from the northern mountains, began to flow through the plain in a straggling and undecided course. To collect all its waters into one bed, Hercules, it is said, dug a canal which was 50 stadia in length and 30 feet in breadth. The impatient flood, however, after a lapse of time, broke out of this artificial channel and resumed its former wanderings. At an advanced point of its course, finding its passage blocked up by mountains, it escaped into subterranean channels called *katavothra*, and gurgled under ground until it came upon the bed of the Ladon. Sometimes it happened that these channels became choked. The waters were then dammed up until they swamped the whole plain, and rose to a considerable height within the rocky basin. When at length they forced away the obstruction, they rushed along their former course, flooding the Ladon and the Alphæus to overflowing. Such an inundation occurred so recently as 1821, and continued till 1832. The

remains of Pheneus are still seen near the village of *Fonia.*

PHERECRATES, an eminent writer of the old comedy, was a native of Athens, and contemporary of Plato, Aristophanes, Phrynichus, and Eupolis. According to Suidas, he was a soldier in his youth, but afterwards attached himself to the stage, and became one of the most successful dramatic writers. We know that he exhibited a play entitled "Savages" (Ἄγριοι), B.C. 420 (Plato, *Protag.* 327, d.; Athen. v. 218, d) He invented a species of verse, called from his name Pherecratean, consisting of a spondee and the two last feet of an hexameter line. Suidas attributes seventeen plays to him, referring probably to those only which he considered as genuine, since the titles of twenty are found in Athenæus. The fragments of Pherecrates have been collected by Hertel in *Vetustissimorum Comicorum Sententiæ*, p. 340–57; and by Runkel, Leipzig, 1829. Of all the fragments of Pherecrates, the most remarkable is that entitled "Cheiron," in which he introduces music clad in rags, to which state she says she has been reduced by Melanippides, Phryoris, and Timotheus, the authors of some innovations on that art.

PHERECYDES, a Greek philosopher of the island of Syros, one of the Cyclades, was the son of Badys, and the pupil of the celebrated Pittacus, of Mitylene. The exact date of his birth and death is unknown, but he flourished B.C. 544, being a contemporary of Thales, Anaximenes, Anacreon, and Hipponax. There is some doubt whether he is not the astronomer Pherecydes who constructed a sun-dial at Syros; but as this person is said to have been the master of Thales, it is more likely that there was another of an earlier date. The philosopher was the instructor of Pythagoras, and is said to have foretold earthquakes by observing the movement of water in wells (Cic. *Tus.* i. 16; *Div.* i. 50). There were various accounts respecting his death, but most are agreed that he was devoured by worms and insects like Sylla; and the reason assigned was, that he had offended Apollo, because he said that he lived very happily though he had never sacrificed to the gods. (Ælian. *V. H.* iv. 28.) Pherecydes was the author of a work on Nature and on the Gods, being the first of the Greeks who wrote on this subject. (Diogenes Laertius, *Life of Pherecydes.*) The fragments of Pherecydes have been collected by August Wolf, in the first part of his *Litterarische Analecten*, Berlin, 1817.

PHERECYDES, an historian or logographer of the island of Leros, in the Ægean Sea, is satisfactorily proved by Vossius (*De Hist. Græcis*, p. 444) to be the same who is called an Athenian by some. He flourished B.C. 480, in the reign of Darius Hystaspes, and preceded Heredotus by a few years. He is said to have made a collection of the poems of Orpheus, to have written on the genealogy of the gods (*Theogoneia*) in ten books, on the mythological part of the history of Athens (Ἀυτόχθονες) in ten books, and moral maxims in hexameter verse. The fragments of Pherecydes, along with those of Acusilaüs, have been published by Sturtz, Gera, 1789, 1798, 1824; also by C. and Th. Müller, in *Fragmenta Hist. Græcorum*, with a learned dissertation.

PHIDIAS, was the son of Charmidas, and was born about 490 B.C. The facts regarding his education are few and detached. But knowing the result of his training, we can in a general way infer its character, and thus eke out the scanty narrative. He began to study sculpture under a certain Hippias, supposed by some to be the well-known Hegias; and then under Ageladas of Argos. Nor, while under their instruction, did he content himself with a servile observance of stereotyped rules. His bold and vigorous genius pursued his art into all its relations with other arts and sciences. He acquired an experimental knowledge of painting and pictorial effect. He was not unacquainted with the principles of architecture. There was scarcely a department of general information into which his investigating mind did not wander. At the same time his soul kindled its ardour, and nursed its creative energies, by frequent contact with the great genius of Homer. Under such an invigorating discipline it was natural that new and enlarged views of the sculptor's art should dawn upon the mind of Phidias. Accordingly, he began to repudiate the prevalent custom of taking a common-place figure, and then representing it in an attitude stiff and affected, and with a garment falling into formal geometrical lines. The legitimate subject, he thought, should be one of the most perfect specimens of human nature as viewed by an imaginative mind. The bearing ought to be easy and dignified, and the drapery ought to flow in the free and ever-varying folds of nature. Especially in the statues of the gods was it necessary for the sculptor to rise above the dull level of ordinary life. No dimensions could be too grand and imposing to body forth ineffable power; no materials could be too costly to represent immortal health and beauty; no draperies could be too variegated and elaborate to imitate the gorgeous dresses of the court of heaven. Imagination should rise to its highest efforts in the conception, and art should lavish all its resources in the execution. These elevated and catholic principles Phidias set himself to establish. He carried them into practice in a gold and ivory statue of Minerva at Pellene, in a group of bronze statues at Delphi, and in several other works which he executed. He also inculcated them upon a number of pupils; and thus, in course of time, overturned the old, and established a new school of sculpture.

About 444 B.C., Phidias, in the full maturity of his genius and fame, entered upon the brightest part of his career. It was then that the great Pericles chose him for his coadjutor in the high task of raising Athens to the very climax of beauty and magnificence. Appointed overseer of the public works, the sculptor was employed in superintending the erection of the edifices on the Acropolis. The architects Ictinus and Callicrates, several painters, and many artificers all worked under his inspection. He himself designed the numerous sculptures, assigned them to his pupils and to other sculptors to be executed, and frequently gave them the last polish with his own exquisite chisel. Under the busy hands of so many workmen, the Parthenon rose up perfect in form, and enriched with every kind of decoration and device. To complete the general effect and put the finishing stroke upon this great enterprise, the superintendent himself executed, among other images, two colossal statues of Pallas, the presiding genius of the place. The one, a bronze statue, represented the goddess in her warlike character, and was called, on that account, the *Athene Promachos*. Stationed on a pedestal on the summit of the Acropolis, and rising out from among the surrounding architecture, until she overlooked a great part of Attica, she kept guard over the city in the attitude of a combatant. Her left arm extended a shield, and her right hand brandished a spear, as if ready to hurl destruction at any daring invader. Still more imposing was the statue of the same divinity which stood within the Parthenon. Her height was nearly 40 feet; her nude parts were made of ivory; and her drapery and ornaments were of solid gold. She now appeared in her character of the patron goddess of the city. The excited air of battle had given place to the settled attitude of calm deliberation. Her shield stood by her left side. Her spear stood against her left shoulder. A dragon lay coiled at her feet. With her left hand she leant upon her shield, and with her right hand she extended an image of victory. Nor were the decorations out of harmony with such a noble mien. A golden sphinx in the middle, and a golden gryphon on each side, adorned her helmet; a string of golden serpents formed the fringe of

her ægis; and a golden garment flowed down to her feet. On the outer side of her shield the Amazons fought with the Athenians; on the inner side the gods overcame the giants; and on the base which supported the entire work, Pandora received her graces and fascinations from the assembled divinities. In fact the eye of the spectator, while roaming over the grand statue, and passing from the grand statue to the magnificent expanse and painted and sculptured walls of the temple, could see nothing but what was beautiful and harmonious in the entire scene.

The fame of this great masterpiece was still ringing through Greece, when the Eleians, about 437 B.C., invited Phidias to finish and decorate their temple of Jupiter Olympius. Repairing to the plain of Olympia with his scholars, he set up his studio close beside the wall of the Altis, within hearing of the murmur of the sacred olives. In that quiet retreat he began to execute a gold and ivory statue of Jove 60 feet in height. After the lapse of four years the image was completed, was set up in the temple, and was found to surpass every other work of art that the race of men had ever yet witnessed. It was seen to be a striking embodiment of the Zeus of Homer. There, in awful state, and with the most stupendous proportions, sat the almighty king of the gods. There was the serene dignity of countenance which becomes the sovereign of the skies; there were the dark eye-brows and clustering locks whose motion shakes the spheres; there were the shoulders of strength which move and control the dread artillery of heaven. With his left hand he leant upon the sceptre of the universe, and with his right hand he extended a winged Victory. Nor did the imagination of the artist confine itself to the figure. It also lavished its creations upon the furniture and embellishments of the god. A chaplet of olive crowned his brows. A robe of solid gold, garnished with lilies and other flowers, swathed his limbs. Four golden lions supported his footstool. On the back of the throne, above his head, appeared the Hours and the Graces. At each corner of the throne a Victory danced upon a sphinx that was tearing a Theban youth. The cedar throne itself was bespangled with ebony, ivory, gold, and precious stones; and displayed painted and sculptured representations of the destruction of Niobe's children, the contests of Hercules, and other exploits of the heroic age. On the base which supported the entire fabric appeared sculptured figures of the deities in gold, and the interesting inscription—"Phidias, the Athenian, son of Charmidas, made me." So dazzling and sublime indeed, was the general effect, that the Jupiter Olympius became the wonder of the world. Its almost superhuman magnificence threw all succeeding artists into despair, and absolutely set at defiance all competition. It seemed, according to an old epigrammatist, as if Phidias had either ascended to heaven to see Jove, or Jove had descended to earth to sit to Phidias. Some visitors even felt themselves to be in the real presence-chamber of the Thunderer, and expected to see him rise from his throne, and throw off the roof of the temple with his mighty head and shoulders.

Filled with satisfaction at his unparalleled success, Phidias returned to Athens in 432 B.C., only to meet an end which was fearfully discordant with his peaceful and illustrious career. The aristocratic faction were then indirectly aiming at Pericles by attacking the intimate friends of that democratic leader. The old sculptor, as a notable associate of the great statesman, was immediately doomed to persecution. A certain Menon, who had worked in the capacity of an underling at the Parthenon, accused him of having appropriated the gold intended for the garment of Minerva. Even after this charge had been triumphantly refuted by Phidias, who had taken the precaution of fixing on the drapery of the goddess in such a manner that it could easily be unloosed and weighed, his persecutors did not desist. They arraigned him for having inserted his own portrait and that of Pericles in the representation of the battle between the Athenians and the Amazons on the shield of the same statue. This accusation was sustained, and before the year was closed, the ill-requited Phidias died in prison.

The only extant works which retain any traces of the delicate chisel of Phidias are the sculptures which have been recovered of late years from the ruins of the Parthenon. The finest specimens of these were transferred to England by Lord Elgin in 1803, were deposited in the British Museum in 1816, and are now known by the name of the "Elgin Marbles." (In addition to the ordinary histories of ancient art, see Smith's *Dictionary of Greek and Roman Biography;* and Müller's *De Phidiæ Vita et Operibus*, Gottingen, 1827. Quatremère de Quincy, in his *Jupiter Olympien*, and Flaxman, in his *Lectures on Sculpture*, have attempted, with the aid of the descriptions of ancient authors, to give drawings of the Minerva of the Parthenon and of Jupiter Olympius.)

PHIGALIA, or PHIALIA, an ancient town of Arcadia, stood near the confines of Messenia, on the right bank of the small river Neda (*Buzi*). It is famous in history for several contests in which it maintained its liberties against the Spartans. But its chief celebrity is derived from a temple which stood about 40 stadia N.E. from the city on Mount Cotilium. That temple, a peripteral edifice of the Doric order, was erected by Ictinus, one of the architects of the Parthenon at Athens, and was dedicated to Apollo Epicurius, in gratitude for the cures effected by that god during the Peloponnesian war upon the plague-stricken citizens. The hard yellowish-brown limestone which composed its walls and roof rendered it singularly durable. In the times of Pausanias, it was considered the most perfect, with one exception, of all the temples in the Peloponnesus. It continued to remain entire long after the world had lost all knowledge of its existence. Modern scholars discovered it in a state of good preservation, standing deserted among a few aged oaks on the wild and desolate mountain-side. When the ruins were cleared away in 1812, there were found some fine sculptured representations of the contests between the Centaurs and the Lapithæ, and between the Amazons and the Greeks, which are now in the British Museum.

PHILADELPHIA, the second city in size and importance in the United States, is situated on the west bank of the Delaware river, in the south-eastern part of the state of Pennsylvania, 96 miles from the sea by way of the river and bay of Delaware, 136 miles N.E. of Washington, and 86 miles S.W. of New York. The geographical position of the Old State House, which is nearly in the centre of the city, is 39. 57. N. Lat., and 75. 9. W. Long. The Schuylkill river passes through the western part of the city, and enters the Delaware 6 miles S. of the centre of the city proper.

The closely-built portion occupies an area 4 miles in length N. and S., and from 2½ to 4 miles in width from E. to W., or about 12 square miles. The Delaware front is built along a curved line of 4 miles in length, the north-eastern part of the city lying eastward of the central water front. A line through the city at the narrowest part between the two rivers is a little more than 2 miles, but W. of the Schuylkill at this point nearly a square mile is built up, called West Philadelphia. North-westward the city now extends 3½ miles from the City Hall, and still further in that direction along the Schuylkill is the large suburb of Manayunk, 7 miles from the City Hall. Germantown, still larger, is 6 miles N.N.W., and Frankford 5 miles N.N.E. of the same point. A large number of smaller suburban villages occupy the intermediate space, all of the area embraced by the county of Philadelphia being now within the corporate limits of the city. Before the act of consolidation in 1854, the city proper occupied a space 1 mile in

extent N. and S., and 2 miles E. and W., between the two rivers. The districts of Southwark and Moyamensing at the S., and of Kensington, Spring Garden, Penn Township, and Northern Liberties, at the N., each with a distinct municipal government, completed the organization of the occupied portions. But as all the area was densely and uniformly built upon, the whole was consolidated as the city of Philadelphia in 1854; and the whole county formerly so called, covering 120 square miles, was embraced in the corporate limits. Camden and Gloucester in New Jersey, across the Delaware river, are really part of the city also, and contain 20,000 inhabitants.

The plan of the city, as laid out by Penn, is remarkably regular, 10 streets being laid E. and W., and 25 streets N. and S., crossing the first at right angles. The subsequent extensions of its limits have in most cases been equally regular. The greatest street E. and W. is High or Market Street, 100 feet wide; and Broad Street, N. and S., is 113 feet wide; the remaining principal streets being 50 to 66 feet in width. Five squares, in central positions and equidistant, were reserved for parks in the original plan of the city, to which Independence Square has since been added, near the State-House, and several squares in the newer parts of the city, with pleasure-grounds and parks, are now in preparation.

The surface occupied by the city is remarkably level, rising, however, in the northern suburbs, into hills of 90 to 150 feet above tide. Between the rivers the plain rises regularly about 45 feet above tide; but from most points of view the city and site appear a perfect plain. The Fairmount Reservoir, 100 feet high, and the Girard College Observatory, 160 feet high, afford the best views. In the original condition of the Delaware front, a stream, in which shipping could lie, intruded into the city along the space now built over as Dock Street; and a bluff bank along the Delaware was designed as a broad, open levee. This was densely built upon after Penn's death. The streets are well paved with granite blocks for the principal business streets in the eastern part, and with rubble stone generally; the sidewalks being mostly brick, with some flagging of sandstone. Drainage to both rivers is easy; and the subsoil is gravel, facilitating cleanliness and dryness. No American city has so great an extent of clean, well-paved, and well-kept streets, capable at any moment of being flooded from the water reservoirs, and perfectly drained by the sewers.

The predominating material for building is brick, with, in houses of three and four storeys, marble facings. Within a few years greater variety in styles and material has been introduced; and marble, sandstone, and iron have been largely used. The great business streets—Market, Chesnut, and Walnut Streets—now exhibit very fine buildings for business purposes, erected within ten or fifteen years. These streets are now rapidly becoming occupied, westward from the Delaware, by the finer buildings of this character; while elegant buildings for residences are extending west of Broad Street and in the northern part of the city. Several superior marble structures were erected many years since in the older part of the city. The first United States bank, now the Girard Bank, is of marble, in Corinthian style, erected in 1797. The second United States bank building in Chesnut Street, now the custom-house, is a noble specimen of Doric architecture, which, at the time of its erection, cost L.100,000. The United States Mint, farther west in Chesnut Street, is a fine marble building in the Grecian style. The State-House, mostly of brick, and having no high pretensions to architectural beauty, occupies a central square in Chesnut Street, and is the principal point of interest to strangers, in consequence of its historical association, the provincial Congress having held its sessions here. The national independence was declared here, July 4, 1776, and for the greater portion of the time subsequently to the year 1800, the national government remained here. Most of the buildings are now occupied by the various departments of the city government, the Hall of Independence alone being unused, and kept as a place for the preservation of historical relics. Girard College is a magnificent marble structure of Grecian architecture, about 2 miles N.W. of the City Hall. A colonnade of 34 Corinthian columns, 6 feet in diameter, and 55 feet high, surrounds a cella 169 feet long by 111 feet wide; the whole forming a building 218 feet long by 160 wide, and 97 feet high. The whole, with the roof, is of white marble; and this one building cost at its erection L.200,000. The inclosing wall contains 41 acres, and the embellishments, with the remaining buildings of this great charity, cost L.194,546 more. Among the recent buildings are superb banks, churches, hotels, and mercantile structures, built of marble, granite, sandstone, and iron. The Academy of Music, a new sandstone building, is the largest opera-house in the United States, being 238 by 140 feet. Several fine structures are devoted to charitable and scientific purposes; among them the Pennsylvania Hospital, the Blockley Almshouse, the United States Naval Asylum, the Franklin Institute, the Athenæum, the Philadelphia and Mercantile libraries, &c.

The city is well supplied with water and gas. The Fairmount Water-Works, on the Schuylkill, elevate 1,500,000 gallons in twenty-four hours 92 feet, to reservoirs constructed on a rocky bluff, from which the greater part of the city is supplied. Separate reservoirs, into which water is elevated from the Schuylkill and the Delaware by steam-power, supply the northern part of the city. The Fairmount works cost L.687,500, and the others about L.83,000. Gas is supplied to every part of the city by extensive public works, in one of which there is a gasometer 140 feet in diameter, and in another, one 90 feet high and 160 feet in diameter, with others of less size.

The charitable institutions of the city are, first, the Pennsylvania Hospital, centrally placed, but with a branch for the insane 2 miles distant. Both departments together have relieved 65,000 patients since their foundation in 1752; both occupy extensive buildings, those in the city covering a fine square, and being kept in superior order. Ten medical men are in daily attendance, four of whom are surgeons. There are four dispensaries in the city, the Pennsylvania Institution for the Instruction of the Blind, a lying-in charity, a widows' asylum, an orphans' asylum (a temporary house of great usefulness), the Pennsylvania Deaf-and-Dumb Asylum, a city pest hospital, three Magdalen asylums, a coloured orphans' asylum, a home for friendless children, and a large number of other noble and special charities.

Institutions of learning are numerous: the Girard College for orphans has 7 professors and 500 beneficiaries; the university of Pennsylvania, 12 professors, 129 literary and 450 medical students; Jefferson Medical College has 514 students; Pennsylvania College, 160 students; and several less important colleges exist. The scientific societies embrace the American Philosophical Society, the oldest and most distinguished in the United States, with a large library, and high historical associations; the Academy of Natural Sciences, with a fine building and valuable collections; the Franklin Institute, which has a library and building, and publishes a monthly journal; the Athenæum, and others. The educational system of the city is organized separately from that of the state generally; a system of graduated schools being established, with a high school of collegiate grade at the head, to which all may aspire. There were in 1857, 157 primary, 47 secondary, 45 unclassified, 55 grammar, one normal, and one high school, in this system; a total of 306 schools, with 57,521 pupils, and 78 male and 877 female teachers. In the High School there are

10 professors and 534 pupils, and it has had at an average over 500 pupils since its foundation in 1838. The total cost of this system for 1857 was L.100,963. It is under the direction of a body of comptrollers, 24 in number, one being elected from each ward. There are many private schools of high rank, and a very large number are sustained by religious and other associations.

The manufacturing industry of the city is more extensive than that of any other in the United States, at least one-half its population of 600,000 being so supported. By the census of 1850, there was reported as employed in manufactures as capital, L.7,028,731; and as labourers, 43,296 men, and 15,803 women; yielding products valued at L.13,357,106. Investigations subsequently undertaken by the Board of Trade and others interested in the city, showed that many departments were greatly underrated by this census; and it is concluded that the total production for the year closing with June 1857, cannot be less than L.27,000,000. The leading manufactures are of cotton and woollen cloths and other textile fabrics, for which there are 98 factories within the city limits, working 3000 hand-looms, 7000 power-looms, 150 sets of wool cards, 750 cotton cards, 40,000 woollen spindles, and 135,000 cotton spindles. These establishments employ 8700 work-people, male and female, exclusive of the hand-loom weavers, and others outside the mills. The production of this department of manufacture for the year named was L.4,166,000; and the capital invested is calculated at L.5,800,000. The next in importance is the iron manufacture, which, in all its forms, employed 10,000 workmen within the city, and produced an aggregate value of about L.3,125,000 for the same year. The manufactures next in importance are, books and stationery, chemicals and drugs, manufactures of silver and the precious metals, clothing and hats, paper and paper-hangings, leather and manufactures of leather, malt and distilled liquors, &c., each of which makes up the value of one to two millions sterling annually. Carriages, furniture, glass and glass wares, mirrors and upholstery, &c., are also produced in large quantities. A very considerable amount of grain is here converted into flour for consumption and for exportation.

The commerce of Philadelphia embraces all the foreign commerce of the state, and is represented in the statistics given for PENNSYLVANIA. It has a water front on the Delaware of 4 miles in length, with a depth at the wharf line of 14 to 54 feet, constituting extraordinary capacity for shipping. Valuable wharf accommodation exists in the Schuylkill for more than a mile in length on the western side of the city. The shipping of the port of Philadelphia amounted to the following aggregates of registered and licensed tonnage for the years named:—

Years.	Tons.	Years.	Tons.
1850	206,498	1854	268,746
1851	222,429	1855	294,807
1852	229,443	1856	197,228
1853	252,451	1857	211,381

Lines of steam-ships run to New York, Boston, Savannah, Charleston, and other ports. One to Liverpool, established in 1851, was temporarily discontinued in 1857. A line of superior packet-ships to Liverpool was among the first lines from the United States to Europe, and it is now in the best condition of efficiency. A vast coasting trade is conducted from this port in coal, produce, and domestic goods. In 1852, 9993 vessels with coal left this port for the coasting and foreign trade; and in 1854, 8152 vessels, carrying 1,411,731 tons of coals, loaded at the suburb of Richmond; while 571,081 tons were taken from the Schuylkill wharves. An extensive trade to California exists, the exports thither in 1853 reaching L.461,500. The trade of this port with the West Indies and with South America now constitutes the largest department of its foreign commerce, except the Liverpool trade. Of the total value, L.3,718,880, imported in the year ending with June 1857, the following proportions were mostly tropical:—

Sugar	58,137,504 lb.,	value	L.651,351
Molasses	3,137,011 galls.,	„	164,631
Coffee	18,823,714 lb.,	„	371,410
Salt	1,101,567 bush.,	„	32,537
Tobacco and cigars	...	„	51,817
Indigo	47,037 lb.,	„	7,536
Tropical fruits	...	„	10,406

A very extensive internal trade is carried on by the canals and railroads leading to New York; by the great coal roads and canals reaching the city from the north; by the southern tow-boat and railroad lines; and by the Pennsylvania Central Railroad, and other lines to the west. Much of the import trade of the city enters the custom-house of New York, and the goods are brought over the New Jersey roads and canals without breaking bulk. Very large quantities of domestic exports are sent abroad by the same lines; and the apparent decline in the direct foreign trade and shipping of the port is but a transfer to the port of New York as a more convenient entrepôt. The actual export and import trade of the city of Philadelphia is rapidly increasing. The tonnage transportation of one internal line, the Pennsylvania Railroad, for 1857, was 92,660 tons westward, and 205,500 tons eastward; the first of package and dry goods mainly, and the second of hemp, wool, grain, and other agricultural produce. The great coal roads bring an immense tonnage, both for consumption and for exportation.

The consolidated city of Philadelphia is divided into 24 wards, two or three being mainly suburban, and embracing the area formerly called the county. The government is by a mayor, elected for two years; a select council of 24 members, elected for the same period; and a common council of 72 members, elected annually. The police organization is made up of one chief, 8 high constables, 16 lieutenants, 32 sergeants, 615 regular police, and 37 special officers and reserved corps—a total force of 708. There are 16 aldermen or police magistrates; the remaining judicial organization being that of the state.

The city possesses a very large productive property in water and gas works, real estate in fee and in trust, with stocks and bonds in addition to the value of L.2,190,000, only about half of which is at present fully productive. The aggregate debt of the city is L.4,168,500, for the larger share of which sinking funds are established, leaving but about L.730,000, for the interest on which provision is required to be made by taxation. The sum expended for all city purposes in 1857 was L.868,802; of which L.320,840 was for repayment of loans and for interest; L.87,284 for police; L.85,109 for highways, sewers, and bridges; L.54,916 for the poor; L.90,361 for administration of lighting and water departments; and L.100,872 for the support of the city public schools.

There are in Philadelphia 12 daily newspapers, 39 weekly newspapers, and 48 periodicals published monthly, bi-monthly, and quarterly. There are in the city 17 banks, with an aggregate capital of L.2,357,725, which had, June 1858, in specie, L.1,469,831; in circulating notes, L.497,476; and in loans and discounts, L.4,957,517. There are also 15 saving fund banks not issuing notes; 18 fire insurance companies chartered by the state; 29 fire and marine and fire and life, and 5 marine insurance companies. Most of the coal, iron, and navigation companies of the eastern part of the state have their offices in the city.

A system of city railroads was begun in 1857, which will soon supersede the local conveyance by omnibuses, for which over 600 vehicles were employed in 1857. The level nature of the city facilitates the construction of passenger railways, with cars drawn by horses; and ten distinct com-

panies are now chartered, and are placing railroad tracks along most of the principal streets, by which, at a cost not exceeding five cents, passengers are conveyed, in a low noiseless carriage, any distance within the city.

The population of Philadelphia exceeded that of any other America city previous to 1830. It is now second only to New York. The following were the numbers at the several decennial enumerations:—

1777	21,767	1810	96,287	1840	258,037
1790	42,520	1820	119,325	1850	408,962
1800	70,287	1830	167,325	1858 (calculated)	620,000

The increase in the number of voters and of taxable inhabitants indicates a larger population than that assigned for 1858. In 1850 there were 121,699 persons of foreign birth, of whom 72,312 were born in Ireland, 22,750 in Germany, 17,500 in England, 3291 in Scotland, and 1981 in France. The number of coloured persons was 19,761. At the election for president in 1856, 70,198 votes were cast, and at that for mayor in May 1858, 62,839.

PHILADELPHIA (the modern *Allahsher*), an ancient city in the east of Lydia, owed its origin and its name to Attalus Philadelphus, King of Pergamus. It was situated between the southern bank of the river Cogamus and the north-western side of Mount Tmolus. The city makes no small figure in history. Strabo narrates that it was famous for being frequently shaken by earthquakes. In the Apocalypse it is mentioned as one of the "seven churches of Asia." It was also notable in more modern times for holding out against the Turks till 1390, after all the other cities of Asia Minor had surrendered. The only remarkable remains of the ancient Philadelphia are the ruins of a church.

PHILÆ, an island in the river Nile, celebrated for its ancient ruins. (See EGYPT.)

PHILÆNI (*Φιλαίνοι, lovers, of praise*), two Carthaginian brothers, are celebrated in ancient legends for their patriotism. The following is the account of their exploits, as given by Sallust:—It happened that the Carthaginians and the Cyrenians were involved in a bloody and indecisive war regarding the boundary between their respective territories. At length, when they had nearly exterminated each other, without settling the dispute, they mutually consented to try a simpler mode. They agreed that, at the same moment of time, a pair of deputies should set out from Carthage to Cyrene, and another pair from Cyrene to Carthage, and that the spot where the two pairs should meet should be considered the boundary between the two countries. It was then that the Philæni, being chosen to represent Carthage, appeared in the characters of devoted patriots. Hastening eastward, and panting over the toilsome deserts with deathless ardour, they passed the middle distance, and meeting their opponents at a place far on the other side, claimed that advanced spot as the limit of their country's possessions. An altercation ensued; accusations of having started before their time were brought against them; but they remained immoveable. Their determination at last became so invincible that, rather than bate a step of ground, they consented there and then to be buried alive in the sand, and to make their graves the land-marks between the two nations. The fearful proposal was carried into execution; and long afterwards, two altars erected over their resting-place, and called the "altars of the Philæni," preserved their memory, and formed the boundary of the territories of Carthage.

PHILEMON, a Greek dramatist, who stands next to Menander among the poets of the new comedy, was born at Soli in Cilicia about 360 B.C., and settled in Athens at an early age. His career seems to have been singularly prosperous. The lively wit and practical good sense of his plays soon introduced him to popular favour. In many a dramatic contest, he carried off the palm from his abler rival Menander. He continued to write on, free from the troubles and ills of life, until he had produced ninety-seven comedies, and passed beyond the age of ninety. His sunshine even remained till the last, for he is said to have died laughing at a ludicrous incident. The few extant fragments of Philemon's plays are inserted in all the principal editions of Menander. (See MENANDER.)

PHILEMON, *Epistle to*. That this Epistle was written by the apostle Paul is the constant tradition of the ancient church. It is expressly cited as such by Origen (*Homil. XIX. in Jerom.*, tom. i., p. 185, ed. Huet.); it is referred to as such by Tertullian (*Nov. Marc.* v. 21); and both Eusebius (*Hist. Eccles.* iii. 25) and Jerome (*Proem. in Ep. ad Philem.*, tom. iv., p. 442) attest its universal reception as such in the Christian world. It was most probably written during the apostle's two years' imprisonment at Rome. It was occasioned by his sending back to Philemon his runaway slave Onesimus, who, having found his way to Rome, was there, through the instrumentality of the apostle, converted to Christianity; and after serving Paul for a season, was by him restored to his former master, without whose consent the apostle did not feel at liberty to retain him. This Epistle has been universally admired as a model of graceful, delicate, and manly writing.

Of separate commentaries on this Epistle, the following is nearly a complete list:—Eichhorn's *Einleit. ins N. T.* iii. 300; Henr. Hummel, *Explanatio Ep. Ap. Pauli ad Philem.*, Tiguri, 1670, fol.; Lebr. Ch. Gottlieb Schmid, *Pauli Ap. ad Philem. Ep. Gr. et Lat. Illustr. et ut Exemplum Humanitatis Pauli Proposita*, Lips. 1786, 8vo; Konrad Rudolf Hagenbach, *Pauli Ep. ad Philem. Interpretatus est*, Basil, 1829, 4to; W. Attersol, *Commentary upon the Ep. to Philem.*, Lond. 1633, 4to; and Davidson's *Introduction to the New Testament*, London, 1848.

PHILIP, the name of *five* kings of Macedonia, the most celebrated of whom was Philip II., father of Alexander the Great. (See MACEDONIA.)

PHILIP, the name of *five* kings of Spain, of whom the most noted was Philip II., who projected the conquest of England by means of the *Invincible Armada*, was the son of the Emperor Charles V. and of Isabella of Portugal, and was born at Valladolid on the 21st of May 1527. He became king of Naples aud Sicily on his father's abdication in 1554; succeeded to the Spanish throne on the 17th January 1556; was married in succession to the Princess Mary of Portugal in 1543, to Mary, Queen of England, in 1554, to the Princess Elizabeth of France, daughter of Henry II., in 1559, and to the Archduchess Anne of Austria in 1571. This cruel bigot died at Madrid on the 13th September 1598. (For information respecting his life and career, see SPAIN.)

PHILIPPE, the name of *six* kings of France. (For an account of each, see FRANCE.)

PHILIPPEVILLE, a town of Algeria, in the province of Constantine, stands at the head of the Gulf of Stora, 35 miles W. of Bona. It is quite a modern town, having been built in 1838, and has straight and regular streets, lined with handsome houses. It is defended by a citadel and four forts, built on eminences in the vicinity. It is built in a great measure of the ruins of the ancient *Rusicada*, which occupied the site of Stora, not far off. Philippeville is connected with Constantine by a good road. Pop. (almost entirely Europeans) 8050.

PHILIPPI, a city of Macedonia, was situated eastward of Amphipolis, within the limits of ancient Thrace. (Acts xvi. 12; xx. 6; Phil. i. 1.) It was anciently called Κρηνίδες, from its many fountains; but having been taken and fortified by Philip of Macedon, he named it, after himself, *Philippi*. In the vicinity were mines of gold and silver; and the spot eventually became celebrated for the battle in

which Brutus and Cassius were defeated. Paul made some stay in this place on his first arrival in Greece, and here founded the church to which he afterwards addressed one of his Epistles. It was here that the interesting circumstances related in Acts xvi. occurred; and the city was again visited by the apostle on his departure from Greece. (Acts xx. 6.) In the former passage (xvi. 12) Philippi is called a colony (κολωνία); and this character it had in fact acquired through many of the followers of Antony having been colonized thither by Augustus (Dion. Cass. xlvii. 432). The ruins of Philippi have not been much visited by travellers; but an interesting account of them may be found in the *American Missionary Herald*, by the missionaries Dwight and Schauffler, who were there in 1834. The most prominent of the existing remains is the remainder of a palatial edifice, the architecture of which is grand, and the materials costly.

PHILIPPIANS, Epistle to the. Of this part of the apostle Paul's writings the authenticity has never been questioned. It is referred to formally and expressly by Polycarp, in his *Epistle to the Philippians* (§§ 3, 11), besides being repeatedly quoted by him. It is quoted by the churches at Vienne and Lyons, in their letter to the churches in Asia and Phrygia, preserved by Eusebius (*Hist. Eccles.* v. 2); by Irenæus (*Cont. Hær.* iv. 18, § 4); by Clement of Alexandria (*Pædag.*, lib. i., p. 107; *Strom.* iv., p. 511; *Admon. ad Gentes*, p. 56); by Tertullian (*De Resur. Carnis*, c. 23); by Origen (*Cont. Cels.*, lib. iii., p. 122, ed. Spencer; *et sæpiss.*); by Cyprian (*Lib. Testim.* iii. 39), and by many of the later fathers.

From allusions in the Epistle itself, it is evident that it was written at Rome during the period of the apostle's two years imprisonment in that city, and in all probability towards the close of that period (i. 13, 14, 23, 26; ii. 18, 25). This Epistle is written throughout in a very animated and elevated style. It is full of the most sublime thoughts and the most affectionate exhortations. It resembles more the production of a father addressing his children, than that of an apostle laying down authoritatively what is to be received and followed. The whole of it shows, as Theophylact observes, how very much he loved and estimated those to whom it was addressed. (*Proem. in Ep. ad Phil.*)

The chief commentaries upon this Epistle are the following:—M. H. Schotanus, *Analys. et Comment. in Ep. Pauli ad Phil. cum observationibus et earum usibus*, Franc. 1637, 4to; J. Gottfried Am Ende, *Pauli Ep. ad Phil. Gr. ex recens Griesbachii; Nova vers. Lat et annot. perpet. illust.*, Vitemb. 1798, 8vo; G. F. H. Rheinwald, *Commentar. ub. d Brief Pauli an die Philipp.*, Berlin, 1827, 8vo; Konrad Steph. Matthies, *Erklarung d. Briefes Pauli an d. Phil.*, Greifswold, 1835, 8vo; Hermann Gustav. Holemann, *Comment. in Ep ad Phil.*, Lips. 1839; Wessel Alb von Hengel, *Comment. perpetuus in Ep. Pauli ad Phil.*, Amstel, 1839; A. Rilliet, *Commentaire sur l'Epitre de l'Apôtre Paul aux Phil.*, Geneva, 1841, 8vo. In English the works of Pearce and Ferguson may be mentioned; also an English translation of Neander's *Epistle to the Philippians practically and historically considered*, Edinburgh, 1851; and Olshausen's *Commentary on the Epistle to the Philippians*, translated in "Clark's Foreign Theological Library."

PHILIPPICS is a name applied to the orations of Demosthenes against Philip, King of Macedon. The Philippics are reckoned the masterpieces of that great orator. (See Demosthenes.) This name is likewise applied to the fourteen orations of Cicero against Marc Antony.

PHILIPPINES, The (Span. *Islas Filipinas*), a group of islands in the Pacific Ocean, belonging to the Indian Archipelago. They lie between N. Lat. 5. 32. and 19. 38., E. Long. 117. and 127., being bounded on the N. and E. by the Pacific, S. by the seas of Celebes and Sooloo, and W. by the China Sea. The form of the group is triangular; and the total number of the islands, large and small, is, at the lowest estimate, 1200. Of these the largest and most important are the following:—Luzon (by far the largest of the whole), Mindoro, Panay, Negros, Zebu, Bohol, Leyte, Samar, Masbate, Mindanao, and Palawan. The smaller islands in the centre of the group, between Luzon and Mindanao, are known by the name of the Bisayan Islands. The area of the whole group is estimated at more than 120,000 square miles. The outline of most of the islands is very irregular, as they are generally indented by arms of the sea, which stretch far into the land, and the surface of all is more or less mountainous; some of the heights being very considerable. A chain of volcanoes traverses the group, and dangerous eruptions are frequent. Among the mountains lie valleys and plains of great richness and beauty; while numerous lakes and rivers diversify the face of the land, and facilitate the internal communications. There are also extensive marshes and mosses in these islands. Their structure is throughout volcanic. Many of the mountains abound in metals. Gold is found in the sand of the rivers. Ironstone, containing a large proportion of iron, and copper of an excellent quality, are also obtained. Several of the islands contain coal, limestone, marble, and other minerals; while an almost inexhaustible supply of sulphur may be obtained from the volcanoes. The climate of the Philippines is tropical and very hot; but the heat is tempered by the continual moisture, which contributes very much to the fertility of the soil. Extending, however, as they do, over an extensive region of the earth's surface, it necessarily varies at different parts. The same alternation of seasons prevails here as in other tropical countries, the year being divided into a rainy and a dry season. The former begins with the month of May, and continues till the end of October or beginning of November. During this period the fall of rain is very great, frequently continuing twelve or fourteen days without intermission. In many places the low and marshy regions are laid under water. The northern part of Luzon is subject to the tremendous storms called *typhoons*, which occur between May and December; but they are seldom experienced south of 14. N. Lat. Earthquakes occur frequently, as well as volcanic eruptions; and at times they are very destructive in their effects. The soil is in general extremely rich; and the products of the islands are numerous and varied. The mountains are covered with forests of large trees, which yield timber useful for the building of ships and houses. Sapan-wood (*Cæsalpinia Sapan*), which produces a good red dye; the mastic tree (*Pistacia Lentiscus*), the cocoa and palm (*Cocos nucifera*), the sago palm (*Sagus*), the bread-fruit tree (*Artocarpus incisa*), the banana (*Musa sapientum*), and other trees valuable for their fruits or other productions, grow in the islands with more or less cultivation. Among the crops raised, the most important is rice, which furnishes the chief article of food to the inhabitants. It is grown in large quantities for exportation, as well as for home use; and the marshy nature of a great part of the soil is not unfavourable to its growth. The sugar-cane is grown to a large and increasing extent, and the sugar is of an excellent quality; tobacco, coffee, hemp, cotton, indigo, pepper, cloves, and cassia, as well as maize, wheat, yams, sweet potatoes, and various fruits, are cultivated. Among the animals, one of the most important is the buffalo, which is found in a wild state, and is domesticated and used for ploughing, and as a beast of burden. A breed of small but hardy horses has been introduced by the Spaniards: they are only used for riding. A small number of sheep, numerous goats, pigs, ducks, and other tame fowls, are also reared. The only rapacious animal is the crocodile, which is found in most of the rivers and lakes. Fish are numerous on the coasts; and pearl oysters are obtained in large quantities. The forests and jungles are filled with many species of wild birds,—such as eagles, herons, creepers, and parrots; and the swallow which makes the edible nests used by the Chinese, haunts these islands. Monkeys, wild cats, and small foxes are among the quad-

rupeds of the Philippines. The natives of the islands belong to several tribes, differing considerably from each other. The mountains are occupied by the Negritos, a diminutive Papuan race, who are said to have originally possessed the whole of the islands, but have been displaced and driven to the mountains by the Malays from the adjacent countries. These latter are now the predominant population of the Philippines. They consist chiefly of two classes,—the Tagals in Luzon, and the Bisayans in the other islands. Each of these speak a different language; and there are also several subordinate dialects. These people have for the most part acknowledged the supremacy of the Spaniards, and adopted the Roman Catholic religion, while the inhabitants of the mountains preserve their independence. Besides these races, the islands contain a comparatively small number of Spaniards; of Mestizos, or half-castes, who are largely engaged in commerce; and a considerable number of Chinese, who have recently settled here. The manufactures are not very numerous or important. Various textile fabrics, from the coarsest to the finest materials, are woven by the women; straw hats and cordage are made; and the building of ships and coaches is carried on. The manufacture of cigars and cheroots, for which the islands are famous, is a government monopoly, and at Manilla employs a large number of hands. Commerce is extensively and actively carried on here, although neither encouraged by the Spanish government, nor promoted by Spanish enterprise. Indeed, were it not for the cheapness and excellence of the produce, and the advantageous situation of these colonies, the prohibitions and restraints imposed by the mother country would have quite checked the commercial development of the Philippines. The principal articles exported are sugar, tobacco, cigars, indigo, hemp, coffee, dyewoods, hides, and gold dust; while cotton, woollen, and silk stuffs, agricultural instruments, clocks, watches, jewellery, &c., are imported. The trade is chiefly in the hands of British houses; and in 1856 the value of the imports from Great Britain amounted to L.1,575,000, and that of the exports to L.1,370,000. Next to Great Britain, the United States have the largest trade with the Philippines; and there are commercial relations with France, Spain, Germany, Switzerland, China, the Sandwich Islands, and Chile. The entire amount of the trade export and import of the islands is estimated at L.5,700,000, of which L.3,000,000 belong to Great Britain and its dependencies, and L.1,000,000 to the United States. The supreme authority, civil and military, is in the hands of a governor-general, appointed by the crown, who resides at Manilla, the capital. He is commander-in-chief of the forces, and president of the supreme court of law, and is assisted by a ministry. The islands are divided into provinces, each under a governor appointed by the crown; and these again into *pueblos* or townships, with mayors elected by the people. The revenue is made up by the monopoly of cigars, a poll tax on the people, and duties on exports and imports. The dominions of the governor-general of the Philippines include also the Bashee and Babuyan islands, to the north of Luzon, and the Ladrones, which lie a long distance to the west. The entire population of the group is estimated at 5,000,000.

These islands were discovered in 1521 by Magalhaens, who named them the Archipelago of St Lazarus. In 1565 they were taken possession of by a fleet which was despatched from Mexico, in consequence of orders from Philip II. of Spain, and first stopped at the island of Zebu, which was soon wholly subdued. In 1570 a fleet sailed from the island of Panay for Luzon, and after several engagements with the princes of the country, effected a settlement on the Bay of Manilla. In 1571 the Spanish admiral took possession of the town of Manilla, which he constituted the capital of the Spanish possessions in the Philippines (so named after Philip II.), and proceeded in his reduction of the island under the Spanish authority. Towards the conclusion of the sixteenth century a considerable trade was openly carried on with Japan; and many rich cargoes were brought from that country to Manilla, which had now become an emporium of the trade with China, Java, the coast of Coromandel, and Mexico. In 1590 the island of Sooloo was attacked by the Spaniards, but they were repulsed with great slaughter by the natives; nor could the Spanish maritime force make any impression on the Sooloo pirates, who continued for nearly three centuries the scourge of these seas. In 1762 Manilla was attacked by the British under Admiral Cornish and General Draper, and the place was stormed on the 5th of October. A capitulation was agreed upon next day, when, in order to redeem the city from general plunder, a ransom was agreed upon of one million sterling. Manilla was restored to the Spaniards at the peace of 1763, and has ever since remained in their possession. Besides Manilla and the larger establishments in Luzon, the Spaniards have many smaller settlements scattered over the islands to the southward; but they were long unable to protect them against the attacks of the pirates who infest these seas. In 1851, however, the governor-general sent an expedition against the Sooloo islands with a view to putting a stop to these attacks. In this he proved successful, having destroyed the power of the Sultan of Sooloo, and formed a settlement in the principal island.

PHILIPPOPOLIS (Turkish *Filibe* or *Felibe*), a town of European Turkey, in the province of Rumilia, on the Maritza, 86 miles W.N.W. of Adrianople. It stands in a beautiful and fertile region, producing wine and rice; and contains fine mosques, caravanserais, khans, and numerous public baths. Leather, silk, and cotton fabrics are manufactured here. Philippopolis is the chief place of trade for the northern provinces of Turkey. The Maritza is navigable up to this town. A few remains of antiquity are still to be seen here; and the old church is pointed out in which Paul is said to have preached. The ancient town was founded by Philip, the father of Alexander the Great; but it afterwards fell into the hands of the Thracians, who retained it until the Roman conquest. It was almost destroyed by an earthquake in 1818, and again laid waste by a terrible conflagration in 1846. About half of the inhabitants are Greeks. Pop. 30,000.

PHILIPS, AMBROSE, an English poet of some note in his day, was descended from an old Leicestershire family, and was born about 1671. He was educated at St John's College, Cambridge, where he took his master's degree in 1700, and where, four years before, he printed a copy of English verses on the death of Queen Mary, in the collection published by the university. Little is known of his career till the year 1709, when six pastorals appeared from his pen, published along with Pope's in Tonson's *Miscellany.* During the same year Philips wrote his poetical *Letter from Copenhagen,* addressed to the Duke of Dorset. It appeared in the *Tatler,* with a laudatory criticism from Richard Steele, and Pope spoke of it as the production of a man "who could write very nobly." Meanwhile Philips contrived to support himself by translating the *Persian Tales* from the French for Tonson, and by empitomizing Hacket's *Life of Archbishop Williams.* In 1712 he brought upon the stage his tragedy of the *Distrest Mother,* which, although little more than a translation of Racine's *Andromaque,* yet was received with rapturous applause, particularly from all trusty Whigs. The *Spectator* took an entire number to herald its advent, and after its appearance another *Spectator* was written "to tell what impression it made upon Sir Roger;" and, to crown all, Addison, in the name of Budgell, wrote an epilogue for it, which, according to Johnson, was "the most successful epilogue that was ever yet spoken on the English theatre." (*Lives of Brit.*

Poets.) To have a rival, and a Whig too, thus puffed into fame, was too much for the forbearance of Pope, who, not content with whispering something about "packed audiences" into the ear of his friend Spence, resolved, by an unexampled artifice of irony, to strip Philips of his laurels. A short time before Addison had bestowed high praise on the "admirable pastorals and winter-piece" of Philips both in the *Spectator* and *Guardian*. Pope, under a guise of favourable criticism, put a paper into the hands of the guileless Steele, which he inserted in the fortieth number of the *Guardian*. This piece turned out, however, to be filled with the most subtle irony and covert mockery of Philips' pastorals, while written with the apparent design of magnifying their superiority to Pope's own. The open feud which ensued between the two poets was never healed. Philips, by threatening to cane Pope, kept him out of his way, but the satirist sought his revenge by garnishing the *Art of Sinking in Poetry* with the choicest specimens of his rival's verse. Again, when Philips attempted to cultivate simplicity and ease in neat little verses, with very short lines and rather childish thoughts, Pope joined Henry Carey in calling it "namby-pamby." In 1722 Philips produced the tragedies of *The Briton*, and *Humphrey, Duke of Gloucester*, which are now forgotten. His happiest undertaking was a periodical called the *Free-Thinker*, in which one of his associates was Dr Boulter; who, upon his being made archbishop of Armagh, took Philips with him, and got him a seat in the Irish Parliament. In 1726 he was made secretary to the lord chancellor, and in 1733 had risen to be judge of the Prerogative Court in Ireland. Having resigned in 1748, he returned to London, where he died on the 18th of June 1749.

PHILIPS, *John*, an English poet of some eminence, was born in 1676. He was educated at Winchester and Oxford, where he became acquainted with the works of Milton, whom he studied with great application, and traced in all his successful translations from the ancients. The first poem by which he distinguished himself was his *Splendid Shilling*, which in the *Tatler* is styled the "finest burlesque poem in the English language." His next was entitled *Blenheim*, which was written at the request of the Earl of Oxford and Mr Henry St John, afterwards Lord Bolingbroke, on the victory obtained by the Duke of Marlborough in the year 1704. It was published in 1705; and the year after, he finished another poem upon *Cider*, the first book of which had been written at Oxford. It is on the model of Virgil's *Georgics*, and is thought a very excellent piece. We have no more of Philips' writings except a Latin ode to Mr Henry St John, which is esteemed a masterpiece. He was meditating a poem on the *Last Day*, when he was cut off by consumption on the 15th of February 1708.

PHILISTINES (Heb. *Philistim*), a tribe which gave its name to the country known as Palestine, though it occupied only a portion of the southern coast, namely, that which was bounded on the E. by the hill country of Ephraim and Judah, and on the W. extended from Joppa to the borders of Egypt, thus touching on the Israelite tribes Dan, Simeon, and Judah. Indeed the portions of Simeon and Dan covered a large part of Philistia; but its possession by the Israelites was disputed, and was never entirely achieved. This country was originally held by the Avims, who were destroyed and their land seized by the Caphtorims, coming forth out of Caphtor (Deut. ii. 23). Caphtor has been thought to be Cappadocia; so is it rendered by the Targums, as well as by the Syriac and Vulgate translations ("Palæsthinos reliquias insulæ Cappadociæ"). Bertheau, however, decides that Caphtor is Crete, on several grounds (Bertheau, *Zur Geschichte der Israeliten*, 1842; see also *Die Phönizier*, von Movers, 1841; and *Kanáan*, von C. von Lengerke, 1844). Since the appearance of Lakemacher's *Observat. Philol.* (ii. 11, sq.), and Calmet's *Biblical Researches*, the word Kreti has been considered to prove that the Philistines were wanderers from Crete, which recent scholars have confirmed. Greeks and Romans support this view. Tacitus (*Hist.* v. 2) relates that inhabitants of Palestine came thither from Crete. Stephen of Byzantium, under the word Gaza, states that this city was properly called Minoa, from Minos, King of Crete, who came to Gaza with his brothers Acakos and Rhadamanthus, and named the place after himself (comp. *Kreta*, von Karl Hoeck, ii. 368). The same writer adds that the Cretan Jupiter was honoured in Gaza. (See PALESTINE.)

The Philistines are represented in the Old Testament as foreign immigrants. The ordinary translation of their name in the Septuagint is Ἀλλόφυλοι, *men of another tribe*. The root פלש, whence Philistine, denotes *a wanderer, one from a foreign land*, and was probably given by the Hebrews to the foreign immigrants who called themselves Cretans. The names of their cities and their proper names are of Shemitic origin. In their intercourse with the Israelites there are many intimations that the two used a common language. How is this, if they were immigrants in Palestine? This difficulty is removed by supposing that originally they were in Palestine, went westward, but afterwards returned eastward, back from Crete to Palestine; so that in Amos ix. 7, it is to be understood that God brought them up to Palestine, as He brought the Israelites out of Egypt—back to their home. (Movers, *Die Phönizier*, pp. 19, 29, 35.) Greek writers, however, give evidence of a wide diffusion of the Shemitic race over the islands of the Mediterranean. (See Thucydides, i. 8; Herodotus, i 173; and Homer, *Od.* ix. 174; comp. Strabo, p. 475.) Many proofs offer themselves that, before the spread of the Hellenes, these islands were inhabited by Shemitic races. The worship observed in them at this time shows a Shemitic origin. The Shemitics gave place to the Hellenics; a change which dates from the time of Minos, who drove them out of the islands, giving the dominion to his son. The expelled population settled on the Asiatic coast. This evidence, derived from heathen sources, gives a representation which agrees with the Scriptural account of the origin, the westerly wandering, and return eastwards of the Philistines.

If now we follow the Biblical accounts, we find the history of the Philistines to be in brief as follows:—They had established themselves in their land as early as the time of Abraham, when they had founded a kingdom at Gerar. (Gen. xxi. 32; xxvi. 1.) When the Israelites left Egypt, they were deterred by fear of the power of the Philistines from returning by the shortest road—that which the caravans still take—because it lay through the country of the Philistines. (Exod. xiii. 17.) Joshua appears to have thought it prudent to attempt nothing for their dispossession. The days of the Judges, however, brought conflicts between the Israelites and the Philistines, which were destined to continue during the entire history of the Hebrew monarchy.

In the Maccabæan period the Philistines were Syrian subjects, and had at times to suffer at the hands of the Jews (1 Macc. x. 86; xi. 60, sq.) King Alexander (*Balas*) gave Jonathan part of their territory, Accaron, with the borders thereof in possession (1 Macc. x. 89). The Jewish monarch, Alexander Jannæus, overcame and destroyed Gaza (Joseph. *Antiq.* xiii. 3. 3; *De Bell. Jud.* i. 4. 2). By Pompey Azotus, Jamnia and Gaza were united to the Roman province of Syria (*Antiq.* xiv. 4. 4); but Gaza was given by Augustus to King Herod (*Antiq.* xv. 7. 3).

The cities of the Philistines were greatly distinguished. The chief were Gaza, Ashdod, Askalon, Gath, and Ekron (Josh. xiii. 3; Judg. iii. 3). The greatness of these cities was mainly owing to commerce, for the coast of Palestine was in the earliest ages exclusively in possession of the trade which for many ages was carried on between Europe and

Asia. Besides a great transit trade, they had internal sources of wealth, being given to agriculture, &c. Their religion was not essentially different from that of the Phœnicians. The idol which they most reverenced was Astarte. Priests and soothsayers were numerous (1 Sam. vi. 2). Their magicians were in repute (Isa. ii. 6); and the oracle of Baalzebub at Ekron was consulted by foreigners (2 Kings i. 2). They had the custom of carrying with them in war the images of their gods (2 Sam. v. 21). Tradition makes the Philistines the inventors of the bow and arrow.

PHILISTUS, a celebrated Syracusan, was the son of Archonides or Archomenides, and was born about 435 B.C. His chief fame in ancient times was derived from his character as a historian. In this capacity his conduct was that of an inveterate time-server. He aided Dionysius the Elder in seizing the chief power at Syracuse, and afterwards became one of the most devoted supporters of the tyranny. Nor when the ungrateful despot banished him to Adria was his spirit cured of its servility. He gave vent to the most beseeching complaints in order to move the pity of his former patron. He sought to regain favour by giving, in the History of his country which he was then writing, a virtuous colouring to all the tyrant's unprincipled deeds. When all these devices had failed, and Dionysius the Elder had died in 367 B.C. without pardoning him, he assumed the same cringing attitude towards Dionysius the Younger. The interest of his friends at court was employed to procure his recall. No sooner had that object been attained, than he insinuated himself into the highest place in the young tyrant's confidence. He was continuing to hold that position by pandering to his master's vices, when the revolt of Dion in 356 B.C. brought about his overthrow. The defeat of the naval armament under his command drove him to commit suicide. The fragments of the works, and the facts of the biography of Philistus, are given in an appendix to Göller's *De Situ et Origine Syracusarum*, 8vo, Leipsic, 1818; and in Didot's *Fragmenta Historicorum Græcorum*, Paris, 1841.

PHILLIPS, RICHARD, an eminent mineralogical and pharmaceutical chemist, was born in London in the year 1778. He spent the earlier part of his career as a chemist and druggist; and in 1805 he first attracted the attention of the scientific world by his "Analyses of the Bath Waters," followed by analyses of our mineral waters generally, and of minerals of a rare kind. These papers were published for the first time in the *Annals of Philosophy*, a journal partially conducted by Phillips both before and after its subsequent incorporation with the *Philosophical Magazine* in 1827. He was appointed lecturer on chemistry to the London Hospital in 1817; and about the same period he was elected by government professor of chemistry at the Military College, Sandhurst, and became lecturer on chemistry at Grainger's School of Medicine in Southwark. It is, however, in the character of editor and translator of the *London Pharmacopœia* that Richard Phillips is best known. In 1816 he produced a review, consisting of an *Experimental Examination of the Last Edition of the Pharmacopœia Londinensis*, which established his name as a scientific critic, and raised his reputation as a chemist. During the same year he wrote another *brochure* entitled *Remarks on the Editio Altera of the Pharmacopœia Londinensis.* These pungent criticisms had the effect of drawing upon their author the notice of the College of Physicians; and Phillips was accordingly induced to come forward with his first official translation of the *Pharmacopœia* in 1824. From that period down to the time of his death Phillips took a lively interest in the improvement of this important publication, and much of its present excellence is mainly due to his industry and skill. In 1822 he was made a fellow of the Royal Society; in 1832 he became lecturer on chemistry at St Thomas's Hospital; in 1839 he was appointed chemist and curator of the Museum of Practical Geology; and in 1849 he was chosen president of the Chemical Society, a position which he continued to occupy till his death, which happened on the 11th of May 1851.

The numerous and valuable contributions to science which Richard Phillips left behind him are to be found scattered throughout the *Transactions of the Royal Society*, the *Philosophical Magazine*, and the *Pharmaceutical Journal.* He likewise contributed the principal articles on chemistry and mineralogy in the *Penny Cyclopædia.* "Of modern British analytical chemists," said Dr Thomas Thomson in his *History of Chemistry*, published in 1831, "undoubtedly the first is Mr Richard Phillips, to whom we are indebted for not a few analyses conducted with great chemical skill, and performed with accuracy."

Richard Phillips was younger brother of William Phillips, the mineralogist, who will be found noticed in a subsequent article.

PHILLIPS, *Samuel*, an industrious and successful litterateur, was the son of a Jewish tradesman in Regent Street, London, and was born in 1815. A somewhat precocious talent for mimicry and recitation had disposed his parents to train him for the stage; but they were afterwards induced, through the advice of the Duke of Sussex, to send the lad to the London University. After remaining a year at that institution, Phillips proceeded to the university of Göttingen. Having renounced the Jewish faith, he returned shortly afterwards to England, and entered Sidney Sussex College, Cambridge, with the design of taking orders. His father's death, however, altered his plans; and after an unsuccessful attempt, in conjunction with his brother, to carry on his father's business, he, in 1841, took to literature as a profession. His first work, the novel of *Caleb Stukely*, appeared originally in the pages of *Blackwood's Magazine;* and he subsequently contributed other anonymous tales to that and to other periodicals. In 1845 he began, through the interest of Lord Stanley, to write political leaders for the *Morning Herald;* and about the same time he obtained an appointment on the staff of the *Times* as literary critic for that journal. In the following year he purchased the *John Bull* newspaper, which he edited for a year; but finding his strength, which was slowly wasting under the influence of confirmed consumption, quite unequal to such laborious work, he was constrained to abandon the undertaking. From that period till his death Phillips worked cheerfully and courageously as literary critic for the *Times*, and also wrote an occasional review for the *Literary Gazette.* Two anonymous volumes of *Essays from the Times* were published by him in 1852 and 1854. They are written in a light, dashing, picturesque style, sometimes eloquent, frequently bitter, and with a tolerable show of fairness. Phillips took an active part in the formation of the Crystal Palace Company. He was appointed their literary director; he wrote their *Guide to the Crystal Palace and Park*, and the *Portrait Gallery of the Crystal Palace.* In 1852 the university of Gottingen conferred upon him the honorary degree of LL.D. But while success attended his industry, and honours came thick upon him, the fell disease with which he had long struggled at length brought his career to a close. He died at Brighton on the 14th October 1854, leaving behind him a widow and five children, for whom he had made a comfortable provision.

PHILLIPS, *Thomas*, an eminent portrait-painter, was born at Dudley in Warwickshire in 1770. Having acquired the art of glass-painting at Birmingham, he visited London in 1790 with an introduction to Benjamin West, who found him employment on the glass-paintings in St George's chapel at Windsor. In 1792 Phillips painted a "View of Windsor Castle," and ere the two succeeding years had passed, he exhibited "The Death of Talbot, Earl of Shrewsbury, at the Battle of Cassillon," "Ruth and Naomi,"

"Elijah restoring the Widow's Son," "Cupid disarmed by Euphrosyne," and other pictures of that class. From the year 1796, however, he seems to have mainly confined himself to portrait-painting; and it was in this walk he was destined to acquire his reputation as an artist. It was not long before he became the chosen painter of men of genius and talent, notwithstanding the rivalry of such distinguished artists as Koppner, Owen, Jackson, and Lawrence. He has left behind him, accordingly, portraits of nearly all the illustrious characters of his day, which will serve to justify the laudatory epithet of "the English Vandyck" bestowed upon him by the eminent foreign artist Nicaise de Keyser. In 1824 Phillips suceeeded Fuseli as professor of painting to the Royal Academy, an office which he held till 1832. During this period he delivered ten *Lectures on the History and Principles of Painting*, which were published in 1833. He likewise wrote a large number of the articles on the fine arts in Rees's *Cyclopædia.* He died on the 20th of April 1845.

Phillips, *William*, an industrious mineralogist and geologist, was born in London on the 10th of May 1773. In conjunction with his brother Richard Phillips, already noticed, and eight other young men, chiefly of the Society of Friends, he founded the Askesian Society, to which he contributed his first paper in 1801, "On the *Virgula Divinatoria*, or Divining-Rod," afterwards published in the *Philosophical Magazine*. The principal objects of Phillips' early studies were mineralogy and geology; and few men of his time contributed more to the diffusion of general information on these sciences. He was among the very first to turn to good account the reflective goniometer of Wollaston in the measurement of crystals; and in the use of that instrument, says Dr Whewell (*Hist. of Ind Sciences*), "No one was more laborious and successful than William Phillips, whose power of apprehending the most complex forms with steadiness and clearness led Wollaston to say that he had a 'geometrical sense.'" His *Elementary Introduction to the Knowledge of Mineralogy*, first published in 1816, and made the basis in 1852 of Brooke and Miller's *Introduction to Mineralogy*, is pronounced by the same writer to be "an extraordinary treasure of crystallographic facts." This work had been an expansion of his *Outlines of Mineralogy and Geology*, published some years previously for the use of the young. In 1818 he published *An Outline of the Geology of England and Wales*, which he afterwards expanded into his more famous *Outlines of the Geology of England and Wales.* William Phillips likewise contributed elaborate communications on subjects connected with his favourite sciences of mineralogy and geology to the first series of *Transactions of the Geological Society*. He also wrote some minor papers for the *Annals of Philosophy* and the *Philosophical Magazine*. He was chosen a fellow of the Royal Society a year before his death, which took place in the spring of 1828.

PHILO JUDÆUS, or *Philo the Jew*, an ancient Greek writer, descended of a noble family amongst the Jews, flourished at Alexandria during the reign of Caligula. He was the chief of an embassy sent to Rome about the year 42 A.D., to plead the cause of the Jews against Apion, who had been sent by the Alexandrians to charge them with neglecting the honours due to Cæsar. He afterwards went to Rome in the reign of Claudius, and both Eusebius and Jerome inform us that he became acquainted with St Peter, with whom he lived on terms of friendship. At a later period, it is said, his son Tiberius Alexander married Bernice, the daughter of King Agrippa.

Philo was educated at Alexandria, and made very great progress in eloquence and in philosophy. After the fashion of the time, he cultivated, like many of his nation and faith, the philosophy of Plato, whose principles he so thoroughly imbibed, and whose manner he so well imitated, that it became a common saying, *Aut Plato philonizat, aut Philo platonizat.* Josephus describes him as a man "eminent on all accounts;" and Eusebius represents him as "copious in speech, rich in sentiment, and sublime in the knowledge of Holy Writ." He was, however, so much immersed in philosophy, particularly the Platonic, that he neglected the Hebrew language, and also the rites and customs of his own people. Scaliger, Grotius, and Cudworth declare that, though a Jew by nation, he was yet very ignorant of Jewish literature and of Jewish customs. But Fabricius and Mangey think differently. In his works, however, there are certainly many excellent things. Though he is continually platonizing and allegorizing the Scriptures, he abounds with fine sentiments and lessons of morality; and his morals are rather the morals of a Christian than those of a Jew. History, as well as his own writings, give us every reason to believe that he was a man of great prudence, constancy, and virtue.

His works were first published in Greek by Turnebus, at Paris, 1552; and to these a Latin translation, executed by Gelenius, was afterwards added. The best editions are those of Paris, 1640; Dr Mangey, London, 2 vols. folio, 1742, of which the text is considered to be the best; Richter, 8 vols. 8vo, 1828–30, with additions not before published. The works of Philo Judæus have been translated into English by C. D. Yonge, forming 4 vols. of Bohn's "Ecclesiastical Library," 1854.

Philo, a celebrated writer on mechanics, was a native of Byzantium, and flourished in the year 160, being the contemporary of Ctesibius and Hero. He was the author of a work, entitled Πολιορκητικά, on the method of attacking and defending towns, of which the fourth and fifth books have been preserved. The first treats of the manner of preparing arrows, balistæ, catapultæ, and other warlike engines. Amongst other inventions, he mentions a machine of Ctesibius which discharged weapons by means of compressed air, upon the same principle, no doubt, as our air-gun. In the second book he treats of the manner of fortifying and provisioning cities, and, amongst other things, recommends that the provisions and water be poisoned if there be danger of the place falling into the hands of an enemy. This work has been published, with a Latin translation, in a collection entitled *Veterum Mathematicorum Opera*, Par. 1693. The invention of the air-gun has been treated of by Alb.-Louis Meister, *De Catapulta polybola Commentatio qua locus Philonis Mechanici, in libro iv. de telorum constructione extans illustratur*, Göttingen, 1768. There is another little work attributed to Philo, entitled Περὶ τῶν ἑπτὰ θεαμάτων (*On the Seven Wonders of the World*), part of the sixth chapter of which, and the whole of the seventh, are lost. It has been published, with a Latin translation and many learned notes, by J. C. Orelli, Leipsic, 1816, 8vo.

PHILOLAUS, a distinguished Pythagorean philosopher, born, according to some, at Crotona, according to others, at Tarentum, some time during the latter half of the fifth century B.C. He was instructed in philosophy by Aresas, and had for his disciples Simmias, Cebes, and Archytas, the friend of Plato, whom he taught at Thebes in Bœotia. Philolaus was the first who published a book on the Pythagorean doctrines, a treatise which Plato is said to have made use of in the composition of his *Timæus.* This work of the Pythagorean seems to have consisted of three books:—1. Containing a general account of the Origin and Arrangement of the Universe; 2. An Exposition of the Nature of Numbers; 3. On the Nature of the Soul. (See Fabricius' *Bibliotheca Græca.*) There is an edition of the fragments of Philolaus, by Böckh, 8vo, Berlin, 1819.

PHILOLOGY.

Definition.

PHILOLOGY, in the usual and generally correct acceptation of the term, is a branch of study of which the object is some language and literature fixed in a permanent, if not unalterable form. The application, however, of the original word by the Greeks themselves is much wider and more general than this definition would imply; and modern scholars have endeavoured to claim for philology a distinct and important place among the highest and most systematic sciences. As common Greek terms, φιλόλογος and φιλολογία denote merely a fondness for literature and literary discussion. In more than one passage Plato makes Socrates describe himself as φιλόλογος (*Phædr.*, p. 236 E.; *Lach.*, p. 188 C.; *Theætet.*, 161 A., cf. 146 A.), meaning by this that he delighted not only in hearing speeches, but also in the dialectical argumentation which formed his chief employment; and the same great writer describes Athens in general as both φιλόλογος ("loving discourses"), and πολύλογος ("full of talk"), in contradistinction to Lacedæmon and Crete, which cultivated reflection rather than conversation. (*Legg.*, p. 641 E.) A little later, a distinction was made between the more general sense in which philology could be predicated of all the Athenians as a national characteristic, and a more special application of the term; and Zenon contrasted those who were mere lovers of conversation with those who cultivated literature and philosophy as liberal studies, by calling the latter φιλόλογοι, but the former λογόφιλοι. (Stobæus, *Serm.* 36, 26, vol. ii., p. 40, Meineke; *Ecl.*, vol. ii., p. 214, Heeren.) When philology had thus fixed itself as a word denoting liberal study, it soon became applicable to studies of a particular kind. And as philosophy denoted the whole compass of ancient learning,—that is, not only the investigation of nature and thought, but also the study of transmitted opinions and of the books by which they were conveyed,—philology was understood to signify the second part only of philosophy,—namely, all that referred to literature, language, and history. (See Wyttenbach on Plutarch *de audiend. poët.*, p. 22 C., p. 226.) The first person who was called a philologer (φιλόλογος) in this sense was the great Eratosthenes (Sueton. *de illustr. Gramm.*, c. 10), who, however, did not by any means relinquish the name or the functions of a philosopher, but laid claim especially to a combination of various departments of learning (*multiplex variaque doctrina*), which made him the "admirable Crichton" of his age. The same name, for the same reason, was bestowed upon Atteius (Sueton., *u. s.*) and Demetrius of Scepsis (Diog. Laërt. v., § 84). And all these, with many others, regarded the possession of book-learning, which made man a philologer and polyhistor (πολυΐστωρ; Vit. Arat. *Phæn.*, p. 268, 11), or more generally a student (*studiosus*, Plin. *Epist.* iii. 3), as merely an adjunct to other accomplishments, or rather as a department of philosophy. In process of time, however, philosophy was limited to the investigation and discovery of physical and psychological facts; and then philology assumed a sort of antagonistic position in regard to that which was originally esteemed as merely a branch or department of the same manifestation of intellectual activity. Hence it was that Plotinus, whose literary qualifications were of a very humble order, described his eminent contemporary Longinus, who was emphatically a learned man (Eunapius, *Porphyr.*, p. 13), and had written a book called *The Philologers* (οἱ φιλόλογοι: see Ruhnken, *Diss. de Long.*, § 10), as a philologer indeed, but in no sense a philosopher (Porphyry, *Vit. Plotini*, c. 14, p. lxiv., Creuzer). This opposition has been either accepted by those in modern times who have wished to claim for philology the most extensive province and the most exalted functions; or, allowing physiology and philology to be still the two main branches of philosophy, they have assigned to the latter the duty of surveying all knowledge which is already placed on record; so that all human study is divided into two great departments,—the retrospective and the prospective, the known and the unknown. "It appears to me," says the enthusiastic disciple of W. von Humboldt (*De Pronomine Relativo Commentatio Philosophico-Philologica*, scripsit H. Steinthal, Berolini, 1847, pp. 4, 5), "that it is the business of the human understanding, or of literature in general, to comprehend those simple and absolute laws which appear in the *world* or in *nature* on the one hand, and in *the history of the human race* on the other hand. As, therefore, there are two forms of literature,—one, the *history of nature*, or *physiology;* the other, the *history of the human mind*,—philologers undertake the examination of all that the λόγος, or human reason, has produced. Now, whatever the human reason produces is some idea, something recognised and discerned by the mind, although it may be clothed in some outward form, whether it be a form of government constituted by human society: or some monument of hewn stone: or some type of mythology and religion: or some demonstrative result of philosophical acuteness: or some outpouring of poetical genius or oratorical eloquence. So that even the history of philology belongs to philology, with this limitation, that, *e.g.*, the history of classical philology is the specialty of those who consider modern life from a philological point of view. Accordingly, the only true definition is Böckh's, that *philology* is the *teaching and learning of that which is already discovered* (*philologiam esse cogniti cognitionem*); which is not to be understood, as though philologers were always doing over again the work done to their hands; but all the products of the human mind which remain as recorded facts have to be submitted afresh to the crucible of human thought, to the end that, being recognised, not as the arbitrary acts of individuals, but as sprung from the necessary laws of minds individually free, they may be regarded as a mirror or picture of the human reason in general." This sweeping generalization, by claiming for philology a sovereignty over all that has received a literary expression,—everything, in fact, except the new discoveries which inductive science may make in the domain of visible nature,—virtually deprives the philologer of any definite functions, and almost makes his name co-extensive with that of studious and thinking man. Still, it contains the germs of the true definition of philology—a definition quite consistent with the popular acceptation of the term. For the opposition between discovery (*inventio*) and learning (*cognitio*), on which it rests, is really that which, in his own proper department, distinguishes the philologer from all others who claim the possession of a particular science,—namely, some branch of knowledge methodized and reduced to general laws and principles. The fact is, that philology always presumes, as the basis of its operations, some fixed form of language and literature. By the nature of the case, it deals with that which has been completed in the past, and is no longer liable to fluctuation and change. Living and contemporary literature may be criticised, but it cannot be a proper object of philology. No fixed conclusions can be drawn from that which is still in a state of transition. It follows therefore, that, as far as language and literature are concerned, philology is most truly defined as the science of investigating and learning that which is already before the world as an accomplished result of human intellect. And the Romans actually used this distinction to describe the contrast between the Greeks, who had furnished them with models of rhetoric and philosophy, and themselves, as the

Ancient Philology.

intelligent inheritors of that transmitted wealth,—"Illis enim," says Quintilian (*Inst. Orat.* xii. 11. § 22), "hæc *invenienda* fuerunt, nobis *cognoscenda* sunt." The essential distinction, that philology deals only with a fixed and completed form of language and literature, leads to another limitation by which its province is more accurately defined It not only does not deal with modern and living literature, but it does not even concern itself with those departments of criticism which are equally applicable to all forms of literature, whether modern or ancient. This removes from the province of philology many branches of study which the ancient φιλόλογος claimed as his own, such as rhetoric, poetry, and the theory of taste. The philologer, in the full sense of the term, deals with ancient literature for the sake of language in general, which the fixed forms of an ancient idiom enable him to analyse according to methodical and scientific principles. With the literature itself the philologer, as such, is concerned chiefly as a verbal critic and interpreter. He undertakes to furnish the means by which the true reading may be ascertained and the intended signification elicited; and although a knowledge of many collateral subjects may be necessary to enable him to do this effectually, he regards these particulars as auxiliary matters only, and does not concern himself with the literary or philosophical results of his own criticisms so far as the subject-matter of his author is concerned. Taking all the circumstances into consideration, we are disposed to define philology as, in itself, the general name for a scientific inquiry into the principles of language. It deals at once with the theory of the origin and formation of words, and with the method of language, which treats of the formation of sentences. But whether we consider the origin of philology,—*i.e.*, the circumstances under which such a branch of study has assumed a systematic form,—or the procedure by which it tests its conclusions and extends its field of research, we must consider it as dealing with some branch of literature, national or classic, which is no longer vague or floating; so that it includes all the higher applications of grammar, criticism, and exegesis. Again, when we regard the intimate connection between the mind of man and his spoken language, we cannot fail to see, that the highest philology must involve an investigation of the laws of thought, and so trench on the boundaries of psychology. Lastly, when we remember that language is the most ancient and the most trustworthy of pre-historical records, we shall not be surprised to find that philology constitutes one of the main ingredients in the new science of ethnography, or the history of the varieties of the human race, and that it has led to special investigations into the primitive condition and primitive religious belief of families of men long since divided by the inevitable process of emigration. In the following pages it is not our object to treat methodically of any branch or application of philology. It is sufficient that we should show how this science of language gradually developed itself; what it has achieved; and what it is still doing. With this view, we propose to discuss, in order, the establishment of a methodical and minute study of language on the basis of classical and sacred criticism, and the subsequent growth of comparative grammar, with its adjuncts—comparative history and mythology. The following will be the most convenient divisions of our subject:—(1.) Ancient Philology; (2.) Philology during the Middle Ages; (3.) Classical and Sacred Philology, after the revival of literature; (4.) Comparative Philology, with its various developments and applications in the present century.

I.—ANCIENT PHILOLOGY.

The science of philology, like the name, is of Greek origin. Its first faint beginnings may be discerned in the age when the Pisistratidæ at Athens undertook the collection and editorship of the scattered poems attributed to Homer. (See the important Scholium on Plautus, Ritschl. *Alexandr. Biblioth.*, p. 4.) In the classical period which followed, the great epic poems were more and more regarded as a text-book for study and elucidation; and to such an extent did the text of Homer serve as the foundation of all Greek training, that Plato, in his *Republic*, feels himself obliged to discuss formally how far such an influence should be encouraged in his model commonwealth. At the same time, the Sophists, or literary men by profession, who were the earliest students of language on its own account, began to investigate the elements of grammar and criticism with an immediate reference to the text of the old poems. Protagoras, one of the most eminent of this class of public teachers, was the first to treat of the inflections of his own language; and he noticed with due attention the machinery used for the modal distinctions of the verb, and for the genders of the noun. The first principles of syntax, namely, the relation of the subject to the predicate, and the distinction between the substantive verb as a mere copula and its use as a means of predicating existence, were perhaps not stated distinctly before the publication of Plato's *Sophistes*. And Aristotle from this developed his theory of the method of language, which has since held its place as the best exposition of the subject. These, however, were but the beginnings of philology, scattered over a hundred years, and appearing only as incidental hints at a time when the productive genius of Greek literature was in full vigour, and when the age of writers had not yet given place to the age of commentators. Philology, as a study furnishing a main occupation to those who embraced it, came into active operation at the end of the fourth or at the beginning of the third century B.C., when the Greek dynasty settled in Egypt established at Alexandria a museum or college and a library on a large scale, and invited to that city all the men of letters who were willing to devote themselves to a life of book-learning. As far as any one man can claim the distinction of having initiated this school of learning, the honour must be conceded to Demetrius the Phalerian, who, having come to Egypt as an exile from Athens, induced Ptolemy Soter to lay the foundation of the library, and to undertake methodically the revision of the more ancient writers, especially Homer. The undertaking thus started was carried on with increasing vigour by a series of eminent men who filled the office of chief of the museum at Alexandria, and who, besides their special employments as literary men in different fields, were critics and commentators by profession. The first six of these librarians were Zenodotus, the great Homeric editor; Callimachus; Eratosthenes; Apollonius of Rhodes; Aristophanes of Byzantium; and Aristarchus of Samothrace. By their exertions, and those of their contemporaries among the grammarians of Pergamus and the Stoics of Athens, all the details of editorial criticism were put into a systematic form. The Greek language was analysed; the parts of speech were classified; cases and other inflections received their names, and their usage was defined; the divisions of the sentence were marked by a system of punctuation; and the pronunciation was registered by the simple but ingenious contrivance of accentual marks. At the same time, the texts of the great poets, especially Homer, were settled by a most careful revision of all the materials.

Origin of classic Philology in Greece.

The Sophists.

Plato and Aristotle.

The school of Alexandria.

From the establishment, then, of the Alexandrian school we date the origin of classical philology, or at least of a methodical and critical study of the Greek language, resting on a revision of its oldest literary remains. The period marked by the labours of the first six librarians at Alexandria also saw the first beginnings of sacred philology, which may, indeed, be regarded as an offshoot from the studies of the Alexandrian scholars. The Jews had begun to make

Beginnings of sacred philology.

Ancient Philology.

a collection of their sacred books as early as B.C. 446, when they were restored to their own country; and those of the nation who were settled at Alexandria were already in possession of the Pentateuch, at all events, when Demetrius the Phalerian persuaded Ptolemy Soter either to procure a translation of these books, or to add to his library the Greek version of them already in use by his Jewish subjects, which, however, he had revised and sanctioned by the Sanhedrim at Jerusalem; and the name of the version (that of the Seventy, *Septuaginta*), is derived from the number of that council. As other books were added to the canon at Jerusalem, they were from time to time translated at Alexandria; and when the collection was completed, sometime about B.C. 130, the whole series was divided into twenty-four parts, in accordance with the number of letters in the *Greek* alphabet, and in imitation of the same division adopted by Aristarchus for the two great Homeric poems. As the division into twenty-two parts, according to the number of letters in the *Hebrew* alphabet, was not adopted till afterwards (see Beveridge's *Works*, vii., p. 202, *sqq.*), it is clear that in this important matter the procedure of the classical school established at Alexandria re-acted on the Jewish Masorets; so that classical and sacred criticism may really be traced back to one and the same origin.

Philology at Rome.

The philology of Rome was merely an offshoot or application of that which had established itself in the schools of Greece. Not only was the later Roman literature entirely built up on the foundations of the Greek, but the later Greek literature was itself domesticated at Rome; and rhetoricians, grammarians, commentators, and lexicographers wrote or compiled for the benefit of the accomplished Romans no less than for the literary public still furnished by their own countrymen. Among the Romans themselves, or those who wrote in Latin, the most eminent philologers were M. Terentius Varro, the contemporary of Cicero; Atteius Philologus, the friend of Sallust and Pollio, who wrote an enormous miscellany in 800 books, called Ὕλη, or "Materials;" Verrius Flaccus, the tutor of the grandsons of Augustus, whose invaluable treatise *De Verborum Significatione* has come down to us only in the mutilated abridgment of Festus; Quintilian, the great rhetorician, who flourished under the Flavian emperors; Aulus Gellius, who was a contemporary of Hadrian and the Antonines; Macrobius, the author of the *Saturnalia*, and his contemporary Servius, the learned commentator on Virgil, who are referred to the age of Honorius and Theodosius; and Martianus Capella, who is usually placed at the end of the fifth century A.D. These writers treated the classical authors of Greece and Rome in the manner and spirit which the Alexandrian grammarians had exhibited in their commentaries on the older Hellenic literature; and many of them do not differ in any essential respect from the commentators who have appeared since the revival of learning in the fifteenth century.

Philology in India.

Quite unconnected with any of the manifestations of philology which we have hitherto noticed, but destined at a distant period to exercise no slight influence on the science of language in general, a school of grammarians sprung up in India, and applied to their own sacred or classical literature methods virtually identical with those which had been adopted by the classical philologers. It cannot be determined at what particular date the northern tribe of the worshippers of Brahma effected the conquest of the district which they called the Arian land (*Arya-ávartah*), lying between the Himalayan and Vindhyan chains of mountains. From the internal evidence of the oldest writings, it is concluded that their movement from the north-west did not commence until after B.C. 1400. There can be no doubt, however, that these conquerors introduced into India their own language, the Sanscrit, or grammatically perfect idiom, and with it their sacred literature; and that the latter, represented by the Vêdas, dates as far back as the fourteenth century before Christ. On the basis of this revelation (for the Vêdas, by their very name, claim to be a direct communication from the Supreme Being) was built up a copious literature, partly poetical and partly scientific. In process of time, the Sanscrit language, in which this literature, or the more solemn parts of it, was composed, and even the Prâcrit dialect, which represented a more vulgar and popular type of the sacred dialect, became dead languages; and the literature was studied only by the learned men of the upper classes. (See Lassen, *Indische Alterthumsk.* ii., pp. 1153, sqq.) In India, then, as at Alexandria, a school of philology arose; and connected as their grammatical studies were with the intellectual activity of the highest functionaries in the religious and secular bodies, it is not surprising that the learned and able grammarian obtained a rank little less sacred than that of the writers whose works he expounded. The full establishment of the grammatical system in northern India is referred to the reign of King Vicramâditya, who rescued the north-western provinces of India from the Sacæ, and reigned as absolute sovereign from the Punjâb to the Ganges. The beginning of his epoch is fixed at B.C. 58. (Ideler, quoted by Lepsius, *Chronologie der Ægypter*, i., p. 4.) How long before this time the philological element had existed in Sanscrit literature cannot be determined; for the grammarians of Vicramâditya's court at Oujein were, like the Masorets of the Jews, the sole editors of the sacred or classical books, and may have introduced into the texts the grammatical allusions which we find here and there. For example, we cannot but regard it as an interpolation when Krishna is made to say in the Bhagavad-Gita, an episode of the Mahâ-Bhârata:—"I am the A of letters, and the copula which connects the elements of the compound word" (aksharânâm-a-kâras asmi; dvandvas sâmâsikasya-cha, *Bhag. Git.* x. 33). The first of the Sanscrit grammarians, Pânini, is referred to a fabulous antiquity. "Pânini," says Colebrooke (*Miscellaneous Essays*, ii., p. 4) "lived in so remote an age that he ranks among those ancient sages whose fabulous history occupies a conspicuous place in the *Paranas*, or Indian theogonies. The name is a patronymic indicating his descent from *Panin;* but ascending to the *Paurânica* legends, he was grandson of *Dêvala*, an inspired legislator." The probability is, that the Indian scribes, like those in other countries, claimed as the author of their own theories some great personage veiled in the mist of ages, and endeavoured to exalt their own science by referring it to a sacred origin. The same attempt to give undue antiquity to a philological work is apparent in the reference of the vocabulary of Amara-Sinha to an older age. It is pretty clear that this lexicographer flourished under Vicramâditya, and was one of the nine gems of his court—a phrase which reminds us of the Alexandrian Pleiad; and it is at least probable that the *Sutras* attributed to Pânini were not much more ancient. The latter, at all events, found a commentator in the person of Bhartrihari, a brother of King Vicramâditya, whose *Kâri-kâ*, or metrical aphorisms of grammar, and the *Vârttikas*, or annotations of the inspired saint and legislator Kâtyâyana,[1] have nearly the same authority as the work of Pânini itself.

Parallel between philology in India and among the Greeks and Jews.

Those who are interested in every additional proof of the axiom, that the same causes produce the same effects, will be gratified by observing how exactly similar the growth of philology has been not only in the Greek and Jewish schools, which had a certain connection with each other, but also in the Indian school, which, though long subsequent, must have been nearly independent of any western influences. In Central Hindostan, where Vicra-

[1] On the identification of Kâtyâyana and Vararuchi, see Cowell's edition of the *Prâkrita-Prakâça*, Pref., p. vi.

Ancient Philology.

mâditya reigned, no less than in Egypt under the Ptolemies, and in Palestine after the return from Babylon, these critical and grammatical labours were stimulated by the wish to preserve an accurate knowledge of an idiom which was becoming less vernacular every day, and which contained the key to a literature regarded as classical at Alexandria, sacred at Jerusalem, and both classical and sacred at Oujein. The process in all these cases was precisely the same. The first care was to settle the texts of the most ancient and precious books. What Zenodotus, Aristophanes, and Aristarchus attempted at Alexandria, was the object of Ezra and his followers in Judea, and of the priestly or princely scholars who illustrated the glories of King Vicramâditya. The different editions of the text of Homer, and the varieties indicated by the Septuagint, as compared with the Hebrew texts of the Hebrew books, are paralleled by similar phenomena in India. For example, the great epic poem called the *Râmâyana*, which describes, under the mythical form of the adventures of *Râma*, an incarnate deity, the conquest of Southern India and Ceylon by the Brahminical race, appears in two distinct recensions, one of which is called the edition of the commentators, and is supposed to have been settled at Benares; the other, which belongs to the Bengal school, and is called *Gaudana*, from *Gauda*, the ancient name of the central region of Bengal, and of its capital, now destroyed.[1] The commentaries and paraphrases of the Alexandrian scholiasts and the Jewish Talmudists are more than paralleled by the similar efforts of the Indian pundits; and while the latter are rivalled by the Greeks only in their lexicography, neither Greeks nor Jews can vie with them in the minute and artificial accuracy of their grammatical system.

Greek philology during the decline of the Roman Empire.

Under the Roman emperors Greek philology, which had domesticated itself in Italy from the time when the Greeks first fell under the paramount influence of the Romans, was represented by an unbroken series of rhetoricians and grammarians. Flourishing schools existed not only at Rome, Athens, and Alexandria, but in outlying places like Marseilles, Rhodes, Apollonia, and Tarsus. In the reign of Vespasian distinct provision was made for the due remuneration of the Greek teachers settled at Rome (Suet. *Vesp.*, c. 18). Hadrian directed his efforts to the re-establishment of Athens as the principal university in the empire, and the steps which he initiated were carried out by M. Aurelius in the second century. In the school of Athens the chief professor was the occupant of the chair of rhetoric; and that his functions implied that he was the greatest philologer or scholar of the day is clear, not only from his title as "leader of the youth of Athens," but also from the fact that Julius Pollux, who held this office under Commodus, had been the tutor of that prince, and has left us an *Onomasticon*, or lexicon of classical terms, corresponding in effect to the *Amara-Cosha* of the Indian grammarians. Other rhetoricians or grammarians of the same age drew up glossaries or treatises on grammar and metres, which exhibit a thoroughly philological spirit, and have been found very useful by modern scholars. Among the most eminent of these were Apollonius Dyscolus, who first reduced Greek grammar to something like a systematic form, and his son Herodian, whose writings treated of many departments of minute criticism. We see the influence of the philological studies of the second century in some of the writings of the great satirist Lucian, who was not only an eminent verbal critic, but contrived, by a careful study of the best authors, to pass from the semi-barbarous Hellenism of his native place (Samosata, on the Euphrates) to a style more purely Attic than has ever been attained by an imitator. Philology of the same kind was cultivated by many other learned Greeks, most of them being, like Lucian, of oriental origin. As scholars, the most eminent of these were the contemporary writers of the third century,—Longinus, who, as we have seen, wrote a book called *The Philologers*; Porphyry, who was called "the most grammatical of philosophers" (Wyttenb. *ad Eunap.*, p. 7, ed. Boissonade); and Origen, the Christian father, who may be said to have founded the modern school of sacred hermeneutics. A taste for philological investigation was exhibited by many writers in the fourth and fifth centuries; and Athens, Alexandria, and Constantinople abounded in philosophers and rhetoricians, both Christian and pagan, who made the illustration of the classical authors one of the main objects of their labours. Such were Themistius and Libanius, Synesius, Theon and his daughter Hypatia, Olympiodorus and Simplicius, and, above all, Proclus, the last of the Neo-Platonists. Orus and Orion wrote on the details of the language; Stephanus of Byzantium collected the traditions of geographical knowledge; and perhaps at this time John of Stobi preserved, by a series of extracts, some records of the ancient philosophical systems.

Philology during the Middle Ages.

II.—PHILOLOGY DURING THE MIDDLE AGES.

Commencement of the middle ages fixed by two nearly contemporaneous events

The *middle*, or, as they are sometimes called, the *dark* ages, may be said to have commenced with two nearly contemporaneous events in the eastern and western divisions of the Roman empire. In 529 A.D. the school at Athens was closed by Justinian, and the living literature of Greece received a blow from which it never entirely recovered. Heathen philosophy took refuge for a while in the uncongenial hospitality of Persia; and the intermitting patronage of the Byzantine emperors never gave it an opportunity of really reviving in the regions where the Greek language was still vernacular. In 524 A.D. Boëthius died in prison; and his *Consolation of Philosophy* was the last dying swan-note of classical culture in the districts where the Latin language was still spoken and written according to the forms of the better ages. For some nine centuries after these events, philological studies were prosecuted, if at all, in a very partial and imperfect manner. According to the definition of the term from which we have started, there was no true philology in the dark ages. For though something was done for the illustration of the ancient writers, and something more for their preservation, the classical languages were not viewed with any proper regard to their structure and significance, and the higher kind of verbal criticism was simply non-existent.

How far philology existed during the middle ages.

As far as philology existed at all during these nine centuries, it may be said to have presented itself under four distinct forms of activity, —that which appeared in the general cultivation of Greek literature at Constantinople; that which was represented by the biblical studies of the Jews, especially at Tiberias in Palestine, and at Babylon; that which manifested itself in the intelligent curiosity of Arabic scholars at the two extremities of the Mohammedan conquests,—Baghdad and Seville; and that which is implied in the scholastic learning of Northern and Western Europe.

a. Philology at Byzantium.

At Constantinople, in the long interval between the reigns of Justinian and Constantine Palæologus, the cultivation of Greek literature went through many phases of neglect and revival. And from the time of Photius the Patriarch, in the latter half of the ninth century, down to the fourteenth and fifteenth centuries, when wandering Greeks appeared as the teachers of their own language in Italy and other parts of Europe, Byzantine literature contained some strong ingredients of a philological nature. Lexicons, like the well-known compilations known by the

[1] See Gorresio's Preface to his edition of the *Râmâyana*. Lassen thinks that there were three recensions, all amplifications of a common nucleus. (*Ind. Alterthumsk.* ii., p. 500.)

Philology during the Middle Ages.

names of Hesychius and Suidas, or by the title of *Etymologicum Magnum;* commentaries, like those of Eustathius on Homer; treatises on grammar and dialects, like those of Thomas Magister, Georgius Lecapenus, and Gregory of Corinth, at least furnished the materials for those who, a little later, and in a different part of Europe, were destined to bring a more accurate and searching criticism to the same department of study.

b. Philology among the Jews.

The attention which the Jews had paid to the texts of their sacred books from the time of their restoration, and especially after they had come into contact with the Greek learning of Alexandria, was in the strictest sense philological; though, from their one-sidedness and natural prejudice, they were not likely to bring any comprehensive or philosophical views to bear on the study of their own language and literature. The Masora or traditionary school, which dates from the days of Ezra, continued to exist in Palestine for many centuries. Even after the destruction of Jerusalem it had its seats of learning at Jabneh, Tsiphoriah, Cæsarea and Tiberias. In the last of these places the Rabbi Jehudah was famous about A.D. 230; and after his death Babylon became the chief abode of Jewish learning, having been in fact the birthplace of the studies which Ezra and Nehemiah had imported into their native land, and having been the second home of the Israelites from the time of their exile under Nebucadnezzar. (See Fuerst, *Kultur und Literaturgeschichte der Juden in Asien*, i., p. 3.) In the time before this establishment of Jewish learning in Babylon as its metropolis, three epochs are distinguished,—that from 585 to 300 B.C., when the canon was in the process of formation; that from 300 to 32 B.C., when tradition and Jewish theology were establishing themselves on an independent basis of speculation; and that from 32 B.C. to 188 A.D., when the Mischna was in the process of formation. But although Babylon became the chief seat of Jewish learning after the death of the Rabbi Jehudah, the school of Tiberias still retained its authority; and it was here, in A.D. 506, that the Masora of the law was first committed to writing, its last compiler and editor being Ben Asher, who lived at a somewhat later period. The school of Babylon flourished till the year 1037 A.D., and from this proceeded the thriving branches of Jewish literature which were transplanted to Italy, Barbary, and Spain about the year 900 A.D. These learned Jews not only devised an elaborate system of grammar, which still holds its ground, to the great detriment of comparative philology, but they endeavoured to fix the pronunciation of the sacred language by a system of vowel-points, which came into use between the sixth and eighth centuries A.D.; and while they seem to have dealt rather arbitrarily with the text itself, they sought to fix its interpretation by an elaborate contrivance of points and accents.

c. Arabic learning.

While the Jews, though denationalized and dispersed in foreign lands, were exhibiting this activity in the philological study of their sacred literature, another branch of the Semitic family had succeeded in carrying their living language from the Indian Ocean to the Atlantic. The establishment of the religion of Mahomet, and the proselytizing conquests of his successors, had made Arabic the court language in more than one populous and civilized region; and it was the policy of the khalifs to encourage the cultivation of a native literature among their subjects. It was under the Abbassidæ, and especially under Haroun-al-Rashid, in A.D. 786–808, that this Alexandrian period of Arabic learning attained its greatest lustre. Translations were made from Greek, Syriac, Persian, and Pehlevi writings; and this love of foreign learning was carried so far by Al-Mamun, who reigned in 813–833, that he offered the Byzantine emperor a large sum of money and favourable terms of peace for the services of Leo the philosopher. Under this khalif schools were established at Baghdad, Bosra, Bokhara, and Kufa, and great libraries collected at the capital and in other places. The Moorish dynasty of the Omayids in Spain vied in this patronage of learning with the Abbassidæ at Baghdad; and Cordova became one of the chief seats of Arabic culture, especially in the tenth century. Besides Cordova, Spain possessed 14 universities and many lower schools in which Arabic studies were prosecuted; and the influence of these Semitic teachers on the education of Europe in general is shown by the universal substitution of the Arabic for the Roman numerical signs, and by the adoption from the Arabic of a great many technical terms, such as *alcohol, algebra, alkali, azimuth, zenith, nadir*, &c. The extent to which these Arabic scholars studied the classical writings of the ancients, at a time when they were almost unknown in Europe, is indicated by the importance attached, on the revival of letters, to the translations and commentaries on Aristotle published by Averroes (*Ibn-Roschd*) of Cordova in the twelfth century, and rendered into Latin for the benefit of the European schoolmen.

d. Scholastic learning in Northern and Western Europe.

In Northern and Western Europe the clergy for a long time monopolized the little learning which still struggled for existence. The prejudice which the church had entertained against heathen culture from the fourth century, prevented the priests themselves from engaging with much interest in the study of the best writers. Greek was an unknown tongue to the Latin Christians; and the language of Cicero and Virgil was gradually breaking up into the Romance dialects, which are its representatives in Italy, France, and Spain. The Latin was indeed retained as the language of religion and law; and the necessity imposed upon the clergy of studying the vulgate translation of the Scriptures and the standard books of canon law, which were written in the classical idiom, maintained the practice of grammatical training even on the part of those who had no taste for a pure and accurate style. And if the classical writers were not much studied, they were at all events preserved from a wider destruction than has befallen them by the monks of the Benedictine order, whose rules obliged them to read and copy manuscripts, and who exercised this rule not unfrequently on behalf of the best Latin authors. Individual instances occurred in which a desire for better learning was manifested. In England, in particular, an Asiatic Greek, named Theodore, who became primate in 668 A.D., introduced a knowledge of Greek and Latin; and in the following century Bede, and a little later Alcuin, exhibited a respectable amount of philological attainments. The intellectual excitement occasioned by the first Crusade, and the glimpses of eastern civilization and refinement which this pilgrimage of warriors and priests opened to the ruder nations of the West, seem to have led to the development of universities in the twelfth century. It is generally supposed that the university of Paris was the earliest of these institutions; but it was followed speedily by similar establishments in England and Italy. In all these universities the faculty of arts or philosophy was the original department; and of the seven liberal arts of which the course of study consisted, the first three, or grammar, logic, and rhetoric, attracted the greatest attention. And as all these consist more or less in the study of language for its own sake, it may be said with truth that the universities of Western Europe had at once grappled with no inconsiderable part of philology.

Foundation of universities.

The scholastic philosophy.

Almost contemporary with this beginning of university education was the establishment of the scholastic philosophy; that is, of a system of grammar and logic derived ultimately from the Stoics, and applied to the solution of the most difficult questions in metaphysics and theology. The founder of this school-philosophy was Roscelin of Compiègne, who flourished in the early part of the twelfth century, and adopted the tenets generally known as *nominalism.* He was, therefore, the first to inaugurate a

Classical and Sacred Philology.

mode of dealing with language, which in the fourteenth century, under the able guidance of our countryman, William of Ockham, was destined to pave the way at once for a reformation of theology, and a revival of literary criticism. The schoolmen, however, dealt only with the method of language, or with the structure of the sentence; and though they occasionally speculated on the meaning of terms, they had no linguistic knowledge; and if the universities had been left to the training which they encouraged and exemplified, there would have been no restoration of the better kind of learning. But while they were wrangling on questions of divinity at Paris, Oxford, and Salamanca, and while Bologna was prosecuting the study of the civil law, eminent literary men in Tuscany had been led by their own good taste to make themselves acquainted with the great writers of ancient Greece and Rome, and to acquire the classical idioms in which they had composed their works. Dante, who wrote his *Divina Commedia* at the very beginning of the fourteenth century, takes Virgil for his guide through the gloomy regions of future punishment, admitting that he had derived all the graces of his style from a careful study of that great poet. Petrarch was induced to devote his special attention to Virgil and Cicero, and recommended them by his warm eulogiums to the notice of his contemporaries. But the traditions of classical Latin had never been entirely lost; and Petrarch aimed at a more important acquisition when he endeavoured, with the aid of the Calabrian Barlaam, to gain some knowledge of Greek in 1342. In this effort he was not successful; but the achievement was effected by Boccaccio a few years later, when he was fortunate enough to obtain the assistance of Leontius Pilatus, the last of those who, in Greece itself, were supposed to understand the text of Homer. These, however, were isolated instances; and no public teacher of Greek was established in Italy before the year 1395, when Emmanuel Chrysoloras gave lectures at Florence, and became the founder of a school of Italian Hellenists. Guarini of Verona had been his pupil at Constantinople, and became his fellow-labourer in spreading a knowledge of Greek. Numerous manuscripts of the best authors were imported by Aurispa and others; and nothing was wanted but formal and public patronage to establish in Italy the renewed study of classical antiquity. The accordance of that patronage in the fifteenth century, combined with the invention of printing in Germany or the Netherlands, and other concurrent causes, gave rise to the revival of learning in Europe, and led to the foundation of modern philology as a main ingredient in liberal education.

Classical studies revived in Italy in the 14th century.

III.—CLASSICAL AND SACRED PHILOLOGY AFTER THE REVIVAL OF LITERATURE.

Patronage of ancient learning in the 15th century.

It was about the same period that printed books began to appear in the Low Countries and in Germany that the conquests of the Turks drove the most learned Greeks from their own country, and obliged them to seek an asylum in Italy; and that Alfonso, King of Naples, the Pope Eugenius IV., and, above all, Cosmo de' Medici, encouraged learning by a direct countenance of its professors. While the first of these contemporary circumstances paved the way for a general circulation of books, the active patronage of the leading men in Italy enabled native or foreign scholars, like Poggio Bracciolini, Laurentius Valla, Theodore Gaza, John Bessarion, Filelfus, Gemistus Pletho, and others, to place the study of the classical writers on a footing of recognised importance. In tracing briefly the history and development of philological studies from this period, which was not only in one sense a revival of what had previously existed among the Greeks and Romans, but also, in another sense, the beginning of critical scholarship and linguistic science in the modern acceptation of these terms, it will be most convenient to consider separately and in succession the different countries which made important contributions to the methodical investigation of the classical languages in the fifteenth and sixteenth centuries.

Italian scholarship.

We must begin with Italy, which, while it may claim the honour of inaugurating modern learning, has perhaps contributed less than any other country in Europe towards the improvement of scientific philology. At the time of their greatest activity,—namely, in the first hundred years after the revival of letters,—the Italian scholars were chiefly occupied with printing Greek and Latin books, and furnishing the former with Latin versions. An eager desire to know the contents of the books written in Greek, which so few had adequately mastered, made the work of translator very popular and remunerative. Poliziano's version of Herodian passed through three editions in 1493, the year of its publication; and the versions of Plato and Plotinus, which Marsilius Ficinus executed from the Greek manuscripts, were for a long time the only sources of knowledge for those who studied the Platonic and Neo-Platonic philosophy. Laurentius Valla, who had begun at an earlier period to translate the historians and epic poets, was the first of these Italian scholars who attempted to deal philologically with the Latin language. His six books on the elegancies of Latin, which were first published before the invention of printing, laid the foundation of modern researches in syntax and the distinctions of synonyms. And he also set the first example of writing critical notes on the text of the New Testament. The first specimen of more general criticism was supplied by the *Miscellanies* of Poliziano, which appeared in 1489, and contained illustrations of one hundred passages, taken at random from the best Latin authors. He entered into questions sometimes involving the minutest accuracy. For example, he was the first to prove what all scholars admit, though few adopt that spelling, that the name of Virgil was really *Vergilius.* With all this, however, the book contains at the end the following curious admission and demonstration of the author's disregard of orthography:—"Impressit ex archetypo Antonius Miscominus. Familiares quidam Politiani recognovere. Politianus ipse nec *Horthographiam* se ait nec omnino alienam præstare culpam." In the same year with the *Miscellanies* of Poliziano appeared the *Cornucopia* of Nicolas Perotti, which was mainly a commentary on Martial; and the same scholar compiled a Latin Grammar, which was used as a text-book by the learners of that age. Philippo Beroaldo did good service as an editor of Latin works; and Hermolaus Barbarus, a noble Venetian, who enjoyed a reputation not inferior to that of Poliziano, boasted that he had introduced some 5000 emendations into the text of Pliny's *Historia Naturalis.* Meanwhile the press of Aldus was in full activity, and before the end of the fifteenth century it had put forth nearly twenty editions of Greek authors, beginning with the elegant but comparatively recent poem of Musæus. The Greek text of Plato, whose writings had excited so much attention at Florence, where they were known in the Latin translation of Ficinus, appeared for the first time from the press of Aldus in 1513, under the editorship of Musurus, who prefixed some Greek elegiac verses of his own, perhaps the last specimen of such a composition from the pen of a native Greek.

German scholarship—Reuchlin.

The heavy ecclesiastical atmosphere, which hung over Italy, did not allow that country to see the full development of the scholarship which it had inaugurated. It was reserved to Germany and the Netherlands, which had introduced the art of printing, to produce also the first beginnings of a free and enlightened criticism, which rescued classicalism from the trammels of sacerdotalism, and paved the way for intellectual liberty in all departments of literature. The founder of modern scholarship in Germany, and the pioneer of the Reformation, which sprung, in part at least, from the establishment of a better kind of learning in

that country, was John Reuchlin, whose name, according to the pedantic fashion of the age, was Græcized into *Capnio.* Born at Pforzheim in 1455, and having received his early education in Germany, he was enabled to extend his opportunities of acquiring knowledge by visits to France and Italy; and while in the latter country in the suite of Eberhard of Wurtemberg, he excited the admiration of Joannes Argyropulus by the accuracy with which he translated Thucydides, and elicited the exclamation that the banished learning of Greece had taken refuge beyond the Alps. His studies were not confined to Greek and Latin. He was also an oriental scholar, and had paid particular attention to the later Hebrew literature.

Melancthon.

His mantle descended to Melanchthon, whom he recommended as his substitute when invited to Wittemberg; and he died in 1522, after having laid the foundation of the philology which has become the inalienable inheritance of his country.

Scholarship in the Netherlands—Erasmus.

In the Low Countries, Desiderius Erasmus of Rotterdam, who was born in 1467, and died in 1536, pursued a course which tended to the same object as that of Reuchlin, though he was less frank and open in the avowal of his convictions. He, too, had visited Italy, and became a doctor at Bologna. And he had made his appearance in England before the end of the fifteenth century, and not only stimulated the learned activity which was commencing in this country, but actually held a professorship in the university of Cambridge, and wrote a book on Latin style for the use of his friend Dean Colet's newly-founded school of St Paul's.

Progress of philology in France—Budæus.

Although the greatest normal influence is thus attributable to Germany and Holland, it was in France that the earliest philological works of the new school made their appearance. William Budé (Budæus), who was born in the same year as Erasmus, by the publication of his two great works, *De Asse et Partibus Ejus* in 1514, and his *Commentarii Linguæ Græcæ* in 1519, opened a new era in philological research. The latter, in particular, must be regarded as the foundation of all modern Greek lexicography; and though the first book of its kind, it is still an excellent authority in some of its departments, especially in the explanation of the orators; insomuch that Porson, the greatest critical scholar of the present century, at one time contemplated a republication of the work. We owe to Frenchmen of the sixteenth century not only this, the earliest specimen of a really scholarlike explanation of Greek words, but also the first beginnings of Latin and Greek lexicography in the ordinary acceptation of the term. The Dictionaries of Calepio and others were completely superseded by the appearance of the

Robert and Henry Stephens.

Latin Thesaurus of Robert Stephens (Etienne) in 1535; and Henry, the son and successor of that eminent scholar and printer, by the publication of his complete Greek Thesaurus in 1572, not only took the place of the Lexicon published ten years previously by his countryman Robert Constantin, but has furnished the groundwork of all future labours of the same kind; and his great Dictionary has been republished twice in the present century, with all the aids and appliances of modern erudition. Besides these eminent men, and the two greatest scholars of the end of the sixteenth and the early part of the seventeenth centuries, Isaac Casaubon, the son-in-law of Henry Stephens, and Joseph Justus Scaliger, the founder of philology in Leyden, when the university was established there in 1575, as a reward for the heroic valour of the citizens, France contributed to Italy, in the fifteenth century, the most learned of those who wrote on philology in that country,—M. A.

Muretus.

Muretus, who, to considerable erudition and critical acumen, added the rare accomplishment of writing Latin in a style which any Roman but Cicero might have envied.

The scholarship of England in the sixteenth century was not only stimulated by the direct influence of foreigners established in the country as teachers, such as Erasmus, P. Martyn, and M. Bucer, and by the intercourse between the leaders of the Reformation on this side of the Channel, and men like Melancthon, who represented at once the revived learning and Protestant feelings of Northern Germany, but also by the labours of Englishmen high in the state—such as Sir T. Smith, who taught Greek at Cambridge in 1533, and was ultimately secretary of state to Queen Elizabeth; Sir John Cheks, who, after being regius professor of Greek and public orator in the university of Cambridge, was tutor, privy councillor, and secretary of state to Edward VI.; and Roger Ascham, who was private tutor and Latin secretary to Queen Elizabeth. The foundation of a number of grammar schools in the latter half of the sixteenth century did a great deal towards confirming the study of philology as the chief branch of a liberal education; and not only the clergy and gentry, but even the ladies of England, attained to a familiarity with Greek and Latin literature which was not common on the Continent. Grammars of both languages were compiled; and in a series of editions, beginning from the year 1548, Thomas Cooper, afterwards bishop of Lincoln and Winchester, so improved Sir T. Elyot's Latin and English Dictionary, that classical students in this country possessed, with explanations in their own mother tongue, a very adequate substitute for the Thesaurus of Robert Stephens.

Classical learning in England.

Philology established in Europe at the end of the 16th century.

By the end of the sixteenth century, classical philology, in its modern sense, was fully established, and the publication of various editions of the New Testament, an active study of Hebrew, especially in Germany and England, and various contributions to the interpretation of Scripture, had placed sacred philology on a parallel footing in the countries which professed Protestantism. Even the remote kingdom of Scotland had felt the influence of this revived study of antiquity; and George Buchanan, who was born in 1506, and died in 1582, obtained a place, at any rate in Latin scholarship, equal to that of his most celebrated contemporaries.—Οὐ Σκότος ἦν, said his pedantic eulogist, ἀλλὰ φάος Σκοτίης. After the commencement of the seventeenth century, it is no longer necessary to consider the progress of philology with reference to the different countries which contributed to it. The republic of letters was of no country; and while scholars formed a sort of confraternity which kept up a friendly intercourse by means of Latin, the universal language, sometimes publishing in one country what had been written in another, the successive epochs in the development of linguistic science were due rather to the eminent talents of individuals than to anything peculiar to the training or circumstances of their respective nations.

Buchanan.

Isaac Casaubon.

J. J. Scaliger.

As we have already intimated, two great French scholars form the link between the creative efforts of the sixteenth and the completed scholarship of the seventeenth century: Isaac Casaubon, who was born at Geneva, where his parents had taken refuge in 1559, and who died as prebendary of Westminster and Canterbury in 1614, being as nearly as possible the contemporary of Shakspeare; and Joseph Justus Scaliger, who was born at Agen in 1540, and died at Leyden in 1609. The latter of these celebrated men constitutes an epoch in the history of philology; and, encouraged as he was by the communications of Casaubon, he laid the foundation of the science of learned chronology. "Scaliger," says Niebuhr (*Hist. of Rome*, i., note 660), "stood at the summit of universal solid philological learning in a degree that no one has reached since; and so high in every branch of science, that from the resources of his own mind he could comprehend, apply, and decide on whatever came in his way." It was not only by his great work *De Emendatione Temporum*, and his numerous contributions to the elucidation and criticism of the ancient authors (see the list given by J. Bernays in his biography of Scali-

ger, Berlin, 1855, pp. 269–316), but also by his labours in oriental learning, that Scaliger deserves to be regarded as the epochal scholar of his age. It was he who, without any dictionary or grammar, engaged first in the study of Arabic; and though he published nothing on the subject, the notes which he had drawn up served as the basis of Rapheleng's Arabic Dictionary, and laid the foundation for the grammatical and lexicographical labours of Erpenius and Golius, who were successively professors at Leyden in the middle of the seventeenth century. The revised translation of the Bible, which appeared in 1611, was a proof of the deep root which philology had struck in this country; and there were many book-learned men of first-rate eminence in England, France, and Holland during the period, which was rendered unhappy by the wars of political or religious opinion in those countries. But the mode of study adopted by these scholars, eminent as they were, did not differ from that of their predecessors. Bellenden, Andrews, Selden, Usher, Pearson, and Gataker, can hardly claim anything as peculiar to themselves, unless we should make an exception in favour of the Latin orthography adopted by the last-named of these writers.

R Bentley.

It was towards the end of the seventeenth century that another new epoch in philology was marked by the appearance of Richard Bentley. Born in January 1662, and educated at Cambridge, he was led by a sort of accident to investigate the genuineness of some epistles written by a sophist, probably in the second century A.D., and attributed to Phalaris, who flourished some six centuries B.C. The absolute demonstration at which Bentley arrived, that these epistles were the ingenious forgeries of an age long subsequent to their pretended date, opened the way for an application of philology as new as it was important. Up to that time it was usual to accept the title-pages of ancient books as conclusive evidence of their authorship. But the matchless learning which Bentley, stimulated by personal controversy, brought to bear on the worthless production of some rhetorician of the age of the Antonines, suggested to scholars of kindred genius similar efforts in the cause of truth where works of greater antiquity and importance came to be cross-examined in the court of philological judgment; and Bentley has been regarded by all the greatest of the scholars who have succeeded him as the author and founder of historical criticism. One of his most active opponents in the squabbles with his college, which occupied too large a portion of his life, Dr Conyers Middleton, was one of the first to enter on this delicate field. To Bentley, also, is due the first beginning of a new form of sacred criticism. He undertook an edition of the New Testament resting on a full collation of all the manuscripts; and though he did not live to carry out his plan, it has produced much fruit in the hands of those who, for a hundred years after his death, laboured according to a similar procedure. In regard to the details of classical scholarship, Bentley was distinguished above all his predecessors and contemporaries by his faculty of conjectural emendation, by his keen observation of the facts of language and the forms of words, and by an attention to the details of the ancient metres, which was quite new at that time. In these particulars he found worthy successors among his own countrymen; and the accurate discipline of the public schools in England placed our scholars generally in a better position at starting than most of their brethren on the Continent. Bentley died in 1742; and in the remaining part of the eighteenth century, the English scholars Dawes, Markland, Toup, Tyrwhitt, and, above all, Porson, had brought minute verbal scholarship to its highest point of accuracy and refinement.

Bentley's successors in England.

Meanwhile Germany and Holland, with which Bentley had kept up uninterrupted intercourse, were contributing largely to the materials at least of philological learning. J. G. Grævius and J. F. Gronovius, the contemporaries of Bentley, were Latinists of first-rate eminence in Holland. Similar studies were pursued at Hamburg by J. A. Fabricius, who was born in 1688, and died in 1736; at Gottingen by J. M. Gesner, who was born in 1691, and died in 1761; and at Leipsic by J. A. Ernesti, who was born in 1707, and died in 1781, and who combined with his classical attainments some amount of theological learning.

German and Dutch scholars.

The Latinism of the university of Leyden was developed into a combination of Latin with Greek, and a devoted study of the latter, by Tiberius Hemsterhuis, whose early labours were both stimulated and guided by Bentley. He was followed by David Ruhnken, who united to a refined accuracy of Greek scholarship, worthy of the English school, a practical skill as a Latinist, in which he was surpassed only by Muretus; by L. C. Valckenaer, who was the first to pay that attention to the remains of the Greek drama which has been a characteristic of more recent scholarship, and who was also an eminent expositor of the New Testament; and by Dan. Wyttenbach, who vied with Ruhnken as a Latinist, and, for the first time, brought accurate scholarship to bear on the study of the best Greek philosophers.

New phase of philology in Germany.

A new phase in the development of philology was marked by the rise of modern German scholarship at the end of the eighteenth century. Up to this time German philology had been little more than an offshoot of that which flourished in Holland; and some of the ablest German scholars, such as Grævius, Alberti, Drakenborch, Ruhnken, and Wyttenbach, had established themselves at Leyden.

Lessing and Winckelmann.

But German literature in general was placed on a new footing by the genius of Lessing, who shook off the overruling influence of the French school; and at the same time Winckelmann laid the foundations of the archæology of art. The peculiar genius of the Teutonic mind seemed to rise at once from its slumbers, like a giant refreshed with necessary repose. Besides the great efforts of original thought in the departments of theology, philosophy, and general literature, which have proceeded from the pens of German writers since the period of the Seven Years' War, the same spirit was soon seen in classical philology.

Heyne.

Here the epochal man was Christian Gottlob Heyne, and the scene of his activity was the university of Gottingen, founded by our King George II. in 1739. Heyne was the son of a poor weaver, born in 1729 at Chemnitz in Upper Saxony, and brought up in the most abject poverty. He contrived to get educated as a starving student under Ernesti at Leipsic; and his editions of Tibullus and Epictetus, which he published in 1754 and 1756, having attracted Ruhnken's notice, he was, on the recommendation of that scholar, in which Hemsterhuis concurred, appointed to succeed J. M. Gesner, and settled at Göttingen in 1763. The difference between Heyne and all preceding scholars consisted in the spirit of general literature which he brought to his philological labours, and the thoroughly modern enlightenment with which he illustrated the objects of erudite speculation. To him politics and art, and all the subjects of the day, fell within the range of a lively and searching interest; and it was to this that he owed the instincts which guided him to some of his discoveries. For instance, a consideration of the socialistic doctrines preached by the leaders of the French revolution probably led him to the inquiries which enabled him to explain, for the first time, the true nature of a Roman agrarian law,—namely, that it dealt with "the pastures of the common land, which were of common right," and not with the private property of the more opulent classes. Heyne did not excel as a verbal critic; and the application of the more reasoning and philosophical spirit, which he exhibited in his own department, to the ancient languages themselves, was due to other scholars.

Reiz.

A beginning in this important field was made by Fr. Wolfgang Reiz (born in 1733, died in 1790), who first started a rational method of dealing with

Classical and Sacred Philology.

grammar and criticism opposed to the mere empiricism which had previously been considered sufficient for all practical purposes. The chief works of Reiz were his treatise *De Temporibus et Modis Verbi Græci et Latini* (Leips. 1766), and his essay *De Prosodiæ Græcæ Accentus Inclinatione* (published after his death, by F. A. Wolf); but whatever influence he may have produced on the learned world by these treatises, a more important effect resulted from his training of the mind of Godfrey Hermann (born 28th November 1772, died on the last day of 1848). The first edition of Buttman's Greek Grammar had been published in 1782, but without evincing any of the marked features of the work as we now have it. In 1801 appeared

G. Hermann.

Hermann's Essay *De Emendanda Ratione Græcæ Grammaticæ*, which took a truly philosophical view of the subject, and applied to the traditionary system of the Greeks principles derived from the general theory of language. The historical criticism, which had been founded by Bentley, and to which Heyne had made some approximations, was revived in a very striking manner by a pupil of the latter,

F. A. Wolf.

Fr. Augustus Wolf, who, following up a theory which had been ventilated in 1725 by an eccentric Italian, Giambattista Vico, perhaps also acting on the hints thrown out by Wood in 1772 (*On the Original Genius of Homer*), and certainly guided in some degree by the Venetian Scholia published by Villoison in 1788, undertook to prove in 1795 that the poems attributed to Homer were not the work of one poet, but were collections of lays reduced to an outward coherence and consistency by the editorial labours, first of the Pisistratidæ at Athens, and afterwards of the Alexandrian grammarians; that, in fact, they were not originally committed to writing, but had gradually assumed in the hands of the rhapsodists the form in which they were thus submitted to the diligence of successive remodellers. Wolf's *Prolegomena ad Homerum*, supplemented in 1797 by his *Briefe an Hrn. Hofrath Heyne, eine Beilage zu den neuesten Untersuchungen über Homer*, produced an effect not unlike that of Bentley's *Dissertation on Phalaris;* and though his views have not found more than a partial acceptance in his own country, and have been warmly combated by some of the best scholars in England, Wolf is accepted, by the chief promoters of historical criticism in the present century, as their great model and immediate forerunner. This was directly admitted by Barthold

Niebuhr.

George Niebuhr (born at Copenhagen 26th August 1776, died at Bonn 2d January 1831), whose *History of Rome* is the most remarkable example of destructive and reconstructive criticism that modern philology has produced. The study of the classical writers in that connection with the taste of modern literature which the old pedantic scholars (Ruhnken's *Doctores Umbratici*) had formally repudiated, and which Heyne had done so much to esta-

Schleiermacher.

blish,[1] found a great supporter in Fr. Schleiermacher, an eminent philosopher and divine, who applied to his examination of Plato's Dialogues a system of interpretation resting on a comprehensive view of the connection of thought in the collected works of his author; and his method was avowedly adopted by Augustus Böckh and Ludolf Dessen. Perhaps the summit of excellence in this application of

K. O. Müller.

classical philology was attained by Karl Otfried Müller, the favourite pupil of Böckh, who pursued with success the paths opened by Heyne, Bockh, Niebuhr, and Winckelmann, and brought his own genial spirit to the aid of his multifarious researches in fields already occupied by other labourers. Views of mythology not confined to the old limits of clas-

Lobeck and Creuzer.

sical erudition were put forth by Lobeck and Creuzer; and when Niebuhr's discovery of the manuscript of Gaius had given a new impulse to the study of civil law, Savigny and

Savigny.

others improved the occasion with such zeal that, in Germany at least, there is a complete union between classical philology and jurisprudence.

Comparison of German and English philology.

The full effects of this new school of German philology were not felt in England until after the general pacification of Europe in 1815. From that time to the present we have gradually extended our acquaintance with the labours of our contemporaries on the Continent; and it may now be said that, according to the definition of those terms on which we have elsewhere insisted (*Classical Scholarship and Classical Learning*, Cambridge, 1856, pp. 149, *sqq.*), philological students in this country have adequately combined the *learning* which is the special characteristic of German classicalism, with the *scholarship* which has been hitherto regarded as the most solid basis of a liberal education in England. The great problem has been, to harmonize the practical skill, the finished mastery over the resources of the Greek and Latin languages, which the habit of composition in prose and verse, in our great schools and older universities, has produced, perhaps in superabundant measure, and in which the Germans are conspicuously deficient, with a more general possession of that knowledge of facts and books, that comprehensive erudition, which the numerous philological professors scattered over Germany are generally found to possess. That such a combination is possible,—that it is sometimes effected in a most remarkable manner,—will not be denied by any one who is aware that the financial affairs of this great commercial country have been administered in succession by two statesmen of nearly the same age, both educated with singular distinction at Eton and Christ Church, Oxford; and that, while one of these has, among other learned works, produced the most profound and critical treatise on the early history of Rome that has appeared since Niebuhr, the other has submitted to an elaborate review, only too much diversified by the flights of an enthusiastic imagination, the various questions connected with the philological analysis of the Homeric poems. We refer of course to Sir G. C. Lewis and Mr W. E. Gladstone.

Completeness of modern classical philology.

Rather more than four centuries have elapsed since the revival of literature, and the commencement of a period when modern scholars proposed to themselves the task of recovering philologically the knowledge of the classical languages which had been lost in Italy and Greece. It is now a long time since the more accomplished scholars of the northern universities have been qualified to expound Thucydides at Athens, and to explain Virgil at Rome; since they could write Greek iambic verse with a correctness not attainable by Gregory of Nazianzus, and could translate their vernacular poetry into Latin elegiacs which Claudian might have acknowledged as equal to his own best efforts. And especially during the last forty years the principles of philological science have attained to such fixedness and maturity, that it does not seem very probable that any very important modifications will be introduced into the method of study which has been established in Germany and England. We cannot therefore conclude the brief survey which we have taken of the history of classical and sacred philology since the middle of the fifteenth century without stating the results which have been secured, and the resources which have been collected for the use of philologers of the present and future ages.

Departments of classical and sacred philology.

The domain of classical and sacred philology has been mapped out, with various degrees of minute detail and refined subdivision, by the most recent writers on the subject (see especially F. A. Wolf, *Vorlesung über die Encyclopädie der Alterthumswissenschaft*, published by Gürtler, Leipsic, 1831; G. Bernhardy, *Grundlinien zur Encyclopädie der*

[1] Compare what Ruhnken says (*De Doctore Umbratico*, p. 120), with the admission of Bockh (*Orat.* A. 1826, *habita*), "qui non videam homines Græcam Latinamque grammaticam imprimis tenentes ceteris mortalibus animo bene conformato longe præstare."

Classical and Sacred Philology.

Philologie, Halle, 1832; A. Matthiä, *Encyklopadie und Methodologie der Philologie*, Leipsic, 1855; Haase, art. "Philologie," in Ersch and Gruber's *Allgemeine Encyclopadie*, part 33, Leipsic, 1847, pp. 392, *sqq.*). It does not appear necessary, at least for our present purpose, that we should go beyond the simple and general classification suggested by Böckh,—namely, that philology falls into two great masses, the *formal* and the *material*, or the doctrine of words (*verbal philology*), and the knowledge of things (*real philology*). To the first (I.) belong exegesis and criticism, including (*a*) grammar, (*b*) lexicography, and (*c*) the constitution and interpretation of the classical and sacred texts; to the second (II.) belong (*a*) political history, with chronology and geography, (*b*) public and private antiquities, (*c*) mythology and the archæology of art, and (*d*) the history of ancient literature and science. In all these departments the labours of the last four hundred years, and especially the methodical efforts of the last half century, have made such progress that it is not reasonable to expect from those who come after us much more than a gradual improvement in the details.

I. (*a*.) Grammars.

I. (*a*.) The grammars of the Greek, Latin, and Hebrew languages have been subjected to the most searching and accurate scrutiny; and both the origin of the word-forms and the structure of the sentences have been expounded according to principles of scientific criticism altogether beyond the reach of Apollonius, Priscian, or the Jewish rabbis. The author of these pages is of course prevented from speaking of what he has attempted to do for the improvement of Greek and Latin grammar; but it is right to mention, as works which have produced a marked influence on the classical scholarship of the present century, the contributions of Buttmann and Lobeck to the establishment of an accurate acquaintance with the forms of words (*Formenlehre*) in the Greek language, and the exposition of Greek syntax by Buttmann, Matthiä, Madvig, and Rost; the metrical researches of Porson, Gaisford, Hermann, and Böckh, have left little to be desired in that department; K. L. Schneider's collections of the forms and inflexions of Latin words exhaust the subject as far as he has gone; and the numerous editions of Zumpt's Latin Grammar, combined with the independent researches of Madvig, have given a lucid and accurate view of Latin syntax. The improvement of Hebrew grammar, and of that of the Aramæan and cognate dialects, is due to Gesenius, Ewald, Fuerst, and Hoffmann.

I. (*b*.) Lexicography.

I. (*b*.) The department of lexicography attained to a complete and lasting development much earlier than that of grammar. We have already mentioned that the great French printers of the sixteenth century, Robert Stephens and his son Henry, drew up respectively complete Dictionaries of the Latin and Greek languages. The Greek Thesaurus of Henry Stephens, which was arranged, as far as the knowledge of those days allowed, in etymological order, was reproduced in the same form, but with very copious additions, by the English printer A. J. Valpy (London 1816–26); and a new edition, with the words arranged alphabetically, has been in the course of publication at Paris since the year 1830, under the conjoint or successive editorship of C. B. Hase, G. B. L. Sinner, T. Fix, L. and W. Dindorf,—all German scholars; and the work, thus remodelled and enlarged, must remain the most copious repertorium of information respecting the facts of the Greek language. A more methodical arrangement of the significations is exhibited in the Greek Lexicons with vernacular interpretations, of which the first specimens were put forth by the German scholar J. G. Schneider, and his editor and abridger F. Passow. After more than one unsuccessful attempt, Greek and English lexicography was placed on a satisfactory footing by Messrs Liddell and Scott of Oxford, whose labours were professedly based on those of Passow. The improvement, however, of the German Dictionary by its more recent editors, Rost and Palm, will probably give rise to a corresponding effort on the part of English scholars. The Latin Thesaurus of Henry Stephens and its successor, Faber's Lexicon (first published in 1571), assumed their best form under the editorship of J. M. Gesner. But the honour of drawing up a Latin Dictionary which should rank with the Greek Thesaurus of Henry Stephens, was reserved for an Italian scholar, Egidio Forcellini of Padua, who, after forty years' labour expended on his task, published his great work in 1771, in 4 vols. folio. His countryman, Furnaletti, enriched the work with a valuable appendix; and the Lexicon has appeared in the best form which it can be expected to attain in the English edition by Mr Bailey (London, 1826). Some Latin and German Dictionaries, especially that by Scheller, have merits of their own; but although the Lexicon of Forcellini, with all its copiousness, is occasionally imperfect, it will ever remain the greatest monument of honest labour bestowed upon the Latin language. Of Latin and English Lexicons, the best representative of the scholarship of the day is undoubtedly that of Dr W. Smith. With regard to the Hebrew language, the Buxtorfs, Pagninus, and others, had adequately conveyed the traditionary interpretation of Hebrew phraseology; but a new era in Hebrew lexicography was opened by the Thesaurus of W. Gesenius, and the elaborate Concordance of Julius Fuerst, and his Dictionary, which is in the course of publication, will leave the student of this language nothing to desire.

I. (*c*.) Criticism and exegesis of texts.

I. (*c*.) The constitution and interpretation of the classical and sacred texts presented the first and most necessary object to the scholars of Europe on the revival of letters; but it has required a long probation in grammatical and metrical criticism to bring this department to its present state of methodical perfection. It can hardly be doubted that the great English scholars have done more than any of their brethren on the Continent to establish the laws of language and metre, and the principles of criticism, which are of constant application in dealing with the texts of authors deformed by the transmitted blunders of ignorant copyists. With regard to the sacred texts, the peculiar feelings with which they are regarded have induced editors to rely as far as possible on manuscript authority, and the most laborious collations have been made with this view. It has been shown, however, that conjectural emendations may be safely introduced into the Hebrew text of the Old Testament, which has often been arbitrarily altered by the Scribes and Talmudists; and Lachmann, one of the most recent, and at the same time most careful editors of the New Testament, has asserted and exemplified the occasional necessity of having recourse to the unaided sagacity of the critic in certain cases of difficulty. (Tom. ii, præf., p. v., *sqq.*) In the classical authors, and especially in the poets, a scrupulous regard for the manuscripts is seldom entertained by any one who has mastered the details of the Greek and Latin languages, and who knows that he has rarely before him a manuscript authority of older date than the later centuries of Byzantine literature. The obvious errors found in the papyri of the newly-discovered fragments of Hypereides, and even in some inscriptions, show that the most ancient copyists were not more immaculate than modern printers; and the chances of error are infinitely multiplied when we have to deal with the last results of many centuries of transcription. The confidence of the verbal critic in conjectural emendation has often been confirmed by the subsequent discovery that the alteration which he felt to be necessary to the grammar or metre is actually preserved in some older copy, or in some citation from the author by an ancient grammarian. The perfection of modern grammar and lexicography, and the great ability which has been brought to the study of the ancient texts,

Comparative Philology.

have left us very few authors, and indeed very few inscriptions or coins, which still require the care of a competent editor.

II. (*a*.) History, chronology, and geography.

II. (*a*.) In history, chronology, and geography, English scholarship has placed the results of philological research in their most complete and perhaps final condition. Although the great German writers, especially Niebuhr and O. Müller, have done very much to investigate the early and obscure periods of Roman and Greek history, the classical period of the former is most adequately narrated by Arnold, Liddell, and Merivale; Gibbon will always remain the master-work for the period of the decline and fall; and Sir G. C. Lewis has investigated even the early history in a new spirit of learned scepticism. In regard to Greek history, the labours of Thirlwall and Grote, coming close in succession, have challenged an incontestible superiority to all previous or contemporary labours. The *Fasti* of the late Mr Clinton are the standard work on chronology. And in geography, the learned investigations of Leake and others are most satisfactorily exhibited in the valuable Dictionary edited by Dr W. Smith.

II (*b*.) Antiquities.

II. (*b*.) For the collection of facts illustrative of the public and private life of the ancients we are chiefly indebted to the laborious erudition of the Germans in the present century, among whom Bockh, Becker, Wachsmuth, Schömann, and K. F. Hermann, occupy a distinguished place.

II (*c*.) Mythology.

II. (*c*.) In mythology, also, no other scholars can vie with the philologers of Germany. From different points of view, Creuzer, O. Müller, and Lobeck have treated the subject with great acuteness and exhaustive learning. The archæology of art, since Winckelmann's time, has been prosecuted with eminent success by German scholars. The Archæological Society of Rome is chiefly sustained by students of this nation; and the late O. Müller's *Manual* is the best text-book on artistic antiquities.

II. (*d*.) Literary history.

II. (*d*.) The history of ancient literature is no longer confined to the learned collections of J. A. Fabricius. Not to speak of the valuable articles contained in the Dictionaries of Pauly and W. Smith, in the various Encylopædias, and in the Prolegomena to elaborate editions of the ancient writers, many books have appeared, or are in the course of publication, which treat elaborately of the history of ancient literature and science. The history of Greek literature, in particular, was undertaken by O. Müller, whose book has been recently completed; and a similar review has been commenced on a much larger scale by Mr Mure, of whose valuable work five volumes have already appeared. Dr Whewell's *History of the Inductive Sciences* contains all that need be said of the progress of physical knowledge in ancient times; and the *Kosmos* of A. von Humboldt is not less remarkable for the learning with which he has collected the reports of more ancient observers of nature, than for the genial sentiment and graphic power with which he has stated the results of modern investigations.

IV.—COMPARATIVE PHILOLOGY.

Distinctions between classical and comparative philology.

Up to the beginning of the present century the great fabric of classical and sacred philology, which had received a gradual increase of solidity or dimensions from the contemporary or successive labours of scholars during the preceding 350 years, stood by itself in a sort of solitary magnificence. Since then there has risen by its side a method of linguistic study, which, though it serves in many respects as a most important auxiliary to the older form of philology, and, conversely, derives from classical learning some of its best materials and safest principles, nevertheless presents many features of contrast to its predecessor, and has not yet been able to effect the intimate and cordial alliance which is necessary for the best possible prosecution of both. This is *comparative philology*, or the comparative study of languages, with an immediate reference to the discovery of the laws which regulate human speech in general, and with an ulterior application to palæological researches respecting the origin of the human race and its various branches, the pre-historical condition, abodes, and civilization of the different tribes of men, and the derivation of those forms of religious belief which seem traceable to some early but not otherwise discoverable contact of nations now geographically distant from one another. The differences between classical and comparative philology seem at first sight sufficiently pronounced. While the student of classical and sacred philology bestows a minute, searching, and critical attention on the grammars of two or three ancient languages, with a professed and special reference to the literature to which they serve as the key; while, if we except the educational results of his grammatical training, we find that the real object of his pursuit is often not so much the words as the things recorded in writing; the comparative philologer, on the other hand, does not confine himself to the classical, or even to the most ancient languages, for every variety of human speech which is fixed in a permanent form furnishes him with inductions for his science, and is alike interesting to him; and he does not concern himself with any literature, whether ancient or modern, except so far as it enables him the better to investigate the structure of language, and so to establish scientifically his views respecting the nature and laws of human speech. Thus, while the classical or sacred philologer studies two or three languages, mainly, or at least professedly, for the sake of their literature, the comparative philologer studies not only all languages, but all literature, for the sake of language in general, and what results from the affinities of particular languages. But though there is this opposition between the two different departments of philology, and though one-sided students in either province have been disposed to regard their fellow-labourers with distrust or superciliousness, philologers of more comprehensive views have recognised the fact, that a prolonged and critical study of some ancient language and literature is the most satisfactory basis for the comparative investigation of all languages with a general object, and that no ancient language and literature can be studied in the best manner by those who ignore the processes and results of comparative philology. And if we speak of a philologer in the fullest and strictest sense of the term, we must not at the present day concede this name to any one who has not ascended from classicalism to comparative grammar, and who cannot extract scientific truth from an examination of the structure and history of language in general.

Rise of comparative philology.

It has been already intimated that comparative philology did not establish itself as a recognised science until after the commencement of the present century. Indeed, its origin may be dated from the time when Sanscrit grammar began to be studied in a proper manner by European scholars; and if a particular year may be fixed as that of its birth, we could hardly select any other than 1808, that of the death of our great verbal scholar, R. Porson; when the publication of Colebrooke's edition of the *Amara-Côsha* at Serampore, paved the way for a more convenient form of Sanscrit and English lexicography; when Wilkins' Sanscrit Grammar, and the notice of the book in the *Edinburgh Review* (vol. xiii.), directed the attention of English scholars to the affinities of Sanscrit with the other Indo-Germanic languages; when F. Schlegel's book *On the Language and Wisdom of the Indians* awakened a similar interest in Germany; and when Prichard's *Inaugural Dissertation on the Varieties of the Human Race* laid the foundation of the modern science of ethnography. But long before this time, gradual and imperfect approximations had been made to a comparative analysis of ancient languages. The first beginnings were

The year 1808.

Comparative Philology.

Earlier approximations to a comparative study of language

due to the fruitless search among existing languages for the primitive form of human speech; and as various idioms were selected as having the highest claim to this distinction, the affiliation of other languages was attempted by the most violent and precarious etymologies. Sometimes the Celtic, in one case the low Dutch, more frequently the Semitic languages, especially the Hebrew, were favoured with this recognition of priority; but the process was in every case the same, the assumptions equally inadmissible, and the conclusions equally unsatisfactory. The true affinity between Persian, German, and Greek was perceived by Lipsius (in 1599), by Salmasius (in 1643), and by D. Wilkins (in 1715); but as they had no fixed principles of philology, no results flowed from the observation of the facts. The progress of missionary labour led to the translation of the Lord's Prayer into a variety of languages, and a collection of these versions was made by Gesner, whose *Mithridates* appeared in 1555, and led to the collection by Wilkins and Chamberlayne in 1715, and ultimately to the more extended work by Adelung and Vater. The first, however, who prosecuted the comparative study of language on sound principles, and saw its possible application to ethnography was the illustrious Leibnitz. His comprehensive genius anticipated many of the future results of linguistic science, and it was he who recommended the formation of comparative lists of words designating common objects, which would be a basis for the inductions of the general grammarian. The first elaborate attempt to carry out this recommendation was made by the Jesuit Hervas in the last twenty years of the eighteenth century, his various works being published between 1784 and 1787; and about the same time appeared the collections made by the naturalist Pallas, under the direction of the Empress Catherine II. The publication of the first volume of Adelung's *Mithridates* in 1806, brings us close upon the period which we have indicated as the true birth-tide of comparative philology, and completes the previous epoch of preparatory labours. Before we discuss the rapid progress of comparative grammar subsequently to the year 1808, it will be desirable to notice what had been done before, or was doing at that time, or has been done since then, for the critical study of the three main branches of language which are spoken by the great Christian nations of Europe,—the Romance, the Teutonic, and the Sclavonian.

Leibnitz.

Hervas.

Pallas.

Adelung.

Study of the Romance languages.

It might have been expected that the obvious resemblances of the Romance languages, and their known derivation from a common origin, and not from any one of themselves, would have attracted attention at an early period, and led to a recognition on these data of the general principles of comparative philology. For if any scholar had merely written down in parallel columns the substantive verb in the Italian, French, Spanish, Portuguese, Rhœto-Romance, and Wallachian languages, he could not have failed to see that the inflexions were but six variations of a common type; and a very small acquaintance with history would have taught the inquirer that this common type was to be found in the old Latin; so that the Romance languages were all sisters, the daughters of one mother. This conclusion, extended to all the members of the Indo-Germanic family, is the primary result of comparative philology in general. But though scholars to whom these languages were vernacular had, from the time of Dante, noted many peculiarities common to them, and though even the Byzantine Greek, Laonicus Chalcondyles, had remarked in the fifteenth century the affinity of the French and Italian (p. 89, ed. Bonn.), nothing was done for the methodical philology of the Romance languages before the time of Raynonard, who was born in 1761, but did not publish the first volume of his *Choix des Poésies Originales des Troubadours* till 1816. His best predecessors—Menage, in the seventeenth, and St Palaye, in the eighteenth century—had only entered on the confines of the subject. But his Grammar and Lexicon, and the abundant examples which he collected, have placed Romance philology on a scientific footing, and enabled his successors, especially Diez, to deal on the principles of comparative grammar with all the languages which derive their origin from the Latin.

Raynonard.

The Teutonic languages—Hicks.

The founder of the comparative philology of the Teutonic languages was an English non-juror, George Hickes, whose *Thesaurus Grammatico-Criticus et Archæologicus Linguarum veterum Septentrionalium*, published in 1715, indicated, however imperfectly, the results which might be obtained from an examination of the affinities of the German and Scandinavian languages. He had no doubt derived great advantage from the Mæso-Gothic studies of Francis Junius, a German settled in England, who died in 1677; and the increasing attention which was subsequently paid to the venerable remains of Ulfilas, the Sanscrit of the Teutonic family, and to Anglo-Saxon literature, contributed to pave the way for the establishment of a scientific school of German philology. The application to this work of a comprehensive and original mind is due to Rasmus Christian Rask, a native of Denmark, who commenced in 1807, while still a young man (he was born in 1787), a series of labours which have placed him in the highest class of linguistic discoverers; and it has been well observed (*Edinb. Rev.*, vol. 94, p. 317), that "Rask's works on the classification and comparison of languages are the best specimens of what could be accomplished in comparative philology without the aid of Sanscrit." In the years 1807–1812 he occupied himself with writing Grammars of most of the Germanic, Scandinavian, Sclavonian, and Romance languages—making references occasionally to the Indian idioms. In 1812 he travelled to Sweden, and laid the foundation of his knowledge of the Finnish dialects. In 1813 he went to Iceland, where he spent three years; and in 1814 appeared his prize essay *On the Origin of the Old Norse or Icelandish Language*. His perception of the affinities of the German and Asiatic languages led him to undertake, in 1820, an overland journey to Persia and India; and the fruit of his linguistic studies in the East appeared in his essay *On the Age of the Zend Language, and the Genuineness of the Zendavesta*, published by Hagen in 1826. On his return to his native country in 1823, he engaged in a long series of linguistic labours; and he died in November 1832. For Teutonic philology he did more than any of his predecessors and contemporaries, and may really claim the honour of having first noticed the law of the permutations of consonants, which is generally connected with the name of James Lewis Grimm. This distinguished philologer, born two years before Rask, may be said to have completed the edifice of which that great linguist laid the foundations. His German Grammar (1819–1840) has subjected the whole range of the Teutonic dialects to a comparative analysis, and in the first volume he has established, by a copious induction, to which, however, there are some exceptions not yet fully explained, the laws for the regular interchange of the mutes, which Rask had less completely indicated. His subsequent works, *The Legal Antiquities of Germany* (1840–1842), his *German Mythology* (1835–1844), his *History of the German Language* (1848), and his German Dictionary, now in the course of publication, have brought all the resources of philology to bear on his Teutonic researches. In this department, however, we must not forget to mention the valuable labours of our own countrymen, the late Mr J. M. Kemble, who not only revived among us, but prosecuted with eminent success, the study of Anglo-Saxon; Dr R. G. Latham, who, in addition to more general labours in comparative philology, has for the first time expounded the principles of English grammar, and investigated the ethnography of the British Islands, in accordance with the results of modern science; and the late Mr Richard Cleasby, who devoted his life, during a

Rask.

Grimm.

J. M. Kemble.

R. G. Latham.

R. Cleasby

Comparative Philology.

long residence at Copenhagen, to the compilation of a Dictionary of the old Norse or Icelandic language, and whose great posthumous work is about to appear at Oxford, under the competent editorship of Dr G. W. Dasent.

Sclavonic philology—Dobrowsky.

The Sclavonic languages, spoken by a hundred millions of Christians in the east of Europe, have not failed to claim their share in the general interest of philologers. The father of Sclavonic philology was Joseph Dobrowsky, born at Gyermet, near Raab, in 1753. Of his numerous works, in which he penetrated for the first time into the peculiar structure of the Sclavonic idioms, the most important was his *Institutiones Linguæ Sclavicæ Dialecti Veteris*, Vienna, 1822. In the path which he opened Dobrowsky was successfully followed by Paul Joseph Schafarik, who was born at Kobeljarowo in Hungary in 1795, and whose *History of the Sclavonic Language and Literature* (Ofen, 1828) is the classical work on the subject. The great Polish Lexicon of Samuel Gottlieb Linde, born at Thorn in 1771, is a complete treasure-house for the comparison of the Sclavonic languages. It appeared at Warsaw in the years 1807–1814. The Lithuanian, Lettish, and Old Prussian, which have many features in common with the Sclavonian, and have made most important contributions to the materials of comparative grammar, have been habilitated in this domain by C. G. von Arndt (1818), J. S. Vater (1821), and A. F. Pott (1837).

Schafarik.

Study of Sanscrit.

But these detached labours bestowed on the different languages of Europe would not have produced, even in connection with the old classical philology, the necessary unity of results, if they had not been assisted and guided by the critical and grammatical study of the old language of the Brahmins. The striking resemblance between the Sanscrit, Persian, Greek, and Latin languages had been incidentally noticed by Mr Halhed as early as 1776, when he edited the code of Gentoo laws, and afterwards in 1778, when he published his Bengali Grammar at Hoogly; and Sir William Jones, and the German missionary John Philip Werdin, had—the latter with very slight knowledge of the subject—carried their observations a little further. In order that satisfactory progress should be made, it was necessary that Sanscrit, and the books written in it, should be really known; and for this the world is indebted to the abilities and industry of certain Englishmen, especially Mr Colebrooke, Sir Charles Wilkins, and Professor Horace Hayman Wilson. When this safe foundation had been secured, it was easy to use it in building up the superstructure of comparative philology; and labouring in the same field with Rask and Grimm, who, in one sense, led the way in the new science of comparative philology, Edward Francis Bopp (born in 1791), and Augustus William Schlegel (born in 1767, died in 1845), were the first who applied Sanscrit scholarship, as a branch of European study, to a general analysis of the structure of human speech. In his *Conjugations-system der Sanskritsprache* (Frankfurt, 1816), which appeared four years afterwards in an English form (*Annals of Oriental Literature*, Lond. 1820), Bopp gave the first specimen of that elaborate and exact scrutiny of grammatical forms, which has made him the chief authority in all that relates to the comparative philology of the Indo-Germanic languages. The works which contain his linguistic discoveries are, besides the early treatise which has just been mentioned, his Essays *On Certain Demonstrative Roots* (1830), and *On the Influence of the Pronouns* (1832); and above all, his *Comparative Grammar of the Sanscrit, Zend, Greek, Latin, Lithuanian, Old Slavonic, Gothic, and German* (1833–1852), which fully established the original identity of the pronominal words and inflexions in all those languages. Schlegel, in a journal called the *Indische Bibliothek*, of which the first part appeared in 1820, did a great deal both to stimulate the study and extend the knowledge of Sanscrit among his countrymen; and a long series of

Halhed, Jones, and Werdin.

Colebrooke, Wilkins, and Wilson.

Bopp and A. W. Schlegel.

Grammars and Lexicons, together with editions and translations of Sanscrit texts, have appeared from the pens of German scholars who for the most part have never travelled in India. It is true that these home-students have occasionally fallen into errors (see, for examples, Gildemeister's tract entitled *Die falsche Sanscritphilologie aus dem Beispiel des Herrn Dr Hoefer*, Bonn, 1840); and that they have often engaged in comparative philology without a competent knowledge of Sanscrit. Others, again, have limited their acquirements to the Indian languages, and have seen Sanscrit names and Sanscrit ideas in domains to which they could not have penetrated. But there are instances, on the contrary, where this learning of the German universities, when directed by competent talent and sagacity, has produced fruits equal to those which have ripened on the soil of India itself; and Christian Lassen, in particular, a Norwegian settled at Bonn (born at Bergen in 1800), has either anticipated, or made good by important additions, the discoveries of Rawlinson at Baghdad and of James Prinsep at Calcutta. It is to be remarked, however, that the best edition and translation of a Sanscrit classic that has appeared in Europe, at least the most extensive labour of this kind, is the *Râmâyana* from the Gaudana recension, published at Paris by the Italian scholar G. Gorresio. The best Sanscrit grammars are those by Wilson and Monier Williams; and the same two scholars have produced as yet unrivalled Dictionaries—the former in Sanscrit and English, and the latter in English and Sanscrit. In one important department of Sanscrit learning, the study of the oldest religious books of the Brahmins, the publication of the *Rig-Vêda*, the most ancient and important of these books, has been undertaken by this country; but the editorship has been intrusted to an able and learned German, Dr Max Muller, who is established as Taylorian professor at Oxford. He has thus completed the work commenced by his countryman, the late Professor F. Rosen, of University College, London.

Lassen.

Gorresio.

H. H. Wilson, and M. Williams.

F. Rosen and Max Muller.

Study of Zend or old Persian.

While Sanscrit scholarship was connecting itself thus intimately with the development of comparative philology, collateral aid of the most important kind was derived from an improved knowledge of another Arian language still spoken in the original abode of the Indo-Germanic race. This was the oldest form of the Medo-Persic idiom. In the middle of the eighteenth century, Anquetil du Perron had introduced into Europe a knowledge of the old languages of Persia, the Zend and the Pehlevi or Huzvaresh, the former deriving its name from "the book" (*Zend*, Sanscrit *Ch'handas*), which contained "the text" (*Avestâ*) of the Zoroastrian religion; and the latter from the heroic race (*pahlau*, "hero;" *hu-zvaresh*, "good heroism") who spoke it. But the most inconsistent and erroneous opinions were entertained respecting the nature and relations of these languages, until Rask, after his journey to the East, both established the genuineness of the Zend language and explained its true nature as an ancient type of the modern Persian. The complete establishment, however, of Zend as an important ingredient in Indo-Germanic philology is due to Eugéne Burnouf (born in 1775, died in 1856), who, in his *Commentaire sur le Yaçna* (Paris, 1835), submitted the Zend texts to a critical analysis, and arrived at philological results strictly analogous to those obtained by Grimm in German, and by Bopp in Sanscrit grammar. He has been followed by Spiegel and Westergaard; and it is now agreed that the Zend language represents a phase of the Arian speech very similar to the Sanscrit of the Vêdas, and that the *Avestâ*, in its original form, was drawn up probably in the north-eastern provinces of Persia—those on the borders of Sogdiana and Bactria—at some period anterior to the establishment of the South Persian dynasty of the Achæmenidæ. The language of South Persia under these kings has been recovered from the cuneiform in-

Du Perron.

Rask.

Burnouf.

Comparative Philology.

Cuneiform inscriptions. Rawlinson.

scriptions of the first Darius, which have been completely deciphered and interpreted by the perseverance and sagacity of Sir H. Rawlinson, assisted by the previous labours of Grotefend, Burnouf, and Lassen. The language of the Sassanian dynasty, the Pehlevi or Huzvaresh, though Indo-Germanic in its grammatical structure, is, like modern Persian, only of secondary importance to the comparative philologer.

Study of Pâli.

Another collateral aid to the study of Sanscrit, as a main ingredient in comparative grammar, has been furnished by the researches of scholars in the field of Pâli records. In the sixth century B.C. Buddhism arose in India; and it is supposed with reason that the Pâli, which is the language of the Buddhist books in Ceylon, and which has many points of affinity with the Prâkrit, or popular language of India, as represented by the dramas of the first century B.C., was the ordinary dialect of the Hindus at the time when Buddha preached. A language very like this has been traced in the inscriptions of the great Buddhist king Asoka, calling himself Piyadasi, who reigned from B.C. 260 to 220, and the interpretation of whose edicts is the glory of our countryman James Prinsep. For, as Mr Prinsep justly observed, "The Buddhists, like all sects who have appealed to the common-sense of the people against the learning and priestcraft of the schools, made use of the vernacular dialect." That the Pâli was a language corrupted by oral and perhaps provincial use is shown by many significant peculiarities, such as the omission of the liquid *r*, which is almost regular; thus the Sanscrit *kritvâ*, "having made," becomes *katvâ* in Pâli; *drishtvâ*, "having seen," becomes *disvâ; srutvâ*, "having heard," becomes *sutvâ;* and so on. In fact, its relation to the Sanscrit is that of the Romance languages to the Latin; and on this account, among others, it is an object of interest to the comparative philologer. It owes most to the researches of Burnouf and Lassen, who have done so much for the study of old Persian.

Prinsep.

Armenian philology.

Armenia, as the traditionary cradle of the human race, naturally invited the attention of comparative philologers as soon as their science had gained an adequate amount of fixity. But although the Armenian is exhibited in a copious literature, these works are not more ancient than the fourth century A.D., and the spoken language is much corrupted by an infusion of Turkish ingredients. The grammar, however, is still decidedly Indo-Germanic; and by a philological analysis of its forms, such as that undertaken by Petermann, Windischmann, and Diefenbach, its affinities to the other members of the Arian family have been established in a very striking manner. These conclusions have been strengthened by a reference to the ancient traditions of Armenian mythology, which to a certain extent identify themselves with those of the Persians. Some valuable inferences may be derived from the statement of Herodotus (vii. 73), that the Armenians were colonists of the Phrygians—a statement which merely implies a recognition of affinity, and might be understood conversely. It can also be shown that the Armenians were related to the Cappadocians on the one hand, and to the Sauromatæ on the other. Striking affinities between the Armenian and the languages of Albania and Dalmatia have been pointed out. And it is not unlikely that the original ingredients of the Armenian language represent in a very ancient form the speech which was common to the oldest Arian settlers in Europe. (See Windischmann's *Grundlage des Armenischen im Arischen Sprachstamme*, Abhandl. d. Bayr. Akad. iv. Bd. Abth. ii.; Diefenbach's Review of Petermann's Grammar, *Jahrbucher d. Wissensch. Kritik*, 1843, Nos. 56, 57; Bötticher, *Arica;* Gosche, *De Ariana Linguæ gentisque Armeniacæ indole;* Ellis, *Contributions to the Ethnography of Italy and Greece.*)

Petermann, Windischmann, and Diefenbach.

In the valleys of the Caucasus, to the north of Armenia, an isolated branch of the Indo-Germanic family of languages has attracted the notice of philologers. This is the Ossetian, from the name *Os*, given by the Georgians to the people, who call themselves *Iron.* Their own traditions point to a time anterior to the thirteenth century, when their territory extended from the Caucasus to the Don; and there can be little doubt that they are an outlying branch of the old Sarmatian stock. Klaproth first called attention to the linguistic importance of their idiom, which is not represented by any literature; and the Royal Academy of Berlin sent Dr George Rosen (a brother of the late Dr F. Rosen) to the Caucasus to learn the Ossetian language from the lips of the Ossetians. The philological results of this expedition, which Rosen has published with the co-operation of Bopp, are an important addition to the materials of comparative grammar.

The Ossetian language. Klaproth.

G. Rosen.

Celtic philology.

The earlier attempts to deal philologically with the Celtic languages were marked by the usual defects of conjectural etymology. The credit of having brought these banished, and in some of their last homes already obsolete idioms, within the domain of comparative grammar, is due to Dr Prichard, the founder of ethnography, whose book on *The Eastern Origin of the Celtic Nations* appeared in 1831; and to his reviewer, the late Mr Richard Garnett, one of the most original and accomplished philologers whom this century has produced. Mr Garnett's contributions to Celtic and general philology, we are happy to say, are about to be republished in a collected form. On the Continent Dr Prichard has been followed by Bopp, Pictet, Diefenbach, and others. The results of their researches were made known by Dr Charles Meyer in the *Report of the British Association for* 1847; and he added the fruits of his own studies, which he had prosecuted with great diligence in the countries where Celtic is still spoken. The *Grammatica Celtica* of J. C. Zeuss (Leips. 1853) has entered fully into the antiquities of the Celtic languages, and has exhibited scientifically the relations of the different dialects with regard to the laws of sound and the development of the inflexions; and some important contributions to Celtic philology are contained in the *Ethnographie Gauloise* (Paris, 1858) of the Baron de Belloguet.

Prichard. Garnett.

Meyer.

Zeuss.

Belloguet.

General results of Indo-Germanic philology established in 1833.

Independently, however, of the more recent investigations into the nature of the various Asiatic and European branches of the Indo-Germanic family of languages, the affinity and mutual relations of these modifications of human speech were fully and finally established more than twenty years ago. At any rate, since the year 1833, when the first part of Bopp's *Comparative Grammar* and the first volume of Pott's *Etymological Researches* appeared together, there has been no doubt that, from the Ganges and the ridges of the Vindhya Mountains to the shores of the Baltic, the Mediterranean, and the Atlantic, one great mother tongue is spoken, or preserved in writing; and that, although the different Arian or Indo-Germanic races are no longer able to understand one another,—though, in fact, long and earnest study is required before the more distant members of the family can interchange oral communications, and though a similar effort is required to pass from the living to the dead forms of the same language,—yet there must have been a time when the original representatives of these widely-separated tribes were united on the table-land of Irân, bound by ties of brotherhood, and speaking the common speech, which may almost be reproduced by a comparison of the different forms of its living children or of their direct progenitors, embalmed in classical and sacred literature. In this great family it is now seen that there are six main branches—I. The Indian; II. The Medo-Persic, including the Armenian, Ossetian, and perhaps the Albanian; III. The Sclavonic, comprising the Lithuanian; IV. The Teutonic, embracing the Scandinavian languages; V. The Celtic; VI. The Græco-Latin, including the old classical languages, with all their dialects,

Branches of the Arian family of languages.

Comparative Philology.

and their modern offspring the Romance languages, namely, the Provençal and French, the Italian, the Spanish and Portuguese, the Rhætian, and the Wallachian. The Indo-Germanic family, then, comprehends, besides some of the most important Asiatic languages, all the languages of Europe, except the Turanian idioms spoken by the Finns, Laplanders, Hungarians, Bulgravians, and Turks, and the isolated Basque or Euskarian language still vernacular in the north-west of Spain. In all these Arian languages, not only are a vast number of the most common and necessary words traccable to an identity by the application of certain established laws for the permutations of consonants, but it can be seen that their system of inflexions, and all the machinery of their grammar, either now works, or must at one time have worked, according to the same organization. The results are as certain as those of any other department of inductive science; and there is little room either for felicitous conjecture or ingenious blundering.

Arian philology—illustrations.

It may be worth while to show, by a few specimens, the nature of the induction on which Arian philology depends. We shall therefore exhibit some of the most important resemblances of the Indo-Germanic idioms, in those words which belong to the inherited treasures of every language, and in the elementary forms of the nouns and verbs.

1.—*Parts of the Body.*

English.	Sanscrit.	Zend.	Lithuanian.	Sclavonian.	Gothic (Scandinavian).	Latin.	Greek.
"Eye"	akshi	ashi	akis	oko	augo	oculus	ὄμ-μα=ὄπ-μα, or ὄκ-μα
"Tooth"	dantas	.	dantis	...	thuntus	dens	ὁ δούς=ὀδόντ-ς
"Ear"	ghôsha	. .	ausis	ucho	auso	auris	οὖας
"Right-hand"	dakshina	dashina	deszine	dessna	taihsvo	dextra	δεξιά
"Knee"	jânu	genu	kielis	koljeno	kniu	genu	γόνυ
"Foot"	padas	padhas	padas		fotus	pes=peds	πούς=πόδ ς
"Heart"	hardaya	. .	szirdis	serdze	hairto	cor(d)	καρδία

2.—*Natural Objects or Measures of Time.*

English.	Sanscrit.	Zend.	Lithuanian.	Sclavonian.	Gothic (Scandinavian).	Latin.	Greek.
"Sun"	hailis	...	saule	solnze	sauil	sol	ἥλιος
"Moon or month"	masa	mao	mienu	miesez	mena	mensis	μήνη
"Sea"	mirah	...	mares	more	marei	mare	.
"Water"	uda	...	vandu	voda	vato	unda	ὕδωρ
"Fire"	agnis	...	ugnis	ogni	anhus	ignis	..
"Day"	diu, dina	...	diena	den	dags	dies	Ζεύς, Διό., ἡμέρα=δια-μέρα
"Night"	nisa, nakta	...	naktis	noch	nahts	nox	νύξ
"Winter"	hima	zima	ziema	zima	...	hiems	χείμων

3.—*Animals.*

English.	Sanscrit.	Zend.	Lithuanian.	Sclavonian.	Gothic (Scandinavian).	Latin.	Greek.
"Horse"	açvah	ashpa	aszwa	(as)kobyla	eikur	equus	ἵππος (ἴκκος)
"Ass"	...	...	asila	osel	asilus	asinus	ὄ(σ)νος
"Ox or cow"	go	gaos	gows	buik	ku	bos	βοῦς
"Sheep"	avis	...	awis	owza	avis	ovis	ὄϜις
"Dog"	çvan	çpa	szun	sabaka	hunths	canis	κυών
"Garden	hansa	...	zasis	gansior	gaas	anser	χήν
"Wolf"	vrikas	vehrko	wilkas	wolk	vulfs	lupus, hirpus	λύκος

4.—*Numerals (Feminine Ordinals).*

English.	Sanscrit.	Zend.	Lithuanian.	Sclavonian.	Gothic (Scandinavian).	Latin.	Greek.
"First"	prathamâ	frathema	prima	pervaja	fruma	prima	πρώτη
"Second"	dvitîyâ	bitya	antru	vtora-ja	anthara	altera	δευτέρα, ἕτερα
"Third"	tritîyâ	thritya	trêcia	treti-ja	thridjo	tertia	τρίτη
"Fourth"	chaturthâ	tûirya	ketwirtâ	cétvertaja	fidvôrdô	quarta	τετάρτη
"Fifth"	panchamâ	pugdha	pankta	pjataja	fimfto	quinta	πέμπτη
"Sixth"	shashtâ	cstvâ	szészta	shestaja	saihstô	sexta	ἕκτη
"Seventh"	saptamâ	haptatha	sêkma	sedma-ja	sibundo	septima	ἑβδόμη
"Eighth"	ashtamâ	astema	aszma	osmaja	ahtudo	octava	ὀγδόη
"Ninth"	navamâ	nâuma	dewintâ	devjataja	niundo	nona	ἐννάτη
"Tenth"	daçamâ	dasema	deszimtâ	desjataja	taihundo	decima	δεκάτη

5.—*Verb Substantive.*

English.	Sanscrit.	Zend.	Lithuanian.	Sclavonian.	Gothic (Scandinavian).	Latin.	Greek.
"I am"	âsmi	ahmi	esmi	yesmi	im	(e)sum	ἐμμί=ἐσμί
"Thou art"	âsi	ahi	essi	yesi	is	es	ἐσσί
"He is"	âsti	asti	esti	yesto	ist	est	ἐστί
"We two are"	'svâs	...	esva	yesva	siju	...	...
"Ye two are"	'sthâs	stho	esta	yesta	sijuts	...	ἔστον
"They two are"	'stâs	sto	esti	yesta	...	...	ἔστον
"We are"	'smâs	hmahi	esmi	yesmă	sijum	(e)sumus	ἐσμές
"Ye are"	'sthâ	stha	este	yeste	sijuth	estis	ἔστε
"They are"	sânti	henti	esti	somte	sind	(e)sunt	(ἐσ)εντι

6.—*Verb Active, Present Tense (in the above six Languages).*

English.	Sanscrit.	Zend.	Lithuanian.	Sclavonian.	Gothic (Scandinavian).	Latin.	Greek.
"I give"	dadâmi	dadhâ-mi	dud-mi	dad-mj	giba	do	δίδω-μι
"Thou givest"	dadâsi	dadhâ-hi	dud-i	dad-si	gibis	das	δίδω-ς
"He gives"	dadâti	dadhâi-ti	dus-ti	das-ti	gibith	dat	διδω-τι
"We two give"	dad-vas	...	dud-wa	dad-eva	gibos	...	...
"Ye two give"	dat-thas	das-tô	dus-ta	das-ta	gibats	...	διδο-τον
"They two give"	dat-tas	das-tô	dus-ti	das-ta	...	...	δίδο-τον
"We give"	dad-mas	dadĕ-mahi	dud-me	dad-my	gibam	damus	δίδο-μεν
"Ye give"	dat-tha	das-ta	dus-te	das-te	gibith	datis	δίδο τε
"They give"	dada-ti	dadĕ-nti	dus-ti	dad-jaty	giband	dant	δίδο-ντι

7.—*Verb Active, Augmented Tense (in Sanscrit and Greek.)*

English.	Sanscrit.	Greek.
"I carried,"	a-bhara-m	ἔ-φερον
"Thou didst carry,"	a-bhara-s	ἔ-φερε-ς
"He did carry,"	a-bhara-t	ἔ-φερε-ν
"We two did carry"	a-bharâ-va	...
"Ye two did carry,"	a-bhara-tam	ἐ-φέρε-τον
"They two did carry,"	a-bhara-tâm	ἐ-φερέ-την
"We did carry,"	a-bharâ-ma	ἐ-φέρο-μεν
"Ye did carry,"	a-bhara-ta	ἐ-φέρε-τε
"They did carry,"	a-bhara-n	ἔ-φερον

8.—*Three Nouns Declined (in Sanscrit and Greek).*

Singular.	Sanscrit.	Greek.
Nominative	mati-s, dâtâ, bhârâs	μῆτι-ς δοτήϱ, φόϱος
Genitive	maty-âs, dâtur, bâra-sya	μήτι-ος δοτῆϱ-ος, φόϱο(σ)ιο
Dative	maty-âi, dâtar-i, bhârê	μήτι-ι, δοτῆϱ ι, φόϱῳ
Accusative	mati-m, datâr-am, bhâra-m	μῆτι-ν, δοτῆϱ α, φόϱο-ν
Vocative	matê, dâtar, bhâra	μήτι, δοτήϱ, φόϱε
Dual.		
Nom.-accusative	matî, dâtâr-au, bhârau	μήτι-ε δοτῆρ-ε φόρω,
Gen.-dative	mati-bhyâm, datri-bhyam, bhârâ-bhyam	μητί-οιν, δοτήϱ-οιν, φόϱο-ιν
Plural		
Nominative	matay-as, dâtâr-as, bhârâs	μήτι-ες, δοτῆϱ-ες, φόϱ-οι
Genitive	mati-n-âm, datri-n-am, bhârâ-n-âm	μητί-ων, δοτήϱ-ων, φόϱ-ων
Dative	mati-shu, datri-shu, bhâré-shu	μήτι-σι, δοτῆϱ-σι, φόϱοι-σι
Accusative	matî-s, dâtri-n, bhârâ-n	μήτι-ας, μήτις, δοτῆϱ-ας, φόϱους

9.—*Simple Demonstrative, in the Singular (in the Six Languages).*

	Sanscrit.	Zend.	Lithuanian.	Sclavonic.	Gothic.	Latin.	Greek.
Nom.	sa, sâ, tat	ho, ha, tat	tas, ta, tai	t', ta, ta	sa, so, thata	is-te, is-ta, is-tud	ὁ, ἡ, τό
Gen.	tasya, tasyas, tasja	tahe, tanhao, tahe	to, tos, to	togo, toja, togo	this, thizos, this	i-tius	τό(σ)ιο, τῆς, τό(σ)ιο
Dat.	tasmai, tasyai, tasmai	tahma, tanhai, tahmai	tam, tai, tam	tomu, toi, tomu	thamma, thizai, thamma	is-ti	τῷ, τῇ, τῷ
Accus.	tam, tâm, tat	tom, tanm, tat	tan, tan, tai	t', tu, to	thana, tho, thata	is-tum, is-tam, is-tud	τόν, τήν, τό

10.—*A Common Noun Declined in the Lithuanian of the Baltic, and in the Sanscrit of the Ganges.*

Singular.	Sanscrit.	Lithuanian.
Nom.	sûnu-s, "a son."	sûnu-s, "a son."
Gen.	sûnô-s, "of a son."	sûnau-s, "a son."
Dat.	sûnav-ê, "to a son."	sûnu-i, "to a son."
Accus.	sûnu-m, "a son."	sûnu-n, "a son."
Voc.	sûnô, "O son."	sûnau "O son."
Instr.	sûn-u-nâ, "by a son."	sûnu-mi, "by a son."
Loc.	sûnâu, "on a son."	sûnu-je, "on a son."
Dual.		
Nom.-acc.	sûnû, "two sons."	sûnu, "two sons."
Gen.-loc.	sûnv-ôs, "of or on two sons."	sûnû, "of or on two sons."
Dat.-instr.	sûnu-bhyâm, "to or by two sons."	sûnu-m, "to or by two sons."
Plural.		
Nom.-voc.	sûnav-as, "sons."	sûnu-s, "sons."
Gen.	sûnû-n-âm, "of sons."	sûnû, "of sons."
Dat.	sûnu-bhyas, "to sons."	sûnu-ms, "to sons."
Accus.	sûnû-n, "ions."	sûnu-s, "sons."
Voc.-instr.	"sûnu-bhis, "by sons."	sûnu-mis, "by sons,"
Loc.	sûnu-shu, "on sons."	sûnu-se, "on sons"

To show that these languages, exhibiting such marks of affinity, need not, on that account, claim any one of their number as the parent-stock, but may all have sprung from one common source, it is only necessary to make a similar comparison in the case of the Romance languages, which we know may be derived from their common mother, the classical Latin. Let us take, for instance, the substantive verb in six of these languages, and we shall see that the form in each bears a relation to *sum*, different from that which this latter does to any of the five forms with which we have compared it above:—

Latin.	Italian.	French.	Spanish.	Portuguese.	Wallachian.	Rhœtian.
sum	sono	suis	soy	son	sum	sunt.
es	sei	es	eres	es	es	eis.
est	e	est	es	he	e	ei
sumus	siamo	sommes	somos	somos	suntemu	essen.
estes	siete	êtes	sois	sois	sunteh	esses.
sunt	sono	sont	son	são	sunt	eân.

It is clear, on the most cursory inspection, that all these forms are derivatives from *sum;* and we shall be still farther convinced of their secondary condition if we find, as we do on farther examination, that the substantive verb in the Romance languages generally borrows some of its tenses from the Latin *stare*, "to stand;" that all Romance verbs of the regular type form their future by annexing the present term of *habere*, "to have," in its corrupted state, *avere*, *haber*, *aver*, or *avoir*, to the infinitive mood of each verb, which in the Provençal is often separated by the interposition of another word; and that although the French alone forms its infinitive from *stare* (for *être* is the modern form of *ester*, from *estar*), while all the other Romance languages have their infinitives formed from *esse* (Ital. *essere*, Prov. *esser*, Span. *ser*), yet the future *ser-ai* of the French substantive verb proves that they must once have agreed in this point also. While, then, the resemblances of these forms among themselves are analogous to those of the substantive verb as it appears in the older Indo-Germanic languages, including the Latin, we are able to trace their derivation from this idiom, just as we can derive the Prâkrit from the Sanscrit; but we cannot thus deduce any of the older Arian languages from another of the same class. We see the same marks of resemblance among the dialects themselves, combined with still more striking proofs of derivation from a common original, in those cases in which a tendency to abbreviation, already observable in Latin, has been consistently carried out in the principal Roman languages. Take, for example, the habit of dropping the letter *d* when it is flanked by two vowels. That this took place in ancient Latin is clear, not only from the old pronunciation, as indicated by the exigencies of the comic meters, but even by a few instances in which this letter is omitted in writing. Thus, while we see that *pater* and *quidem* were often monosyllables, we remark that the *d* is absolutely dropped in writing in such forms as *es* for *edis*, *est* for *edit*, and perhaps *item* for *itidem*. This tendency, which is only indicated in Latin, becomes uniformly phenomenal in the Romance languages, and not only *d*, but *t*, disappear in most of the words which have passed, without direct borrowing at a later period, from Latin into French or Italian. If we compare the old words *Noel* and *naif* with the forms *natal* and *native*, which have been taken from the Latin since the French became a fixed language (Schlegel, *Observations sur la Langue et la Littérature Provençales*, p. 44), we shall see that this omission of the *t* must have prevailed among the Roman provincials themselves, and was not caused by anything peculiar to the French articulation. Sometimes this dropping of the dental is accompanied by other absorptions, which reduce the original word to a bare residuum. Thus the pronominal adjective *même*, signifying identity in general, Spanish *mismo*, Portuguese *mesmo*, although the dental is retained in the Italian *medesimo*, is quite a disguised representative of the original *memet ipsissimum*. To extend these comparisons is not our present duty. The few samples which we have given will suffice to show the nature of the evidence on which the comparative philologer has to rely.

Comparative Philology.

Extensions of Arian philology

The scientific certainty, attained by these researches of comparative philology in the domain of the Arian or Indo-Germanic languages, has not unnaturally led to the wish on the part of those who have prosecuted them, that they might, on the one hand, be connected with the results of the older classical and sacred criticism, and, on the other hand, that they might be extended so as to embrace *primarily* the Semitic languages, which are connected by their literature rather than their idiomatic texture with those of the Arian race, and one of which holds a place by the side of Greek among the studies of the older school of philology; and so as to reach *ultimately* to a classification of human speech in general, and thus to form a basis for the collateral science of ethnology.

Comparative grammar combined with the old classical philology.

A combination of the results of comparative grammar with those of the older classical philology was sure to take place sooner or later, and sooner rather than later. Just about the time when the study of Sanscrit literature was beginning to establish itself in Europe, several scholars, who had not yet made acquaintance with this guide to the analysis of organic inflexions, exhibited a tendency to seek for etymologies in the classical languages by a more rational system of comparison with other tongues than had previously been attempted. For example, Buttmann showed, by the various articles collected in his *Mythologus*, some of which date as far back as the end of the last century, by his *Lexilogus*, of which the first volume appeared in 1818, and by his paper on the *Electron*, which was read in the same year, that he was in spirit a comparative philologer, and would have made an ample use of his opportunities if he had lived a few years longer, or had been born a few years later. The German language, in particular, was brought into direct comparison with Greek and Latin, not always scientifically, but sometimes quite correctly, by Drs Jamieson, Hunter, and Carson in Scotland, and by Jaekell and Rainshorn in Germany. In the year 1828, the establishment of Dr F. Rosen as professor of Sanscrit in University College, London, awakened the attention of classical teachers and students in that institution to a sense of the important results which might be obtained by a combinatian of Greek and Latin philology with the methods which had resulted from the comparative study of Sanscrit grammar. In 1836, only three years after the appearance of the first part of Bopp's grammar, one of the most eminent philologers of the old school, K. O. Muller, expressed himself in the following decided language (*Kleine Schriften*, i., p. 12):—"It has now indeed come to this, that philology must either renounce altogether any historical knowledge about the growth of language, and all etymological researches into the form of roots and the organism of grammatical structures, or trust herself in these matters entirely to the guidance and counsels of the comparative study of language." It is true that some of those who had obtained eminence in classical criticism, and their immediate disciples, regarded comparative philology with much suspicion and distrust. For example, Godfrey Hermann, in the paper which suggested Müller's remarks, had spoken with some contempt of those "who sought light from a sort of aurora borealis, reflecting the gleams of eastern illumination, and who, betaking themselves to the Brahmins and Ulfilas, endeavoured to explain Greek and Latin by the help of languages which they only half understood." Another eminent verbal scholar, K. A. Lobeck, in his *Aglaophamus* (published in 1829), in his *Paralipomena* (published in 1837), and in his *Pathologia* (published in 1843), indicated how little confidence he had in Sanscrit as a help to the Greek grammarian. And the same protest against the claims of Sanscritism was made in 1835 by F. Ellendt, a pupil of Lobeck, in the Preface to his *Lexicon Sophocleum*. In January 1837 the Imperial Academy of Sciences at St Petersburg published a scheme for a prize essay on the Greek dialects from which all consideration of Sanscrit was to be excluded. It was about the time when these opposite opinions were entertained respecting the propriety of an intimate alliance between the old and new philology, that the writer of these pages, who had been indirectly brought within the reach of Rosen's influence in 1829–30, undertook to prove that, by making the classical languages, and especially the Greek, the basis of a scientific method of comparative grammar, not only would the general results be more definite and important than those which had been obtained by starting from the Indian or Teutonic members of the Arian family, but that very great advantages would redound to the improvement of Greek and Latin philology in particular. The first product of these studies appeared in February 1839, the second in 1844; and the author's labours have been continued in this field down to the present time, either in successive editions of these original works, or in auxiliary labours having the same object in view. There are still strong prejudices in favour of the old-fashioned methods of teaching Greek and Latin grammar, arising chiefly from a conventional and conservative bias in favour of established traditions; but it is to be hoped that the stream of philological speculation has finally turned its course into the right direction, and that those who undertake to reason on the grammar and word-forms of the classical languages will from henceforth seek their rules and principles in the method which has been confirmed by the comparative study of the Arian family as a whole.

Buttmann.

F. Rosen.

K. O. Müller.

Comparative philology extended to the Semitic languages.

From the comparison of the Indo-Germanic idioms with one another, the general philologer's next step was to consider the relationship between the different families of languages; and his attention would be arrested primarily by the Semitic group, one of which had connected itself with the special studies of the older school of criticism. The general result of the philological analysis, in the case of the Arian languages, was to show that all words were ultimately reducible to monosyllabic roots, which were, so to speak, set in a framework of significant prefixes and affixes. On the other hand, the Semitic languages presented, both in their nouns and verbs, a basis of triliteral or bisyllabic roots, beyond which the analysis of the grammarian did not attempt to penetrate. As early as the seventeenth century it had been suggested that these triliteral roots may have been primarily biliteral. Michaelis was prepared, in the latter part of his life, to relinquish the triliteral system (see Adelung, *Mithridates*, i., p. 302); the great critical Hebraists of the present century, Gesenius and Ewald, had admitted that, by recognising monosyllabic roots in Hebrew, we might compare that language with the various members of the Indo-Germanic family; and Klaproth, in 1828, plainly asserted that the Hebrew roots were originally and properly monosyllabic. ("Observations sur les Racines des Langues Sémitiques," in Merian's *Principes de l'Etude Comparative des Langues*, pp. 212, sq.) A more formal and systematic attempt to establish the original monosyllabism of the Semitic languages, and especially of the Aramaic branch, was made by Julius Fürst in his *Lehrgebäude der Aramaischen Idiome, mit Bezug auf die Indo-Germanischen Sprachen* (Leipsic, 1835); and in his *Veteris Testamenti Concordantiæ* (completed in 1840). The procedure of Fürst was recommended in an enthusiastic and somewhat extravagant manner by his pupil, F. Delitzsch, in his *Jesurun* (*Isagoge in Grammaticam et Lexicographiam Linguæ Hebraicæ contra G. Gesenium et H. Ewaldum*), which appeared as an Introduction to Fürst's *Concordance* in 1838. Meantime Æmilius Rödiger, who, like Delitzsch, belonged to Halle, and has succeeded Gesenius in that university, was prosecuting similar researches with regard to the structure of the oldest form of Arabic; and a young scholar, Charles Richard Lepsius, who had enjoyed the advantage of direct intercourse with the best

Michaelis.

Klaproth.

Fürst.

Delitzsch.

Rödiger.

Lepsius.

Comparative Philology.

philologers at Leipsic, Göttingen, and Berlin, and was pursuing his researches at Paris in the domain of the old Egyptian and Coptic languages, published some essays indicating the most remarkable genius for philology, and tending to establish the affinity not only between the Indo-Germanic and Semitic languages, but also between both of these and the old language of Egypt. (*Palaographie als Mittel fur die Sprachforschung zunächst aus Sanskrit nachgewiesen*, Berlin, 1834; *Zwei Sprachvergleichende Abhandlungen*, ib. 1836) In the last of these essays Lepsius quite established the affinities of the Egyptian, Semitic, and Indo-Germanic languages, in regard to the numerals and some of the most important of the pronominal elements.

Deciphering of hieroglyphics.

And here the discovery of the clue to the Egyptian hieroglyphics (see articles EGYPT, HIEROGLYPHICS, CHAMPOLLION), produced an immense influence on the determination of the problems to be solved by those who would establish the affinities between the two central families of languages. As the hieroglyphic, hieratic, and demotic inscriptions have been partially deciphered, as the grammatical forms have been established, and the interpretation of particular words ascertained and the virtual identity of the Coptic with the language of the Pharaohs placed beyond doubt, the newly-acquired knowledge has been pressed into the service of comparative philology, and elaborate works have been written, not merely for the purpose of exhibiting the relationship between the Semitic and the old Egyptian (as in Benfey's treatise *Über das Verhaltniss der Ägyptischen Sprache zum Semitischen Sprachstamm*, Leipsic, 1844), or of analysing the structure of the Coptic language with reference to the principles of Indo-Germanic philology in general (as in M. G. Schwartze's great work, *Das Alte Ægypten*, Leipsic, 1843, of which he lived to write only the Introduction, in more than 2000 closely-printed quarto pages!), but still more, in order to make Egyptology a sort of elevated standing-point, from which all the realms of ethnography and philology might be surveyed, and the most distant and isolated points brought within the range of view. This undertaking has been attempted chiefly by Bunsen, who has completed in five volumes his work entitled *Ægypten's Stelle in der Weltgeschichte* ("Egypt's Place in Universal History," Hamburg, 1845–1857), and has discussed some of the same subjects in a more general and miscellaneous book, or collection of treatises, called *Christianity and Mankind, their Beginnings and Prospects* (London, 1854). It is Bunsen's theory that "the Egyptian language is the point in universal history at which the creative energy of language still shows its original form, just before it raises its pinions aloft, and assumes in the world-ruling nations an entirely different and more spiritual form, while in the other races, according to laws not yet explored, it sinks into the atomic and mechanical, or at best deflects into subordinate ramifications." (*Ægypten*, i., p. 338.) Looking back over a period of more than 20,000 years, this philological speculator recognises a time when the as yet undivided families of Japhet and Shem lived together in a civilized state in Northern Asia. From this undivided Asiatic stock Egypt, according to Bunsen, must be a colony, gradually degenerated into the African type, for the old Egyptian language claims affinity at once with the Aramaic idioms in immediate contact with it, and with the Indo-Germanic tongues, with which it has no direct commerce. (*Report of the Brit. Assoc.*, 1847, p. 280; *Ægypten*, iv., Pref., p. 10.) It must be owned that these sweeping conclusions do not rest upon philological inductions of the most accurate kind, and are supported by arguments which are sometimes as arbitrary as they are precarious.

Benfey.

Schwartze.

Bunsen.

Meanwhile the comparative philology of the Semitic languages has been assisted by other palæographical discoveries scarcely less important than that of the hieroglyphic syllabarium. At the beginning of the present century, Professor G. T. Grotefend (born in 1775) made a first attempt to explain the cuneiform or arrow-headed writing of the old Persian inscriptions. His discovery was announced in the *Gottingen Literary Gazette* of 1802; but a full account of it did not appear till 1815, when it was given in the appendix to the third edition of Heeren's *Ideen*. The subject was pursued without any important results by M. Saint Martin, whose Memoir was read at Paris in 1823. More valuable verifications were secured by Rask's identifications in 1826 of the signs of M and N in the name *Achæmenes*. In 1836 appeared Burnouf's Memoir on the cuneiform inscriptions of Hamadân, which contained some interesting discoveries; and in the same year Lassen published his work on the *Old Persian Cuneiform Inscription of Persepolis*, which supplied an identification of at least twelve characters mistaken by his predecessors, and which secures for him perhaps the most honourable place in this band of decipherers. Meanwhile, however, an able British officer was prosecuting in the East, and with complete success, the cuneiform studies which the learning and ingenuity of these European scholars had already advanced so far. In 1835, Major (now Colonel Sir H. C.) Rawlinson, being posted at Kermanshah, on the western frontier of Persia, began to direct his attention to the cuneiform alphabet, and the inscriptions written in it. With the exception of Grotefend, none of the other labourers in this field were known to Rawlinson. He did not receive Burnouf's Memoir till 1838, the year after he had sent to the Asiatic Society his translation of the first two paragraphs of the Behistun inscription; and it was only in 1839 that Lassen sent him a *précis* of his improved system of interpretation. By this time, chiefly by the aid of Burnouf's *Yaçna*, he had completed a literal translation of some 200 lines of cuneiform writing, and by the year 1846 this was augmented by more than 400 lines, and the Persian portion of the Behistun inscriptions of Darius I. was no longer a sealed book to scholars. That inscription, however, like others of the same age, was trilingual. Besides the Persian recital of the deeds of Darius, which Rawlinson had mastered, there was a Semitic or Aramaic version for the conquered inhabitants of Assyria and Babylonia; and one in a Tataric or Turanian dialect, for the benefit of the Scythian tribes beyond the Oxus. As early as 1845 Rawlinson had recognised the Semitic character of the second, or, as it stands on the monument, the third of these inscriptions, and had begun to examine the proper names in it; he had also surmised that the other inscription was Turanian, and not, as some inferred, Median; and the soundness of this opinion has since been established by Mr E. Norris. Rawlinson prosecuted his investigations respecting the Assyrian inscriptions, comparing the Behistun monument with the bricks and other excavated memorials from Nineveh and elsewhere, till, in 1849, he was enabled to decipher and interpret some of these ancient records, and to ascertain the nature of the language in which they were written; and his views have been confirmed in many points by the contemporary and independent labours of Dr E. Hincks, who has done a good deal towards exhibiting the grammatical structure of this old form of the Semitic languages. The result of these inquiries has been to show that the language spoken at Nineveh in the days of Sennacherib and his predecessors was a very ancient type of the language which is recognised as the basis of Arabic and Hebrew.

Comparative Philology.

Discovery of the key to the cuneiform inscriptions.

Grotefend.

Rask.

Burnouf.

Lassen.

Rawlinson.

Norris.

Hincks.

The oldest form of Arabic is that which is still spoken in the south of Arabia. Its primitive type is exhibited in the Himyaric inscriptions which have been fully investigated since 1830 by Fresnel, Gesenius, Rödiger, and Ewald. Linguistic affinities show that the Ethiopic or Abyssinian, which

Ancient Arabic—the Himyaric inscriptions.

Comparative Philology.

is called Gheez by the people who speak it, is an offshoot from the ancient Himyaric.

Sinaitic inscriptions Beer.

Another ancient form of the Semitic, approaching to the Arabic in many points, has been learned from the inscriptions in the peninsula of Sinai. Although these inscriptions had been known for many hundred years, they were not deciphered till Dr E. Beer of Leipsic published his account of the alphabet in 1840–1843 (*Inscriptiones veteres Litteris huc usque incognitis ad Montem Sinai servatæ*); and his views have been carried out with complete success by Professor Tuch (*Zeitschrift d. Deutsch. Morgenl. Gesellsch.*, 1849, pp. 129–215). It is concluded, with much probability, that the language of these inscriptions is that of the ancient Amalekites and other Bedouins of the Sinaitic peninsula.

Tuch.

Classification of the Semitic languages.

These palæographical investigations, combined with a more rational system of grammatical criticism, have enabled scholars to settle the mutual relations of the Semitic languages, and to determine the area occupied by them and the distinctive peculiarities of their structure. The best classification of this group of languages seems to be the following:—I. The old Babylonian or Assyrian, established in the primitive abodes of the Semitic race between the Tigris and the western borders of Irân. From this the Aramaic dialects—the Chaldee and Syriac—derive their origin. II. The old Canaanitish, of which the Hebrew and Phœnician were important dialects. III. The old Arabic, of which the Ethiopic and Abyssinian are offshoots, and which is represented by the modern Arabic in all its literary and geographical developments. IV. The old Egyptian, which is a deposit of some ante-historical Semitic idiom, disorganized by certain local influences. It is represented in a modern form by the Coptic. V. The Berber dialects scattered over the whole north of Africa, from Egypt to the Atlantic Ocean, and still distinct from the cognate Arabic of the Mohammedan conquerors.

Contacts of the Arian and Semitic families to be sought in the Sclavonian.

In seeking a point of contact between these languages and those of the Indo-Germanic class, it has seemed most reasonable to the writer of these pages to look to the district where one of the oldest, if not the very oldest, of the Semitic tribes appears to have been geographically conterminous with a very old Indo-Germanic people,—namely, the district that was occupied by the ancient Assyrians and Babylonians, in close contact with the old Sauromatæ or Sclavonians. He has developed the following argument in a special essay on the subject ("On two Unsolved Problems in Indo-German Philology," *Report of the British Association for* 1851, pp. 143, sqq.) The Sclavonians may be identified with that branch of the great Iranian family which occupied Media, and therefore in their original home stand in close contact with the Assyrians of the adjoining plain. Now, these Assyrians, according to Rawlinson's investigations, spoke a very old form of the Semitic language. But, according to a general agreement among scholars, the Chaldeans, who conquered the plains of Mesopotamia in the eighth century B.C., were an Indo-Germanic tribe, whom some identify with the Sclavonians, while others called them Medo-Persic, which is much the same thing. Consequently, Semitic and Indo-German tribes were in close contact, if not intermingled with one another, on the banks of the Tigris. When, therefore, we find that although the Sclavonian and Semitic tongues stand in direct antithesis or contrast so far as their state or condition is concerned,—the former being marked by the fulness of the etymological forms, and the absence of syntactical machinery, and the latter by a triliteral uniformity and a pervading syntactical mechanism, — they nevertheless present, both in words and forms, the most remarkable indications of original affinity, we are bound to conclude that the inference from their geographical contiguity is philologically also valid and satisfactory.

Outlying groups of languages.

Even if the relationship between the two great central families of language—the Indo-Germanic and the Semitic—were fully ascertained and established, the comparative philologer would not have completed his examination of the affinities of human speech. For (to say nothing of the languages of America and Central and Southern Africa) the idioms spoken by the Finns, Hungarians, and Turks in Europe, and by the tribes scattered over the whole of Northern and Eastern Asia, together with the dialects of the aboriginal inhabitants of Southern India, constitute a class of linguistic phenomena, which differ in the most striking manner from the Arian and Aramaic types. An attempt, however, has been made to classify these languages, and to group them together in accordance with certain peculiarities which they have in common. These languages are called by the general name *Turanian*, a word derived from the root *tur*, signifying "to be swift," "to roam about;" and therefore indicating generally the nomadic character of the tribes which are distinguished by these varieties of human speech. The first beginning of the scientific classification of the different members of the Turanian family was made by John Sainovics, who, in 1770, published at Copenhagen his *Demonstratio Idioma Hungaricum et Lapponicum idem esse*. He was an Austrian astronomer of Hungarian extraction, and had noticed these affinities when sent with Kell to Lapland in 1764. The same position was maintained by Ihre-Oehrling (*De Convenientia Linguæ Lapponicæ cum Hungarica*, Upsal, 1777); and Hager (*Neuen Beweisen der Verwandtschaft der Ungarn mit den Laplandern*, Vienna, 1794). But the most complete work on the subject was Dr Samuel Gyarmathi's *Affinitas Linguæ Hungaricæ cum Linguis Finnicæ Originis grammatice demonstrata* (Gottingen, 1799). This work proves the identity of the Hungarian with all three of the Chudic dialects, the Finnish, the Esthonian, and the Lappish; and adopts in the proof a truly philological method. A comparison of the Asiatic branches of the Turanian family was first attempted by Klaproth (*Reise in den Kaukasus*, 1814); and the whole of the un-Arian and un-Semitic races were boldly grouped together by the great philologer Rask (*Über die Thrakische Sprachklasse*, 1818; *Zend-Sprache*, 1826), under the general name of Scythian. He found in the language of Greenland a link of connection between the idioms of Asia, Europe, and America; and divided the great Scythian race into four main classes,—the North Asiatic, the North American, the Tatar, and the Mongol-Tungusian. The details of the subject were prosecuted with great success by William Schott, who, after stating the case in his Essays on the Tatars and Finns, published in 1836 and 1847, went fully into the linguistic proofs in his valuable paper *Über das Altai'sche oder Finnisch-Tatarische Sprachengeschlecht* (Berlin, 1849). At the same time, Alexander Castrén of Helsingfors, by his travels and the various treatises in which he expounded the results of his inquiries, beginning with his *Elementa Grammatices Syrjænæ*, published in 1844, and ending with his *Reise-Erinnerungen*, published in 1853, completely established the general principles of Turanian philology. Some of these views, especially those of Schott, have been controverted by Bœhtlingk (*Uber die Sprache der Jakuten*, 1851); but the general features of resemblance have been undoubtedly recognised: the peculiar system of vocalization, the process of agglutination by which the naked roots are formed into words, the identities in certain primitive terms, such as the numerals, which in such widely scattered tribes could not have been borrowed by mutual intercourse in the historical ages,—all this, and much else that might be mentioned, would render it considerably more difficult to establish the total independence and diversity of the Turanian tribes than to seek in the peculiar circumstances of their dispersed and nomadic condition for a natural ex-

Turanian family. Sainovics. Ihre-Oehrling. Hager. Gyarmathi. Klaproth. Rask. Schott. Castrén. Bœhtlingk.

Comparative Philology.

planation of the heterogeneous elements in this wide-spread manifestation of human speech. The subject has been so well discussed in English by Dr Max Muller, that we need only refer to what he has written on the subject in the first volume of Bunsen's *Outlines of the Philosophy of Universal History* (London, 1854), or in his own little work *On the Languages of the Seat of War in the East* (second edition, London, 1855). The classification of the Turanian languages, according to the most recent researches, is the following :—I. The Finnic, including the Hungarian, Bulgarian, Chudic, &c. II. The Samoiedic, divided into the northern and eastern branches. III. The Turkish or Tataric, including the Usbeks, Turcomans, Baskirs, Yakuts, Rumelians, and Anatolians. IV. The Mongolic, including the Eastern or Proper Mongols, the Western Mongols, such as the Kalmucks, and the Northern Mongols, such as the Buriats. V. The Tungusic, divided into the western and eastern branches. To these must be added, according to the researches of Max Müller, the Tamulic, Bhotiya, Tai, and Malay languages of the aboriginal tribes inhabiting the Deccan, the sub-Himalayan plains, the trans-Gangetic empires of Siam and Assam, and the Polynesia. There are many striking resemblances between this last group of Turanian languages and the Chinese; and we are strongly inclined to think that the latter is merely a form of the Turanian variety of human speech brought into a different state or condition, by the change from the nomadic to the city life.

Max Müller.

Classification of the Turanian languages.

American family.

The languages of America, to the south of that Turanian fringe which is occupied by the Esquimaux, have not yet been brought into recognised relationship with those of the older continent. Among themselves, however, they fall into distinguishable groups, and both their traditions, and certain peculiarities in the laws which regulate their word-formations, point to the north-east of Asia as the origin of their race, and to the Turanian languages as the parent-stock of their idioms. If this shall ever be established on evidence which the philologer can admit as scientifically valid, diversities of language will oppose no obstacle to the traditionary belief of the unity of the human race, a belief confirmed by the invariable testimony of history, that man has ever occupied new and vacant regions by migration, and by the same process which is still in full activity. So far as it is allowed to anticipate by conjecture the results which comparative philology, in its widest range, may one day hope to realize, the following will be the ultimatum of linguistic ethnography:—Mankind was divided in the ante-historical period into two great connected families, from which all the rest of the world's population has been derived. From the Semitic, occupying primarily the regions of Mesopotamia, Syria, Asia Minor, and Arabia, was derived the population of all Africa. From the Indo-Germanic, primarily settled on the great table-land of Irân, was derived an unbroken series of connected tribes extending into India to the south-east, and spreading to the north and west over the whole of Europe. Of these tribes, the oldest, it seems, were the Celtic emigrants. Next in antiquity, or in the date at which they left their home in Asia, were the Sclavonic nations, including the Lithuanian; and the last or newest immigration into Europe was that of the Teutonic tribes, beginning with those which we call the Low Germans. About the time when these Low Germans left the north-eastern frontier of Irân, it is probable that the Arians began their descent from Bokhara in the direction of the Punjâb; and it is calculated roughly that this must have been about 1400 B.C.; so that the Hindu-Arians are among the youngest members of the family in reference to the period at which they settled in their new abodes, though, being among the last to leave their native seats, they have retained more completely perhaps than any of the sister tribes the original characteristics of the language once common to them all. The traces of Indo-Germanic affinity, which are still perceivable in the Turanian idioms, render it probable that these nomad races broke away from Irân at various periods of undefinable antiquity, or in hordes or clans inconsiderable in number; and that, being kept apart by the very circumstances of their pastoral and wandering life, they lost more and more the original type of their language, and fell into a mode of speaking suited to their detached and deteriorated condition. Where geographical advantages led to re-centralization, as in China, these disintegrated languages assumed new forms, passed, according to one proposed subdivision, from the *nomad* to the *state* or *political* type (Max Muller in Bunsen's *Outlines of the Philosophy of Universal History*, i., p. 282), and connected themselves with literary developments, which again influenced their structure. In accordance with this general view of the population of the world, spreading from a common origin and a common home over the whole face of the globe,—a view which rests on the oldest records of the human race, and is supported by the inductions of philology, as far as the comparison of languages has been carried up to this time,—we have proposed the following classification of the varieties of human speech (*New Cratylus*, § 69):—Languages are either (A) Central or (B) Sporadic. In the first of these classes there are two main subdivisions,—(1.) The Indo-Germanic or Arian; (2.) The Semitic or Syro-Arabian. In the second we place all the African and Turanian languages, adding to them, without, as yet, any accurate means of approximation, the varieties of speech found in America and the Pacific Ocean. And the Sporadic languages also apportion themselves in two groups to the two subdivisions of the central class, the African languages belonging to the Semitic, and the Turanian claiming, however faintly, some affiliation to the Arian stock.

Original unity of the human race.

Process of dispersion from the common home.

Testimonies of Prichard and A. V. Humboldt.

Such are the results, obtained or probable, by which comparative philology has fortified the conclusions of the new science of ethnography. The founder of that science, Dr J. C. Prichard, concluded a general survey of the subject with the following words (*Report of the British Association for* 1847, p. 253):—"I may venture to remark, that with the increase of knowledge in every direction, we find continually less and less reason for believing that the diversified races of men are separated from each other by insurmountable barriers." And A. von Humboldt, to whom he refers with gratification at having arrived at the same ultimate conviction, has thus expressed his sense of the achievements of philological science:—"Languages," he says (*Kosmos*, ii., p. 142), "when compared together and considered as objects of the natural history of the mind, and when separated into families according to the analogies existing in their internal structure, have become a rich source of historical knowledge; and this is probably one of the most brilliant results of modern study in the last sixty or seventy years. From the very fact of their being products of our intellectual powers, they lead us back, by the elementary character of their organization, to an obscure distance, unreached by traditionary records. The comparative study of languages shows how races now separated by vast tracts of land are allied to each other, and have migrated from one common primitive abode; it indicates the course and direction of all migrations; and, in tracing the leading epoch of development, recognises, by means of the more or less changed structure of the language, in the permanence of certain forms, or in the more or less advanced destruction of the formative system, which portion of the race has retained most nearly the language common to all who had migrated from the general seat of their origin."

But comparative philology has not been content with furnishing the ethnographer with the most important data for the establishment of the great religious and moral

Comparative Philology.

Application of philology to the determination of the ante-historical condition and primitive belief of man.

truth, that all men spring from one blood, and are distinguished from all other living creatures not only by the common possession of reason, but by the common inheritance of a language impressed with the same laws, and bearing in the central and most civilized nations the most marked traces of its derivation from a common source. The comparative philologer not only undertakes to prove that mankind, now dispersed over the whole face of the earth, were at one time a united family; but he is enabled, by an examination of the common elements of language, to ascertain the nature of the civilization which men enjoyed, and of the religious belief and worship which represented their spiritual aspirations, at a period long anterior to their local separation. "Comparative philology," says Max Müller (*Oxford Essays* for 1856, p. 11), "has brought this whole period within the pale of documentary history. It has placed in our hands a telescope of such power that, where formerly we could see but nebulous clouds, we now discover distinct forms and outlines; nay, it has given us what we may call contemporary evidence, exhibiting to us the state of thought, language, religion, and civilization, at a period when Sanscrit was not yet Sanscrit, Greek not yet Greek, but when both, together with Latin, German, and other Arian dialects, existed as yet as *one* undivided language, in the same manner as French, Italian, and Spanish may be said to have at one time existed as *one* undivided language in the form of Latin."

Comparative mythology.

As these applications of comparative philology fall into two distinct classes, one referring to the primitive history, the other to the primitive belief of a race, it would be desirable to have them designated by two distinct names. To the latter application the name of "comparative mythology" has been given, and very high functions have been claimed for it by the eminent German writer to whom we owe the first English essay on the subject. "If," says Max Muller (*Oxford Essays*, 1856, p. 86), "Hegel calls the discovery of the common origin of Greek and Sanscrit the discovery of a new world, the same may be said with regard to the common origin of Greek and Sanscrit mythology. The discovery is made, and the science of comparative mythology will soon rise to the same importance as comparative philology." It appears to us that, in the delight which the comparative philologer feels in this application of his own grammatical principles to the examination of ancient beliefs, he is apt to be carried beyond the proper limits of the investigation, which he pursues with such justifiable enthusiasm, or, at all events, that he is liable to neglect the other considerations by which his theories should be guided and corrected. Mythology cannot always be treated strictly according to the laws of language. When we recognise a community of religious fable among a number of different nations, this may be the result of contacts subsequent even to a comparatively recent historical period, or it may arise from something common to the human mind, and suggested by circumstances which may occur in any country, and at any epoch. With regard to the former of these, it is clear that the dualism which prevailed among the Jews after their captivity, and which was not known to them before, was a direct result of their intercourse with the Medo-Persic race, which had for a long time cultivated this form of religion; and its adoption by the Teutonic nations, in connection with a corrupted Christianity, was only in part a result of their inheritance of a mythology ultimately traceable to their primitive home in Irân. On the other hand, the legend which we find in all countries of the interruption of some attempt to sacrifice a human victim, and the substitution of some lower animal as a sort of vicarious atonement, seems to be due in every case to an independent origin,—namely, to the feeling of revulsion with which a better instinct or a better culture must always, sooner or later, repudiate the practice of slaying human beings at the altar of a malignant deity. Not to speak of the interrupted sacrifice of Isaac, the legend of Iphigenia, the substitution of whipping the boys at the shrine of Artemis Orthosia instead of slaying them outright, and even the fight of gladiators at the grave of the deceased warrior instead of immolating the prisoners of war, as we see in the Homeric funeral of Patroclus, must be regarded as so many manifestations of the instinct of humanity, whether the original practice of homicidal adoration, and the cannibalism which was its still earlier prototype, was or was not connected with the Semitic worship of Moloch. The attempts made by some of the German scholars (who have taken up this application of comparative philology with the enthusiasm peculiar to their class) to support their inferences by etymological researches, have not often been very happy. Conceding, for example, that the elements of the Greek and Sanscrit Ἐτεοκλῆς and *Satyáçravas* may be referred to identical roots, and that the compounds convey in every way precisely the same complex notion, it seems to us little less than absurd to suppose, as Dr Kuhn has done (*Zeitschrift f. Vergl. Sprachf.*, iv., p. 100), that the son of Œdipus, who died in fratricidal strife at Thebes, is the same mythological personage as the *Satyáçravas* mentioned in the *Rig-Vêda*, who is designated as *Sahîyas*, "the strong" or "victorious," and who is called the offspring of *Vayya*, to be identified with Λάιος by a change of *v* into *l*.! Comparative mythology, as it appears to us, is only valuable, when viewed in connection with ethnography, and when a due regard is paid to the antiquity of the myths and to the circumstances under which they originated. Every nation is capable of working up the old materials into new forms and combinations; and even at a comparatively late period fresh additions to a pantheon are devised or borrowed. Only imperfect information would confuse between the Sarapis of the Ptolemies and the old deities of the Pharaohs; and no Indian scholar would suppose that the Siva worship, which was introduced during the historical ages, or that of Krishna, which exhibits some traces of the influences of Christianity, and perhaps echoes even the name of the Author of our faith, were connected by direct descent with the Vaidic ages, when the Arian forefathers of the Hindus were offering the *Soma-drink* (*i.e.*, the juice of the *Asclepias acida*) to their primæval and elementary divinities. If, therefore, worship could change, and mythology could be created in the comparatively later ages of Egyptian and Indian history, we ought surely to allow an equal elasticity to the plastic imagination of the ancient Greeks, and abstain from impugning by precarious comparisons their well-established claims to poetical originality.

Linguistic records of civilization.

To the other of these new applications of comparative philology,—namely, the attempt to make language tell the history of ancient times long anterior to the commencement of written annals,—we would propose to give the name of "linguistic records of civilization;" and we recognise in this a means of making discoveries at once certain and important. By examining words of constant occurrence which are common to all the branches of the Indo-Germanic family, we are carried back to a time anterior to the separations of the different branches, and we find in the interpretation of the terms themselves distinct glimpses of the mode of life which could alone have given rise to such designations. In the same way, we argue that the words which are common to only a limited number among the different languages must either show that these branches remained in contact, after the others had left the common home, or, perhaps, in some new home, or must be received as a proof that the separation from the primitive stock was in these cases a very early one. We may take as an example the word designating "son" in the chief Arian languages. The common Sanscrit term is *putra*, and in Celtic we have a form virtually identical—*paotr*. But this exact resemblance is not recognisable in the synonyms found in other branches of the family. As we

Comparative Philology.

know that the Celts were not in contact with the Indians at a late period, this phenomenon alone is a strong confirmation of the theory, resting mainly on other considerations, that the Celtic tribes were those which first left Irân, and that they did so when *putra* or *paotr* was the one term for "son" used by the Iranians; that is, before other terms were introduced or generally adopted. Conversely, there is no term in Sanscrit, or in the Teutonic and Sclavonic branches of the family, corresponding immediately to the Greek φυιός or υἱός, and its Latin congener *filius*, both of which are derived, the latter with a patronymic affix peculiar to the Italian races, from the common root φυίω or *fio*, "to be born." From this we infer with certainty a contact or union between the forefathers of the Greeks and Italians long after their separation from the one Arian race, and before they branched off into the two peninsulas which they have rendered illustrious. The Sanscrit *sûnû*, Gothic *sunus*, and Lithuanian *sûnus*, as well as the received derivation of the Saxons as *Saca-sunus*, "sons of the Sacæ," point to a very ancient time when this was the common expression for sonship. The word is derived from *su* or *swi*, "to beget," which is as much older than φυι or *fi* as *svehrs* is than *fera*. So that the more recent contact of the Greeks and Italians is proved by the contrasts of the two sets of affinities. When, however, all the terms of a class are the same in the different languages, we are entitled to infer that the objects designated had a distinctive value in the earliest days of the Arian race; and if we can discover their etymology and primitive meaning, we are sometimes led to very interesting conclusions, which place the every-day life of our common ancestors before our eyes in the most vivid pictures. Thus every one of the Indo-Germanic languages, except the Latin, has the same word for "daughter,"—namely, some variety of our English term: Sanscrit, *duhitar;* Zend, *dughdar;* Sclavonic, *dukte;* Irish, *dear;* Greek, θυγάτηρ; Gothic, *dauhtar*. And the etymology of the Sanscrit word from *duh*, "to milk," paints the simplicity of a pastoral age when the daughter of the house was most naturally utilized as the milk-maid of the kine. Similarly, the "brother" bears our English name in every language of the family,—namely, Sanscrit, *bhrâtar;* Zend, *brâta;* Sclavonic, *brat;* Irish, *brathair;* Greek, φρατήρ; Latin, *frater;* Gothic, *brôthar*. And though the common Greek word to express this relationship is ἀδελφός "from the same womb," the use of φρατήρ to denote one of a more general fraternity, for the purpose of mutual assistance, is in more strict accordance with the original signification of the Sanscrit word, *i.e.*, "the bearer" or "helper" (root *bhri, fero*), which points to the mutual relations of the brothers in a primitive community. Although it is clear, from their linguistic records, that these primitive Arians recognised the sanctity of domestic relations; although they honoured the marriage tie in its only true form, that of monogamy, and had names for all the affinities which spring from that contract; and though there is every reason to believe that they were acquainted not only with domestic life and the domestication of animals, but even with navigation and the use of the oar (for we have the Sanscrit *naus* and *aritram*, corresponding to the Greek and Latin ναῦς, *navis*, ἐρετμός, *remus*), the fact that they have only one common name for grain (*java*, which means "spelt" and "barley" in Sanscrit; *jawai*, the Lithuanian name for "corn" in general; and ζεFά, which means "spelt" in particular), and the absence of any designation for agricultural implements, have been considered sufficient to justify the inference, that the Indo-Germanic tribes had not, at the time when they were still aggregated in Irân, passed from the pastoral to the agricultural mode of life. On the other hand, we see that the European branches of the family, before they separated into the Sclavonic, Teutonic, and Græco-Latin tribes, had made this further advance in civilization; and Mommsen has justly inferred from a number of specific facts that "the transition from a pastoral to an agricultural life, or, to speak more accurately, the combination of an agricultural with the more ancient pastoral economy, must have taken place after the Indians had separated themselves from the maternal bosom of the nations, but before the Hellenes and the Italians had become distinct peoples. Moreover, when these latter first began to practise tillage, they seem to have been united with other members of the great family; at least, it is a fact that the most important of those agricultural terms, though strange to the Asiatic members of the Indo-Germanic family, are common to the Roman and Greek, with the Teutonic, Sclavonic, Lithuanic, and even Celtic tribes." (*History of Rome*, Introduction, pp. 16, 17, Robertson's translation.)

With this brief notice of its latest and most important application, we must leave the subject of comparative philology. Before, however, we bring this paper to a close, it will be desirable that we should look back on the whole field which we have rapidly surveyed, and endeavour to indicate the place which philology, as a distinct science, is entitled to occupy in the encyclopædia of human knowledge.

Functions of philology in general.

Considered in its full compass, and in all the developments which belong to its definition as the methodical study of language with reference, in the first instance, to some fixed and ancient literature, philology may justly claim the following important functions:—

(1.) It forms the necessary basis of a liberal education in all countries which have been brought to regard their present position from the standing-point of universal history.

(2.) It is an important branch of inductive science.

(3.) It links together the present and the past, and enables those who would otherwise be bound down by the conditions and exigencies of every-day life, to cultivate their spiritual nature by more genial aspirations and a more comprehensive view of their own duties and destiny.

(4.) It rectifies ancient traditions, when, being erroneous or wrongly interpreted, they exercise a mischievous influence on the belief and practice of a generation.

(5.) It forms the key-stone of theology, wherever the knowledge of divine truth professes to rest on a rational interpretation of the documents of religious history.

We will make a few remarks on each of these subjects.

(1.) It is the necessary basis of a liberal education.

(1.) The proper idea of education, as distinguished from the mere acquisition of information or the amassing of stores of knowledge, includes the complete and progressive training of the individual, both mentally and morally. With the latter the science of language is indirectly concerned, because it is through the reason that the teacher acts on the will of his pupils, and because the first lessons of duty are always presented in a form which requires more or less of progressive interpretation. With respect, however, to mental or intellectual culture, philology in its elementary applications becomes of paramount importance. On this subject we have only to repeat the language which we have used on former occasions, and to maintain that the discipline of the mind depends entirely on that system of logical training, which gradually imparts the habit of methodically arranging our thoughts, and exercises the reasoning faculties in the practical processes of deduction. Intellectual education cannot advance beyond this; and educational training will undertake what does not belong to its own province if it does not confine itself to the cultivation and improvement of deductive habits. As far as the world has hitherto advanced, only two forms, under which this instruction is possible, have been excogitated or practised by man,—namely, *grammar*, which deals with the expression of our thoughts in language; and *geometry*, which applies the rules of language to a methodical discussion of quantities, magnitudes, and proportions, or, in Kant's phraseology, to a development of the intuitions of space and time. Practically, the higher education of Europe, since the days when Plato

first discovered and stated the leading principles of Greek syntax, has rested upon this basis and no other. That great philosopher, in whose view dialectics, or the method of language, was the primary science, is reported to have warned those who were unskilled in the geometry, lately brought to perfection by his friends Theodorus and Theætetus, not to enter the sacred precincts of his Academy. And, however, disguised in technical terminology, this has been the maxim of university training both in the middle ages and in modern times. We have already said that the *Trivium* and *Quadrivium* of the mediæval school of arts constituted the original department in the university of Paris and the similar institutions which followed in its wake; and these seven liberal arts,—namely, grammar, logic, and rhetoric, for the *Trivium;* and music, arithmetic, geometry, and astronomy, for the *Quadrivium,*—are represented respectively by the classics and mathematics of modern schools and colleges. It is true that, while the intimate connection of the latter with many branches of practical and professional life have shielded the study of mathematics from any formal attack on the part of those who take a utilitarian view of education, there has been a great outcry in some quarters against the importance assigned to philology, or rather to classical philology, in the higher education of Great Britain; and there are many persons who think that such studies are an anachronism, and that the time bestowed upon them would be better employed in learning modern and living languages, and in becoming well acquainted with the noble literature of our own country. It is not our business on the present occasion to enter into an argument on this subject, which we have sufficiently discussed elsewhere (*Classical Scholarship and Classical Learning*, Cambridge, 1856). But we must remark here, that no modern language, when acquired in the only way in which it can be learned completely,—namely, by a prolonged and generally an early residence in the country where it is spoken,—can furnish the means of that true grammatical training which is the first step in the formation of deductive habits; and that the literature of England and other modern countries rests so entirely on the wisdom of the ancients that it cannot be fully appreciated, and its most illustrious specimens can scarcely be understood, except by those who have made some acquaintance with the dead languages but immortal writings of Greece and Rome. And therefore philology, which, according to its definition, recognises its primary object in some language and literature in a fixed, if not unalterable form, and which, by the conditions of modern civilization, finds its scope and materials in idioms and in books which have become either classical or sacred, cannot really be divorced from the intellectual education of modern times without serious detriment to one great branch of deductive training,—namely, the study of language, on its own account, and for the sake of the mental discipline which it involves.

(2.) It is an important branch of inductive science

(2.) As a branch of inductive science, philology, in that final development which we call comparative philology, stands on precisely the same footing as geology and those other sciences which are "connected by this bond, that they endeavour to ascend to a past state of things by the aid of the evidence of the present" (Whewell, *History of the Inductive Sciences*, vol. iii., p. 481); for, as it has been well observed, "language is one of the most clear and imperishable records of the early events in the career of the human race" (Whewell, *Philosophy of the Inductive Sciences*, vol. i., p. 650). We have already seen how comparative philology enables us to classify the races and languages of man, and how it sets before us, with unmistakeable veracity, the primæval history of Indo-Germanic civilization. Its claim, however, to rank as a branch of inductive science, does not rest merely on its services in classifying the phenomena and interpreting the facts of language. It has also proved itself able to discover, like other inductive sciences, the general laws which prevail among the phenomena. One of the most important of these general laws is that of the "transposition of sounds" (*Lautverschiebung*), or, as it is sometimes called, "the law of the interchange of the mutes," which had been imperfectly indicated by Rask, and which Grimm demonstrated completely in its application to the Greek (Latin, Sanscrit), the Gothic, and the Old High German (*Deutsche Grammatik*, vol. i., pp. 584, sqq.), and which Bopp has extended to the Zend and Lithuanian (*Vergleichende Grammatik*, pp. 78, foll.) The general law is thus stated:—

Labials.

In Greek (Latin, Sanscrit),

P answers to the Gothic	F,	and the Old High German	B or V.
B „ „	P,	„ „	F.
F „ „	B,	„ „	P.

Dentals.

In Greek (Latin, Sanscrit),

T answers to the Gothic	TH,	and the Old High German	D.
D „ „	T,	„ „	Z.
TH „ „	D,	„ „	T.

Gutturals.

In Greek (Latin, Sanscrit),

K answers to the Gothic	{ H (init.) G (med.) }	and Old High Germ.	G.
G „ „	K	„ „	CH.
CH (H) „ „	G	„ „	K.

Or thus:—

Greek (Latin, Sanscrit).	Gothic.	Old High German.
Tenuis,	Aspirate,	Medial.
Medial,	Tenuis,	Aspirate.
Aspirate,	Medial,	Tenuis.

One example of each interchange will explain the application of this law.

	Greek (Latin, Sanscrit).	Gothic (Old Norse).	Old High German.
P, F, V (B),	Πούς=πόδ-ς, Pes=*ped-s*, *Pâdas*,	*Fôtus*,	*Vuoz.*
B, P, F,	*θόρυΒος*, *turBa*,	*thaúrP*,	*doroF.*
F, PH } B, P,	Φηγός, *Fagus*,	*Beyki*,	*Puocha.*
T, TH, D,	{ ὀδούς=ὀδόνΤ-ς, *dens*=*denT-s*, *danTas*, }	*tunTHus*,	*zanD.*
D, T, Z,	ὀΔούς, *Dens*, *Dantâs*,	*Tunthus*,	*Zand.*
TH, D, T,	Θυγατηρ,	*Dauhtar*,	*Tohtar.*
K, { H G } G,	ἑΚυρός, *soCer*,	*svaíHra*,	*schwaGer.*
G, K, CH,	Γένος, *Genus*,	*Kuni*,	*CHunni.*
CH, H, } G, K,	Χόρτος, *Hortus*,	*Gards*,	*Karto.*

Mr Winning has pointed out a curious interchange between the Greek and the Gothic, with regard to the relations established by this law (*Manual of Comparative Philology*, p. 111). Other modifications require to be introduced. And Dr Guest attaches so much weight to the exceptions which he has noticed, that he has arrived at a conviction of "the general unsoundness of these celebrated canons" ("On the Elements of Language, their Arrangements and their Accidents," *Proceedings of the Philological Society*, vol. iii., p. 180). The great majority of philologers, however, acquiesce in the general validity of this theorem of interchange: Bunsen calls it "one of the most fertile and triumphant discoveries of philological ethnology" (*Report of the British Association* for 1847, p. 262); and Max Müller accepts it as a proof of "the systematic regularity—the almost absolute certainty—to which the phonetic laws of different languages can be brought" (*Edinburgh Review*, October 1851, p. 319). The present writer ventures to attach a somewhat similar importance to his own discovery of another principle, which he proposes to call "the law of divergent articulations." Grimm's law of transposition applies only to the interchange of mutes of the same

Comparative Philology.

order, as far as the mode of their articulation is concerned, but distinguished as tenues, aspirates, and medials. For the interchanges of mutes with others belonging to different organs, he had no explanation to offer, and regards them merely as exceptions to the general rule (*Deutsche Grammatik*, i., p. 589). The older grammarians had only one name, *metalepsis*, for all interchanges, whether regular and easily explicable, as from P to B, or irregular, and at first sight inexplicable, as from P to K. The present writer was led to an explanation of these divergent interchanges by an inquiry into the nature of the Greek letter called the digamma, which he proved to be a complex sound, consisting of a guttural combined with a labial (*New Cratylus*, § 110), and he extended the same principle to all cases in which two words, undoubtedly of the same origin, exhibit articulations which could not have been interchanged. In all such cases, he concluded that the original form exhibited a combination of the two sounds. The brief but decisive induction by which this law was established in 1839 (*New Cratylus*, 1st edit., p. 136) was greatly extended by Mr Garrett in his valuable paper "On Certain Initial Letter-Changes in the Indo-European Languages" (*Proceedings of the Philological Society* for 1846, vol. ii., p. 233, sqq.). A simple example or two will show the application of this law. The Sanscrit *paktas* corresponds exactly in meaning to the Latin *coctus* and the Greek πεπτός. But as *p* cannot pass into *k*, the Latin differs from the Sanscrit in the initial, and from the Greek in the included sound, or, in Grimm's useful terminology, they differ reciprocally in *Anlaut* and *Inlaut*. Now the Latin *coquo* shows us that the guttural in this case was not pure, but that it was followed by a vocalized labial; and it is known that even in Cicero's time *coquus* was pronounced *quoquus*. (Quintil. *Inst. Or.* vi. 3, § 47.) The divergent articulations P and K converge, therefore, in the compound sound QV=KP, and the three words are accordingly reducible to an identity of origin as well as of meaning. Again, we have in Greek κελαινός as a synonym of μέλας, μέλαινα, μέλαν; and with the exception of the initial or *Anlaut*, the words are identical in root or crude form. But we cannot derive κ from μ, or *vice versa*; and, according to the law, we must assume the complex sound κμ as the origin of these divergent articulations. Fortunately we are not left to an inference in this case, for Pamphilus, of the school of Aristarchus, recorded the fact, that μέλαθρα, meaning "the rafters blackened by the smoke," were anciently called κμέλεθρα. (*Etymol. Magn.*, p. 521, 33.) Lastly, to take an instance in which we have all forms of the process, the Latin *vivus* exhibits no traces of a guttural in combination with the labial. But the perfect *vixi*, from the corresponding verb *vivo*, shows that the *Inlaut* at least involved a *k*-sound; whereas a comparison with the Gothic *quivs*=*vivus*, indicates that *qv* was also the original type of the *Anlaut*, or initial articulation; and thus we arrive with perfect confidence at the conclusion, that *vivus*=*qviqvus* was ultimately identical in meaning, as it is in signification, with the Old Norse *quikr*, Old Saxon *quic*, and modern English *quick*.

(3.) It releases the mind from the thraldom of the present.

(3.) If the science of philology had not existed, or had been irrecoverably lost at some early period, there must have been a total disruption of those nobler associations which connect the present with the past, and prevent civilized men from becoming the bond-slaves of their everyday requirements and exigencies. It may seem, to those who have not reflected on the subject, something like a paradox to assert that those who have forgotten the past very rarely bestow much thought upon the future. But this is really the condition of human nature. All belief in the future destiny of man necessarily connects itself with a belief in the facts of his past history. Without the latter the former is impossible; for the future is in our minds only the anticipated copy of our recorded experiences. Without this we have no future beyond the idea of proximate coming time; and he who has no past but "yesterday," has no future but "to-morrow":—

> To-morrow, and to-morrow, and to-morrow,
> Creeps in this petty pace from day to day,
> To the last syllable of recorded time;
> And all our yesterdays have lighted fools
> To dusty death.

The very structure of inflected language shows us that we cannot measure futurity beyond the vague statement that it is near and coming; whereas the past, so far as it is registered, stretches back in a lengthening vista, and is, by the mere expression of tense in the oldest languages of our family, declared to be distant. From a contemplation of this remote period, as it is unfolded in ancient history, not only does the present sink to its proper littleness as a mere fleeting unit in the onward progress of the seasons, but the future assumes new and larger proportions in the analogy of the past, till at last it expands in the eyes of faith, or it may be of imagination, into the grand conception of eternity. Dr Johnson, then, has said with great truth (*Journey to the Western Isles*, Works, x., p. 501),—"Whatever withdraws us from the power of the senses,—whatever makes the past, the distant, or the future predominate over the present,—advances us in the dignity of thinking beings." Now it cannot be doubted that the schools of philology, of which we have briefly traced the history in this paper, have alone preserved the records of the past life of man, and enabled the present and future ages to read and understand them. To the critical editorship, which commenced at Athens under the Pisistratidæ, and culminated at Alexandria under the Ptolemies, we owe all that we have of ancient Greek literature, the greatest inheritance of genius and wisdom, and the most influential instrument of liberal culture, that the world has ever possessed. The Jews, stimulated perhaps in part, and certainly guided in no small degree by the school of Alexandria, have preserved and transmitted to us a collection of sacred writings which still preaches to the civilized world the highest lessons of religious faith and divine morality, and breathes forth a spirit of prayer that ascends to heaven like the incense of the sacrifice. The Indians, by a very similar but independent effort, made, perhaps, under the intrusive pressure of Buddhism, have rescued from oblivion and placed on record the relics of their own primitive language and writings, which have enabled us to penetrate to the untold beginnings of Arian civilization, and to discover what the Indo-Germanic race did and believed before it was broken up into distinct nationalities, and scattered over the face of Asia and Europe. The labours of philologers, during the three centuries which have elapsed since the revival of literature and learning, have rendered all these early efforts to preserve the documents of ancient culture available for the purposes of modern speculation. The hieroglyphic annals of Egypt, and the arrow-headed inscriptions of Persia and Assyria, have been, in part at least, deciphered and interpreted. The languages called classical, and those of the Jews and Indians, have been analysed so thoroughly that little, if anything, remains to be done for their elucidation. Historical criticism and comparative grammar have corrected the mistakes of a credulous age, and have raised etymology from guess-work to science; and ethnography, which treats of the origin and growth of man, has been placed, by the aid of the philologer, on a basis as strong as that of physical science. With all these fields of research open to his view,—with these means of connecting himself with the past history of his species, and of basing his future hopes on manifold revelations,—educated men must blame themselves if they yield to the degrading thraldom of their present needs and enjoyments, and make themselves tools for the execution of some daily work.

Comparative Philology.

(4.) It rectifies mistaken traditions.

(4.) Valuable as the records of the past necessarily are, when read with that discriminating judgment which it is the business of philology to cultivate, their possession and use may, without this organon, lead to the most superstitious belief and the most criminal practices. This is especially the case in regard to branches of literature which have become sacred rather than classical. In the interpretation of these records of authoritative tradition it is often found that, so long as they remain in the sole custody of a sacerdotal caste, they are liable to be distorted and misread until they are made to say something quite inconsistent with their true meaning. And it is only when the scholar steps in with his matured and independent knowledge that the mistaken tradition is rectified, and the genuine statement re-invested with an articulate utterance. Thus, to take two most important instances from the sacred writings of the Hindus:—The Brahmins profess to derive the multitudinous practices which they enjoin from the infallible revelations of their Vêdas. The great majority of these ordinances, although childish and absurd in our eyes, have been wisely tolerated by the British government since it became paramount in India. But there was one practice so offensive, not only to morality, but even to humanity, that steps were necessarily taken to do away with it. This was the *suttee*, or compulsory immolation of the widow on her deceased husband's funeral pile. At the time when Christian feeling broke out into open revolt against this monstrous usage, it was supposed that the Brahmins had at least the excuse of believing that the practice of widow-burning was expressly enjoined in the oldest books of their religion; and even the great Sanscrit scholar Colebrooke had translated a passage from the *Rig-Vêda* in accordance with their interpretation of it (*Asiatic Researches*, vol. iv., pp. 209–219, Calcutta, 1795). But when the *Vêdas* were at length studied according to the principles of philological criticism as established in Europe, it was found that the sacred book, instead of countenancing the murderous custom, in the passage immediately before that which the Brahmins quoted as sanctioning it, said,—"Rise up, woman; come to the world of life; thou sleepest nigh unto him whose life is gone. Come to us." And that in the text cited by the Vêdolaters they had changed "*Â rohantu janayo yonim agre*" ("The mothers may go first to the altar"), into "*Â rohantu janayo yonim agneh*" ("Let the mothers pass into the womb of fire"). (See Max Muller, in the *Zeitschrift d. Deutsch. Morgenl. Gesells.*, vol. ix., part 4, p. xxv.; and in the *Oxford Essays* for 1856, pp. 22, 25.) If this discovery had been made only fifty years earlier, many innocent women would have been saved from a cruel death, and we should have escaped the risk of a religious outbreak, which we incurred when we put a stop to this mock martyrdom. Again, the dreadful mutinies which have raged in so large a part of our Indian dominions are attributed immediately to the apprehensions on the part of the Brahminical sepoys that the government intended to interfere with their sacred distinction of caste. In this case, also, philology has proved that the supposed religious sanction is not to be found in the sacred books. "If," says a learned and able writer, who is easily identified as perhaps the best authority on the subject (*Times*, 10th April 1858), "with all the documents before us, we ask the question, Does caste, as we find it in Manu, and at the present day, form part of the religious teaching of the Vêdas? We can answer with a decided *No.* There is no authority whatever in the Vêda for the complicated system of castes; no authority for the offensive privileges claimed by the *Brahmins;* no authority for the degraded position of the *Sûdras.* There is no authority to prevent the different classes of the people from living together, from eating and drinking together; no law to prohibit the marriage of people belonging to different castes; no law to brand the offspring of such marriages with an indelible stigma." And he justly adds that, "As the case now stands, the government would be perfectly justified in declaring that it will no longer consider caste as part of the religious system of the Hindus. Caste, in the modern sense of the term, is no religious institution; it has no authority in the sacred writings of the Brahmins; and, by whatever promise the government may have bound itself to respect the religion of the natives, that promise will not be violated even though penalties were inflicted for the observation of the rules of caste." The evils which have resulted from this misapprehension on the part of the Hindu priests, or rather from the traditions with which they have overlaid and nullified the sacred books, and so substituted a new authority for that which should alone be paramount, have been remedied by a vigorous exertion of our military power; but it is clear that an ultimate pacification on this and other kindred subjects will be greatly facilitated when the spirit of modern philology, applied to the Vêdas and Puranas, shall have finally superseded the half-knowledge of the native pundits.

(5.) It is the key-stone of genuine theology.

(5.) In much the same manner as the sacerdotal caste in India have substituted a traditionary system of their own for that of the sacred writings on which they profess to rely, the priests of the Latin Church in the middle ages had superseded the Scriptures by an elaborate system of theology, and by the recognition of a visible head, whose decisions on questions of doctrine and practice were held to be infallible. The rectification of this erroneous tradition was called Protestantism; and it was due in a great measure to the revival of philological learning, which preceded it, and which has been briefly described in these pages. Indeed, it may be asserted with perfect truth, that the whole fabric of papal pretensions rested on precarious deductions from a philological blunder or oversight,—namely, the supposition or statement that πέτρος, *a stone*, was exactly synonymous with πέτρα, *a rock*,—that is, a mass or collection of similar stones. But although freedom of opinion achieved this partial victory in the sixteenth century, the necessity for an energetic exertion of Protestant principles has never ceased; and it is as urgent now as it was in the days of Luther and Melanchthon. Roman pretensions are not extinct; and the traditions of the Italian church are not the only adscititious envelopments which mar the beauty of the Christian revelation. Among Protestants themselves there are still traditions of infallibility, as degrading to the intellect of man, as prejudicial to true religion, and as untenable in themselves, as those which were put forth to support the dogma of transubstantiation or the practice of indulgences. For every individual Protestant now, as for Protestants in general at the time of the great Reformation, the significant saying of Zschokke (*Autobiography*, p. 29) contains at once a caution and a rule of action:—"He who does not like living in the furnished lodgings of tradition must build his own house, his own system of thought and faith, for himself." And it would be the greatest mistake to suppose that the duty of study and examination in a Protestant community devolves exclusively on the clergy or ministry. The laity cannot thus shift their responsibility in a matter which concerns themselves individually, and in which the general diffusion of education has made them quite as competent judges, while they are also more unprejudiced arbiters, and more free to express their convictions, than most of their authorized teachers. On this subject we need only refer to a temperate and well-considered argument which has just appeared from the pen, as we are informed, of a person who has won a distinguished place in Indian philology (*Free Theological Inquiry the Duty of the Laity*, by a Lay Member of the Church of England, London and Edinburgh, 1858; see p. 13). But for all Protestants, whether ministers or members of congregations, it is certain

that a critical period has arrived, fraught with momentous consequences to the religious and moral training of the age, and that the problems which await solution cannot be successfully encountered except in that spirit of historical and linguistic criticism, the origin, growth, maturity, and various applications of which we have endeavoured to exhibit.

On all these accounts, we claim for philology, or the methodical study of the fixed forms of language and literature, a place of honour in the first class of those branches of knowledge which find their appropriate place in the volumes of an Encyclopædia; and we are prepared to echo the words which Bunsen addressed to the British Association at Oxford (*Report* for 1847, p. 257):—"If man is the apex of the creation, it seems right, on the one side, that a historical inquiry into his origin and development should never be allowed to sever itself from the general body of natural science, and in particular from physiology. But, on the other hand, if man is the apex of the creation; if he is the end to which all organic formations tend from the very beginning; if man is at once the mystery and the key of natural science; if that is the only view of natural science worthy of our age; then ethnologic philology, once established on principles as clear as the physiological are, is the highest branch of that science for the advancement of which this association is instituted. It is not an appendix to physiology or to anything else; but its object is, on the contrary, capable of becoming the end and goal of the labours and transactions of a scientific association."

In the survey which we have now brought to a close we have contented ourselves with describing the first beginnings, successive developments, present condition, and manifold usefulness of linguistic science. It has not been our business to write a treatise on any branch of philology. Special views on certain departments of the subject have been set forth by competent writers in the articles on GRAMMAR and LANGUAGE. Those who wish to prosecute the study of philology in its details are recommended to the following books, which have been mentioned above, and some of which, we believe, are the generally-received representatives of the existing knowledge in the higher branches of comparative grammar and the philosophy of language:—

1. GRIMM (Jacob), *Deutsche Grammatik*, vols i.–iv. Göttingen, 1822–1837. A third edition of part of the first volume appeared in 1840.
2. POTT (August Friedrich), *Etymologische Forschungen auf dem Gebiete der Indo-Germanischen Sprachen*. Lemgo, 1833–6.
3. BOPP (Franz), *Vergleichende Grammatik des Sanskrit, Zend, Griechischen, Lateinischen, Litthauischen, Gothischen, und Deutschen*. Berlin, 1833–1852. This work, which is now in course of republication, has been translated into English by Mr Eastwick, with the co-operation of the late Earl of Ellesmere.
4. HUMBOLDT (Wilhelm von), *Ueber die Verschiedenheit des Menschlichen Sprachbaues und ihren Einfluss auf die geistige Entwickelung des Menschengeschlechts*. Berlin, 1836. Reprinted in the author's collected works, vol. vi. Humboldt's principles have found a special exponent in Dr H. Steinthal, *Sprachwissenschaft W. v. Humboldt's und die Hegel'sche Philosophie*. Berlin, 1848.
5. WINNING (W. B.), *A Manual of Comparative Philology*. London, 1838.
6. *The New Cratylus, or Contributions towards a more Accurate Knowledge of the Greek Language*. First edition, Cambridge, 1839; second edition, considerably enlarged, Cambridge, 1850; third edition, in the press.
7. *Varronianus A Critical and Historical Introduction to the Ethnography of Ancient Italy, and the Philological Study of the Latin Language*. First edition, London, 1844; second edition, considerably enlarged; London, 1852.
8. LATHAM (R. G.), *The English Language*. First edition, London, 1842; second edition, considerably enlarged, 1848; third edition, 1850.
9. GRIMM (Jacob), *Geschichte der Deutschen Sprache*. Leipsic, 1848.
10. SCHWARTZE (M. G.), *Aufstellung und Auseinandersetzung des Koptischen Sprachgebaudes mit Rucksicht auf die vergleichende Sprachforschung*, in his great work *Das Alte Ægypten*. Leipsic, 1843 (pp. 466–932).
11. ZEUSS (J. C.), *Grammatica Celtica*. Lipsiæ, 1853.
12. DIEZ (Friedrich), *Etymologisches Wörterbuch der Romanischen Sprache*. Bonn, 1853.
13. BUNSEN (C. C. J.), *Outlines of the Philosophy of Universal History*. London, 1854.
14. GARNETT (Richard), *Philological Essays*, edited by his son (in the press).

There are several periodicals devoted to the discussion of philology: of these the most important are the *Transactions of the Philological Society*, published in London; and the *Zeitschrift für vergleichende Sprachforschung*, published at Berlin. (J. W. D.)

PHILOMELA, a daughter of Pandion, King of Athens, changed into a nightingale.

PHILOPŒMEN, a celebrated general of the Achæan League, was born about 252 B.C., in Megalopolis, a city of Arcadia, in Peloponnesus, and from his very infancy discovered a strong inclination to the profession of arms. Having been nobly educated by Cassander of Mantinea, he was no sooner able to bear arms than he entered amongst the troops which the city of Megalopolis sent to make incursions into Laconia, and in these inroads never failed to give some remarkable instance of his prudence and valour. After signalizing himself in various services, he was appointed general of the Achæan forces, and applied himself to re-establish military discipline amongst the troops of the republic, strove to rouse the courage of his countrymen, and laboured to put them into a condition to defend themselves without the assistance of foreign allies. With this view, he made great improvements in the Achæan discipline, changing the manner of their exercise, as well as their arms, which were both very defective. After eight months of hard discipline, news reached him that Machanidas was advancing, at the head of a numerous army, to invade Achaia. He met the enemy in the territories of Mantinea, where a decisive battle was fought, about 204 B.C., in which the Achæans were completely victorious. But what most contributed to raise the fame and the reputation of Philopœmen was his uniting the powerful city of Lacedæmon to the Achæan commonwealth, by which means the Achæans were enabled to eclipse all the other states of Greece. (See ACHÆANS.) Philopœmen attacked the Messenians, but was wounded, taken prisoner, and poisoned by the magistrates; and thus died one of the greatest heroes whom Greece or any other country had ever produced. Philopœmen was called the last of the Greeks, as Brutus was afterwards styled the last of the Romans. (See ARMY.)

PHILOSOPHER'S STONE. See ALCHEMY.

PHILOSOPHY (φιλοσοφία, *love of wisdom*) is a term which is said to owe its origin to Pythagoras, who, disclaiming the presumptive title of σοφός, or *sage*, assumed by his predecessors, chose rather to designate himself as a φιλόσοφος, *a lover of the* σοφία,—as one who, though ardent in the pursuit of wisdom, yet could never properly arrogate to himself the possession of it. Cicero tells this story (*Tusc. Quæst.* lib. iv., cap. 3) on the authority of Heraclides Ponticus, who is, however, confessed to have been a fabulous writer. There was, however, a verb φιλοσοφεῖν, *to philosophize*, in the time of Herodotus; and the term, as a distinctive epithet, was brought into general use by Socrates, to denote the science that is conversant about the causes and existence of things. Philosophical knowledge, in the widest acceptation of the term, is the knowledge of effects as dependent on their causes. And as every cause to which we can ascend is also an effect, it follows that it belongs to philosophy to trace up the series of effects till we arrive at causes which are not themselves effects, and have reduced them to the fewest possible number. It follows, therefore,

that philosophy may be defined as *the science of first principles;* and the term is now limited almost exclusively to the mental sciences.

PHILOSTRATUS, the famous author of the *Life of Apollonius of Tyana*, was born most probably about A.D. 172. Eusebius calls him an Athenian, because he taught at Athens; but Eunapius and Suidas always speak of him as a Lemnian. He frequented the schools of the Sophists, and he mentions his having heard Damianus of Ephesus, Proclus Naucratitas, and Hippodromus of Larissa. He afterwards became known to Julia Augusta, the wife of Severus, and was one of those learned men whom this philosophical empress had continually about her. It was by her command that he wrote his celebrated *Life of Apollonius of Tyana.* His *Lives of the Sophists* contain many things which are to be met with nowhere else. The *Heroics* of Philostratus are only a dialogue between a vintner of the Thracian Chersonesus and a Phœnician; while his *Images* are elegant descriptions and illustrations of some ancient paintings, and other particulars relating to the fine arts. The last piece is a collection of Philostratus' *Letters.*

Of the collected works of Philostratus there is the edition of F. Morellius, Paris, 1608; that of Olearius, 2 vols. folio, Leipsic, 1709; and lastly, and by far the best, there is the edition of C. L. Kayser, 4to, Zurich, 1844. The first two books of the *Life of Apollonius of Tyana* were translated into English by the unfortunate Charles Blount, London, 1680; and shortly after prohibited.

PHILOXENUS, a celebrated dithyrambic poet, a native of the island of Cythera, flourished B.C. 398, being contemporary with Timotheus and Telestes, and died at the age of sixty, B.C. 380. He was a son of Euletidas, and, when Cythera was taken by the Lacedæmonians, he was carried off as a slave. He was sold to Agesylas; and on his death was bought by the poet Melanippides, by whose instruction he seems to have profited. He was devoted to the pleasures of the table, and became a great favourite of the elder Dionysius. It is said the luxury of the court of Syracuse furnished the theme of his poem Δεῖπνον (*Dinner*). His poem *Cyclops* or *Galateia* is said to have been one of the finest of his productions. Alexander the Great was a great admirer of the dithyrambs of Philoxenus and Telestes. The fragments of Philoxenus are almost all in Athenæus. Most of them have been recently edited by Meinekè, by Bergk, and by Schmidt.

PHILTER (φίλτρον, *a love charm*, from φιλέω, *I love*), was a potion given by the Greeks and Romans to excite love. Its composition is not known.

PHLEGON, a Greek historian, was a native of Tralles, in Lydia, and the freedman of the Emperor Hadrian (A.D. 117–138). He was the author of a History or Chronicle, in sixteen books, which ended A.D. 141, and which is now lost. Besides a fragment, *De Olympiis*, we have also two other works, *De Longævis libellus* and *De Rebus Mirabilibus liber.* The edition of Bast (Halle, 1822, 8vo) includes all the valuable annotations of his predecessors; but that of Westermann, in his *Scriptores Rerum Mirabilium Græci*, 1839, is unquestionably the best.

PHLIUS, an independent city in the north-eastern part of Peloponnesus, stood on a hill called Arantinus, on the left bank of the Asopus (*Asopo*). Its territory, bounded on the S. by Argolis, on the W. by Arcadia, on the N. by Sicyonia, and on the E. by Cleonæ, was an upland valley, well watered by mountain streams, and fruitful in vines. Its inhabitants are celebrated for their alliance with Sparta. The ruins of Phlius are still visible.

PHOCÆA (the modern *Phokia*), the most northern of the cities of Ionia, was situated on the coast, about 200 stadia from Smyrna. It was founded by a colony of Phocians, led by two Athenians, Philogenes and Damon. Its citizens are said to have been the first amongst the Greeks who extended their commercial voyages to great distances; and its inhabitants abandoned their city rather than submit to the Persians, B.C. 544. They settled in Italy, and founded Velia. Massilia in France, and Alalia in Corsica, were colonies of the Phocæans.

PHOCION, a very celebrated Athenian general, was descended from a family which at no time had been particularly distinguished in the political transactions of their country. He was born B.C. 402, and was condemned to death B.C. 317, at the age of eighty-five. His early years were spent under the direction of Plato and Xenocrates, and his subsequent career showed that he had profited by their instruction. His aspect was forbidding, though his disposition was mild and gentle. It was remarked that he was never seen to laugh or to weep. He commenced his military career under Chabrias, and gained so much influence with that general that he directed many of his proceedings. The victory at Naxos, B.C. 376, was in a great measure due to his prudence and military talents. Nor was he less distinguished as a statesman and orator. He was quick in perception, and ready in debate; so that Demosthenes feared him more than any other orator, and is said to have called him the *Hatchet.* (See DEMOSTHENES, and MACEDONIA.)

PHOCIS, a country of ancient Greece, was bounded on the W. by the Locri Ozolæ and Doris, on the N. by the Locri Epicnemidii and the Locri Opuntii, on the E. by Bœotia, and on the S. by the Corinthian Gulf. Its surface was occupied by a succession of lofty mountains and spacious plains. The Locrian chain of heights formed the northern frontier, hemming in the country. Extending along the inner side of these lay the fertile valley through which the Cephissus flowed. On the southern bank of the river the ground rose suddenly and abruptly into the lofty and rugged range of Parnassus. Then it sank gradually down, leaving many mountain offshoots and recesses, until it found a level in the spacious sea-shore plain of Crissa. Phocis held a prominent place in Grecian history from the very first. At an early date it received its name from a certain King Phocus. In course of time, two of its cities, Delphi and Elatea, became notable,—the former as being the site of the celebrated oracle of Apollo, and the latter as standing on the highway from Northern to Central Greece. Nor was its prowess in arms less remarkable. For many years its inhabitants drove back the repeated incursions of the Thessalians; and during the invasion of Xerxes, they stood at bay among the fastnesses of their native mountains. The chief event, however, in the annals of Phocis is the Phocian or Sacred War. (See MACEDONIA.) Besides Delphi and Elatea, the other important towns of Phocis were Lilæa, on the plain of the Cephissus: Daulis, on the Bœotian frontier; Crissa, on Mount Parnassus; and Cirrha and Anticyra, on the shore of the Corinthian Gulf.

PHŒBUS. See APOLLO.

PHŒNICIA. See SYRIA.

PHOOLGHUR, a small raj of British India, on the S.W. frontier of Bengal. Its centre lies in N. Lat. 21. 15., E. Long. 83.; area, 890 square miles. The surface is undulating; and buffaloes are allowed to run wild over the country. The people are idle and lawless. The revenue is calculated to amount to L.600. Pop. estimated at 40,000.

PHOSPHORUS. See CHEMISTRY.

PHOTIUS, a Patriarch of Constantinople, one of the most remarkable men of his time, was born in the early part of the ninth century, and raised himself by his merit to the patriarchate. When Bardas had driven Ignatius from the see, Photius was consecrated by Asbestus in 859 A.D. He condemned Ignatius in a synod, upon which the Pope excommunicated him, and, to balance the account, Photius anathematized the Pope. Basilius of Macedonia, whom

Photo-galvanography || Photography.

Photius had reproved for the murder of the Emperor Michael, expelled him, and restored Ignatius; but afterwards, upon the death of Ignatius, Photius was re-established, in the year 878 A.D. At last, being wrongfully accused of a conspiracy against the person of Leo the Philosopher, son and successor of Basilius, he was expelled in 886, and is supposed to have died soon afterwards. He wrote a Bibliotheca, an extraordinary monument of literary energy and immense erudition, which contains an examination of 280 authors; and we have also 253 Epistles of his, the *Nomocanon* under 14 *Tituli*, an abridgment of the acts of several councils; besides several other works, many of which are still in manuscript. There was no branch of literature, whether sacred or profane, and scarcely any art or science, in which he was not deeply versed. His rise to the patriarchate was very rapid; for when he was chosen to that office he was only a layman; but he was made monk the first day, reader the next, and the following days sub-deacon, deacon, and priest; so that in the space of six days he attained to the highest offices in the church. On the whole, however, his ardent love of glory and unbounded ambition led him to commit excesses which rendered him a scourge to those around him. It was brought to light by Andreas Scottus, and communicated by him to David Hœschelius, who caused it to be printed in 1601. The Greek text, together with Scottus's Latin translation, was afterwards printed at Geneva in 1611. A revised edition of this work was published by Bekker, in 2 vols., Berlin, 1824–25; but there has been hitherto no collected edition of this great scholar's writings.

PHOTO-GALVANOGRAPHY is a new art, invented by Mr Paul Pretsch of Vienna, and introduced by him into England. After securing his right by patent, he has published, in a series of folio plates, magnificent specimens of the art.

Solutions of glue and solutions of nitrate of silver, iodide of potassium, and bichromate of potash, are mixed according to a rule, and spread, as is done in the albumen process,[1] over the glass plate. A photograph or engraving is placed on the prepared surface, and a negative taken in sunlight or daylight. The glass plate is then placed in water with a little alcohol, and the darkened parts are rendered soluble, while the other parts are insoluble; so that in a few minutes we have a picture represented by the unequal thickness of the gelatine upon the glass. When the plate is dry, soft gutta percha is pressed upon the picture till it hardens. The gutta percha has consequently an image the reverse of the first. After metallizing it,—that is, rubbing it over with bronze powder or black lead,—it is placed in a solution of sulphate of copper, and an electrotype plate taken from it in the usual way with the voltaic battery. From this plate others can be readily taken, and, as in ordinary copperplate printing, thousands of copies exactly similar to the photograph can be thrown off. "By this process," says Mr Hunt, "pictures, in which the most delicate details are very faithfully preserved, and the nice gradations in light and shadow maintained in all their beauty, are now printed from the electrotype plate obtained from the photograph. The process of photo-galvanography is evidently destined to take a very high position as a means of preserving the beauties of nature and art."[2] (D. B.)

Photoglyphic Engraving || Photography.

PHOTOGLYPHIC ENGRAVING, the name given to a new art of engraving by the action of light, which was patented by Mr Fox Talbot on the 21st April 1858. A plate of steel, copper, or zinc is covered with a thin film of the following solution:—

Gelatine .... ¼ oz.	Saturated solution of bichromate of potash in water, 1 oz.
Water ..... 8 or 10 oz.	

The photograph or object to be engraved is then laid upon this film, and screwed down in a copying-frame. After exposure to light, solar or diffused, the plate is taken out, and a little finely-powdered gum copal carefully and evenly spread over its surface. The copal is then melted by holding the plate horizontally over a spirit lamp. Muriatic acid saturated with peroxide of iron, forming perchloride of iron, is the etching liquid employed, and is put up in three bottles:—

No. 1 is a saturated solution of the perchloride in water.
No. 2 consists of 5 or 6 parts of No. 1 in water.
No. 3 consists of equal parts of water and No. 1.

A little of No. 2 is first poured on the plate, and spread with a brush. The liquid will penetrate the gelatine wherever the light has not acted upon it, but cannot penetrate the parts upon which the light has acted, and "it is upon this remarkable fact that the art of photoglyphic engraving is mainly founded." Mr Talbot's specification, containing minute details of the process, has been printed in all the photographic journals.[3]

Mr C. J. Burnett proposed, in March 1858, another method of engraving on metals, which he calls *photo-metallography*, and in which galvanism regulates the etching, and prevents the gelatinous coating from being injured by removing the gas bubbles.[4] (D. B.)

PHOTOGRAPHY.

PHOTOGRAPHY, from φῶς, *light*, and γράφω, *I delineate* or *paint*, is the name given to the art of delineating or painting by light, whether solar, sidereal, or artificial, or by invisible rays which accompany those different varieties of light.

This art is one of modern invention, which, though some steps to it were taken by preceding writers, we owe to M. Nicephorus Niepce, Mr Fox Talbot, and M. Daguerre. So early as June 1802, Mr Thomas Wedgwood published in the *Journal* of the Royal Institution *An Account of a Method of Copying Paintings upon Glass, and of making Profiles by the agency of Light upon Nitrate of Silver*, with observations by Sir Humphry Davy.[5] "When white paper or white leather," says Mr Wedgwood, "covered with a solution of nitrate of silver (*one* part of nitrate to *ten* of water) is placed behind a painting on glass exposed to the solar light, the rays transmitted through the differently-painted surface produce distinct tints of brown and black, sensibly differing in intensity according to the shades of the picture, and where the light is unaltered, the colour of the light becomes deepest." Mr Wedgwood applied this method to take profiles or shadows of figures, by throwing the shadows on the prepared paper, the part concealed by the shadow remaining white. He employed it also in delineating the woody fibres of leaves, the wings of insects, and also to the copying of prints; but though he obtained pretty accurate representations of all objects that were partly opaque and partly transparent, yet he failed in the copying of prints. To copy the images of the camera obscura was the first object of Mr Wedgwood, but "the images were found to be too faint to produce in any moderate time an effect upon the nitrate of silver. He succeeded, however, in copying, without difficulty, the images of small objects produced by the solar microscope. Mr Wedgwood found that the muriate of silver was more sensible to light than the nitrate, and that both were more readily acted upon when moist than when dry.

Mr Wedgwood tried in vain to fix the copies which he obtained; that is, to prevent the uncoloured portion of the picture from being darkened by light. He was therefore obliged to keep his photographs "in an obscure place," and to examine them only in the shade for a few minutes, or by the candle or lamp light. The process of Mr Wedgwood seems to have excited very little notice. So long ago as 1803 Sir David Brewster called the attention of the public

[1] See PHOTOGRAPHY, art. iii.
[2] *Manual of Photography*, 5th edit., pp. 269, 270.
[3] See *Photographic Journal*, vol. v., p. 58, Nov. 6, 1858.
[4] Ibid., vol. v., p. 97, Dec. 11, 1858.
[5] Vol. i., p. 70. This paper was republished in Nov. 1802 in Nicholson's *Journal of Natural Philosophy*, &c., 8vo series, vol. iii., p. 167.

to it in a Scotch journal, but no person seems to have improved or even repeated the process during the next thirty years. Some time previous to 1834, Mr Henry Fox Talbot, without any knowledge of what had been done by Mr Wedgwood, had been led to the same process; and in the spring of that year he had actually taken pictures in the camera by the agency of light upon paper washed with nitrate of silver, and had succeeded in fixing them. To this new art he gave the name of *Calotype*, from καλός, *beautiful*, and τύπος, *an impression*.

At an earlier period another branch of photography had taken its rise in France. So early as 1814, M. Nicephorus Niepce had attempted to fix the pictures produced in the camera obscura, and to copy engravings by means of light transmitted through them upon substances made sensible to its action. The substance used by M. Niepce was a tablet of copper coated with highly-polished plate silver; and he gave to his process the name of *heliography*, from ἥλιος, *the sun*, and γράφω, *I delineate*. In the year 1824, M. Daguerre had made experiments with the view of fixing the pictures in the camera, but he seems at that time to have obtained no definite results. M. Niepce, however, foreseeing the value of his art, went to London in December 1827, and submitted to the Royal Society an account of his heliographic experiments, and several plates, which proved that he possessed a method of taking pictures on metal (covered with a film of asphaltum or Jew's pitch) by the solar rays, and preventing them from being subsequently obliterated by the action of light. The society seems to have taken no notice of this interesting communication; and, thus discouraged, M. Niepce seems to have abandoned his researches, and to have given his heliographs to some of the members of the society who had seen their value.

Having heard of each other's labours, MM. Niepce and Daguerre entered into a copartnery in December 1829, in order to pursue for their mutual benefit the study of heliography. The processes of the two artists were essentially different. M. Niepce used as the groundwork of his picture a thin film of a solution of asphaltum, dissolved in essential oil of lavender, and spread over the clean surface of a plate of silvered copper. After the plate was exposed in the camera for about five hours, the picture was developed by covering it with a mixture of *one* part of essential oil of lavender with *ten* parts of oil of white petroleum. The parts of the picture upon which the light fell being more soluble in proportion to its intensity, a positive heliograph was obtained. In order to produce a better effect, M. Niepce darkened the silver surface with a film of iodine, which no doubt suggested to Daguerre the use of that material.

Into this process M. Daguerre introduced considerable improvements; and in the course of his investigations he discovered an entirely new photographic process, in the success of which M. Niepce did not live to share. He died in July 1833; and soon afterwards a copartnery was formed between his son, M. Isidore Niepce, and M. Daguerre, in which it was admitted that the process discovered by the latter was essentially a new one, and should be called the *daguerreotype*, after its inventor.

In order to reward the eminent inventors of heliography, M. Arago, who had been previously entrusted with the secret of the daguerreotype process, induced the French government to give Daguerre an annual pension of 6000 francs (L.250), and to Niepce a pension of 4000 francs (L.166); and a bill for this purpose was unanimously passed by both chambers, and signed by the king on the 15th June 1839. In proposing this measure to the Chamber of Deputies, M. Arago stated that "*France had adopted the discovery, and that from the first moment she had cherished a pride in liberally bestowing it* A GIFT TO THE WHOLE WORLD." Notwithstanding this declaration, M. Daguerre risked his public character in selling his invention to Mr Miles Berry, to whom the officers of the crown in England granted a patent in the face of a remonstrance by a few individuals who had the manliness to oppose it. England was thus restrained for eight years from the use of this important process; but the specification was afterwards found defective, and the patent invalidated. It is a curious fact, that Mr Talbot's patent for the sister art of the talbotype was also invalidated by an English jury; and it will never be forgotten in the history of art, that the rights of property over the two noblest inventions of the age, which the patent laws were enacted to secure, were wrested from their owners by the unjust decisions of an English jury, prompted by the selfish interests of individuals who had been fattening on the genius of the inventors.[1]

While these two ingenious Frenchmen were occupied with heliography, Mr Henry Fox Talbot was, as we have already stated, occupied with the same subject. On the 30th January 1839, six months before M. Daguerre gave his process to the world, Mr Talbot communicated his discovery to the Royal Society; and in the following February he published his process of *photogenic drawing*, to which he afterwards gave the name of *calotype*, which his friends changed to *talbotype*, in imitation of the example set by those of Daguerre. In this process he made paper sensible to light by nitrate of silver, and fixed the image by common salt.

About the same time (in April 1839) the Rev. J. B. Reade was led by Mr Talbot's paper to delineate objects of natural history by the agency of light, from their images taken by the solar microscope. He washed writing-paper with a strong solution of nitrate of silver, and immediately before using it he washed it with an *infusion of nut-galls, and while it was wet* he received upon it the microscopic images. These pictures were fixed by *hyposulphite of soda*.

On the 29th May 1839, our countryman Mr Mungo Ponton announced to the Royal Scottish Society of Arts, that paper soaked in a saturated solution of bichromate of potash became of a deep orange tint when exposed to the sun; so that in copying upon it dried plants or engravings a negative picture of them was produced. These negatives are dark orange on a yellow ground, and may be fixed by immersion in water, which readily dissolves the portion of the salt not acted upon by the light. This important discovery led M. E. Becquerel to his photographic paper with iodide of starch, Mr Hunt to his chromatype, Mr Sella of Piedmont and Mr Pouncey to their processes, and Mr Macraw of Edinburgh to one of great value. The photographic property of this salt is also the foundation of Mr Paul Pretsch's photo-galvanography, of Mr Talbot's photoglyptic process, and of some attempts at photo-lithography.

Notwithstanding the beauty of some of the pictures obtained by Mr Talbot with the process which he had published, the art was but in its infancy. The discovery of a more sensitive process was necessary; and after much experimental research, he was led to the valuable photographic method which he secured by a patent, sealed on the 8th February 1841. Mr Talbot subsequently took out a patent for an instantaneous process, a patent for photographic engraving, and, more recently, another for what he calls the *polygliptic* process, which promises to be of great value.

The talbotype process, after it became accessible to the public, underwent numerous improvements by Herschel,

[1] We of course suppose that Daguerre's invention had been justly secured by patent in England before he had been rewarded by the French government.

Photography.

Cundell, Bingham, Channing, Le Gray, Martin, Muller, Stewart. Hunt, Fyfe, Furlong, Blanquart, Everard, Collen, Ryan, Woods, Horne, Sagnez, Flacheron, and others; but the most important improvements were made by M. Victor Niepce and Mr Scott Archer, who introduced into photography, the one the use of albumen, and the other that of collodion, as substitutes for paper. A brief account of the most important of the photographic processes will exhaust the space allotted to us for this article.

Art. I.—*Account of the Daguerreotype Process.*

A plate of copper is coated with silver, and polished in the highest degree by means of animal charcoal and spirits of wine, or tripoli and essential oil of lavender. It is then rendered sensitive to light by the vapours of iodine or bromine, either separately or combined in various proportions, after it has been coated with the vapour of iodine. This is done in a box, the bottom of which is strewed with iodine, covered with a little sand or a card; and the plate is held above it till it has a fine *straw-yellow* colour. In order to accelerate the action of light upon this film, the plate is exposed to the vapour of bromine water till it attains a rose colour.

When the plate, thus prepared, has been placed in the camera, and received an impression from the figure or landscape to be photographed, it is put into a dark box, containing mercury, having in it a little pane of yellow glass, through which the surface of the plate can be seen. By the application of heat, the mercury rises in vapour, adhering to the lights of the picture in proportion to their intensity, so that the shadows are represented by the polished surface of the silver. When the picture, as seen through the yellow pane, is completely developed, it is fixed by immersing it in a solution of hyposulphite of soda; and when this salt has been completely removed by water, a solution of a salt of gold (the double hyposulphite of soda and gold introduced by Fizeau) is poured upon the picture, so as to cover it, and the gold is then burnt in by the heat of a strong spirit lamp. The picture is thus brought out with singular brilliancy. The plate is then washed and dried, and is ready to be put into its case or frame. When the surface of the silvered plate reflects white light, the shadows become white, and the lights dark, thus forming a *negative* picture; so that, in order to see a daguerreotype picture in perfection, the polished surface should reflect to the eye of the observer the darkest objects.

Great improvements in the practice of the daguerreotype have been made by Daguerre himself,[1] Mr Claudet, Mr Hunt,[2] Fizeau, Goddard, Bingham, Guerin, Seguier, and others.

The theory of the daguerreotype is still in its infancy. Much light has been thrown upon it by Mr Claudet,[3] Edmund Becquerel, Hunt, and Shaw.[4]

Art. II.—*Account of the Talbotype Process.*

In Mr Talbot's first process of 1839, a sheet of smooth and good writing-paper was dipped in a weak solution of common salt, and after being wiped dry, one of its surfaces was brushed over with a solution of nitrate of silver; namely, a saturated solution diluted with six or eight times its volume of water. When the leaves of flowers or engravings are laid upon the nitrated surface of this paper after it is dried, covered with a glass plate, and exposed to the sun, very perfect images of these objects will be obtained in a short time. As the light blackens the parts of the paper exposed to it, the pictures are delineated in *white* in place of *black* lines, or are *negative* pictures. For the same reason, the images of persons or of landscapes formed by the camera obscura upon nitrated paper will be negatively delineated. In order to *fix* these pictures, Mr Talbot at first washed them in a highly-diluted aqueous solution of iodide of potassium; but he afterwards used in preference a strong solution of common salt. When the negatives thus obtained were placed upon another sheet of paper prepared as before, a positive copy was produced, in which "the lights and shadows were brought back to their original disposition."

Mr Talbot's second and more perfect process, to which we have already referred as the one patented in 1841, is as follows:—Wash one side of the paper with a solution composed of 100 gr. of *nitrate of silver* in 6 oz. of distilled water, by means of a soft camel-hair brush. When dry, immerse it in a solution of *iodide of potassium*, consisting of 50 gr. in a pint of distilled water. The paper is then to be dipped in water, and dried, either by heat, blotting-paper, or spontaneously.

When a sheet of this paper is to be made sensitive for use, wash it with the following solution, which may be called No. 1:—Dissolve 100 gr. of nitrate of silver in 2 oz. of distilled water, and add one-third of its volume of strong *acetic acid*. Make another solution (No. 2), by dissolving crystallized *gallic acid* in cold distilled water, and mix the two solutions together in equal proportions when they are required for use. This mixture—*gallo-nitrate of silver*—is then spread by a brush on the nitrated side of the iodized paper, which, when it has absorbed the solution, should be dipped in distilled water and then dried, first with blotting-paper, and afterwards by heat. In this state it is ready for use, and should be used within a few hours.

After the paper has received the impression of a figure or landscape in the camera, it is taken to a dark room, and may appear either with or without the trace of a picture. In either case the picture, which is a *negative*, is developed by brushing it over with the *gallo-nitrate of silver*. When it is sufficiently distinct, it must be dipped in water, then partly dried by blotting-paper and afterwards fixed by washing it with a solution of *bromide of potassium* (or a strong solution of *common salt*), consisting of 100 gr. of the salt dissolved in 8 or 10 oz. of water.

From this *negative*, positive pictures are obtained by the processes described in art. xvi.

Art. III.—*Account of the Albumen Process.*

The great defect of the talbotype was in the use of paper as the material. M. Niepce de St Victor, in 1848, substituted for it a film of *albumen* spread upon glass. The following is the process by which Messrs Ross and Thomson have produced their splendid photographs[5] (15½ inches by 15½), which have excited so much interest. The whites of several eggs, having 18 drops of a saturated solution of iodide of potassium added for each egg, are beaten up into a large mass of froth, and allowed to stand for ten or twelve hours till the whole falls into a liquid. It is then poured plentifully over a plate of glass (which, by means of a bent wire and a piece of worsted thread, is made to revolve at a moderate rate before a clear fire), till, by the influence of the centrifugal force, a very perfect film of albumen is spread over the glass. When the albumen begins to crack at the edges, the plate is withdrawn from the fire, and appears covered with minute cracks over the whole of its surface. It is now dipped in a solution of nitrate of silver (70 grains to an ounce of water), having in it a twentieth part in quantity of strong acetic acid. When taken out, it is washed once or twice with water, and before it is dry, the picture may be taken on it. If the object is a light one, four minutes will be sufficient to impress the image; but anything red or green will take longer time. The picture is developed by pouring on the albumen a saturated solution of gallic acid, and spreading it with a piece of cotton wool. The negative will then appear slowly and gradually of a reddish colour, and when brought out as far as it will come, a little of the nitrate of silver solution, mixed with gallic acid, is spread over it with a piece of clean cotton wool. It now becomes darker and more distinct, and when fixed with hyposulphite of soda, and washed with clean water, positive pictures may be taken from it in the usual manner.

The albumen process is not suited for portraits, on account of the time required to take the picture, but its sensibility may be increased by the addition of grape-sugar or honey. M. Niepce, in place of albumen, has proposed to employ 70 grains of starch rubbed down in 70 grains of water, and then mixed with 3 or 4 oz. more of water. After adding 5½ grains of iodide of potassium, the whole is boiled till the starch is dissolved. When laid upon glass, it is said to give films of great sensibility.

For architectural subjects, and for still life, the albumen process comes nearest to the daguerreotype in delicacy.

Albumen positives upon glass.

We are not aware that this art has been to any extent practised either in this country or abroad. The following new process has been just published by R. M. Grier:—"A plate coated with asphalt varnish, known in Prussia by the name of *eisenlack*, diluted with rectified benzole or benzine (first product obtained by distillation of coal tar at a low heat), and when barely dry, and still slightly sticky, was placed in contact in the pressure-frame with a negative on albumen, and exposed to the direct rays of the sun for half an hour. On removal from the pressure-frame, the plate was breathed on over its whole surface, until the image became distinctly visible, the parts changed by the action of light absorbing moisture, and those covered by the blacks of the negative remaining unchanged, and repelling it. In this state, the image being distinctly visible

[1] See *Comptes Rendus*, &c., April 1844.
[2] *Manual of Photography*, 5th edit., 1857, p. 184.
[3] *Phil. Trans.* 1847.
[4] Hunt's *Manual*, p. 189.
[5] These photographs represent Edinburgh as seen from the Calton Hill, the interior of Holyrood Chapel, two views of Melrose Abbey, the Golden Gate of St Andrews cathedral, the north door of Dunfermline cathedral, Bonaw, and Benvenue.

Photography.

it was quickly covered by the bronze powder known as *aurum musivum*, which at once changed the almost invisible image to a direct positive on black and gold, the gold adhering to the parts that had been protected from the light, and not adhering to those where the actinic rays had effected such a change in the molecular structure of the film as rendered them capable of absorbing moisture, thus producing a complete picture detailed in all its parts," which the editor of the *Photographic Journal* pronounces to be "a great novelty, and well worthy of attentive inspection."

The *eisenlack* used by Mr Grier is made as follows:—"To 176 lb. of asphalt, melted over a charcoal fire in a pear-shaped iron vessel, is added 279 lb. of oil of turpentine, and 16 lb. of well-boiled linseed oil well heated, the asphalt having been allowed to cool down as far as possible without becoming solid. The whole is then incorporated and heated until perfectly liquid." It resembles treacle when cold, and when diluted with benzine, and made to flow over the plate, it gives a film of a dark amber colour as really transmitted.[1]

ART. IV.—*Account of the Wet Collodion Process.*

The use of collodion, first suggested by M. Le Grey, was introduced by Mr Archer in 1850. It is the most valuable, the easiest, and the most sensitive of all the photographic processes, the daguerreotype and the albumen process being the most difficult. The number of first-class daguerreotypists has been very small, and we believe the albumen process has been practised professionally by no British photographers but Messrs Ross and Thomson; while the collodion process is universally employed.

Collodion process for negatives.

Collodion is a fluid like sherry, and is made by dissolving 15 grs. of gun-cotton in a mixture of *nine* fluid ounces of rectified sulphuric ether, and *one* ounce of alcohol, 60° overproof. The gun-cotton is made by mixing 70 gr. of fine selected cotton with water, nitre, and sulphuric acid, in the proportions of 3, 4, and 5 oz. When the cotton has been stirred and washed in this bath with two glass rods, it is taken out, and when freed from every trace of acid by copious washing in boiling water, it is hung up to dry. After the cotton, thus prepared, is put into the mixture of ether and alcohol above mentioned, it will be almost wholly dissolved, with the exception of some fibres which fall to the bottom. To the collodion thus made add 5 gr. of iodide of potassium, or iodide of ammonia, dissolved in the smallest quantity of alcohol, and also about 3 oz. of sulphuric ether, to make it run freely over the plate of glass. The sensibility of the collodion may be increased by dissolving a few grains of iodide of silver in the iodide of potassium, the superfluous iodide being allowed to settle before using it.

Six operations are necessary for obtaining a negative picture:—

1. The plate of glass (patent plate is the best) must be freed from stains, grease, &c., by a mixture of 2 dr. of cyanide of potassium, 2 dr. of tripoli, and 2 oz. of water, the tripoli being added to the solution of the other two. Cloths free from soap or grease must be used with the mixture, and when the plate is perfectly clean, particles of dust must be removed by a piece of chamois leather.

2. In order to coat the plate, it is held horizontally in the left hand by a corner, while the right hand pours upon its centre a pool of collodion sufficient to cover the whole surface. The plate is then inclined, to make the fluid run to one of the nearest corners, and then to the other two, the superfluous collodion being drained off into a bottle by the last corner which it reached. When a solid film has been left on the plate by the evaporation of the ether, it is ready to be excited, or made sensitive.

3. The exciting fluid recommended by Mr Thornthwaite is composed of

Nitrate of silver, fused..... 6 dr.	Alcohol.........................12 oz.
Iodide of potassium .... 3 gr.	Distilled water .... 2 dr.

Dissolve the *six* drams of the nitrate in $1\frac{1}{2}$ oz. of the distilled water, and the 3 grains of the iodide in 1 dram of distilled water; mix the two solutions, and shake them well together until the precipitate which is first thrown down is re-dissolved. When this takes place, add the remaining $10\frac{1}{2}$ ounces of the distilled water, and the 2 drams of alcohol." This solution is poured into a *dipping-bath*, and the coated plate is immersed "steadily and unhesitatingly" into the fluid, and kept there from *two* to *four* minutes,—for two minutes when the temperature is 60°, and longer at lower temperatures, but always rather longer than shorter. After it has been immersed half a minute, the plate should be lifted out of the liquid two or three times, and as often replaced, to get rid of the ether on its surface. These operations are performed in a room lighted only through an orange or red pane of glass.

4. When the plate has been lifted out of the solution, and the liquid drained off into the bath, it must be placed wet in the camera, and kept there for a sufficient number of seconds, which experience only can determine, depending on the intensity and character of the light, and on the sensitiveness of the film, which is so great that in fine weather, and in a well-lighted studio, the picture can be taken *instantaneously*.

5. The best developing solution, according to Mr Thornthwaite, is obtained by mixing and filtering the following materials:—

Pyrogallic acid. ... . 5 gr.	Glacial acetic acid .... 1 dr.
Distilled water .... 5 oz.	Alcohol .... $\frac{1}{2}$ dr.

Having added to a sufficient portion of the above mixture ($\frac{1}{2}$ oz for a plate 5 inches by 4) 12 drops of a solution of nitrate of silver, consisting of 50 gr. in an oz of water, pour it quickly over the surface of the plate till the picture is completely developed. When this is done the solution must be poured off, and the surface, when held horizontally, washed by pouring water over it.

6. In order to fix the image, which is done by removing the yellow iodide of silver, pour over the surface a solution of *hyposulphite of soda* of the strength of 4 oz. in a pint of water. Every trace of the hyposulphite must then be washed away by pouring water copiously over the picture. The plate must now be varnished, either by spirit varnish or by Dr Dymond's varnish, consisting of amber dissolved in chloroform.

With the negative picture thus prepared positives may be obtained, as shown in art XVI.

This process is, we think, the most important in photography. When collodion was first introduced, it was shown by Mr Horne that the *negative* pictures could be converted into *positive* ones by mixing a small quantity of nitric acid with the pyrogallic, and Mr Fry subsequently proved that a better effect would be obtained with the protosulphite or protonitrate of iron When

Collodion process for positives on glass.

Protosulphate of iron . ...10 gr.	Distilled water . ... 1 oz.
Nitric acid ... . 2 dr.	

are mixed, pour it over the plate to develop the picture. When one part of the protonitrate, with three of water, is used instead of the protosulphate, a fine clear picture is produced.

When the negative picture has been developed by either of the above solutions, a mixture of pyrogallic acid and hyposulphite of soda is immediately poured over, and when it has been slightly warmed, the darkened parts will become of a bright white by the formation of metallic silver. The picture must then be placed upon black velvet.

Mr Hennah, in producing positives, uses a thinner collodion than usual, excites with the ordinary bath, and exposes the plate not more than half the time necessary for a negative. The picture is brought out by immersing it in a bath containing

Protosulphate of iron ...40 gr.	Acetic acid............ ....30 gr.
Nitric acid .... 2 drops	Alcohol .. .. 1 oz.
Distilled water .... 1 oz.	

The pictures are then fixed, as is usual, with hyposulphite of soda.

Mr Archer has obtained delicate white pictures by treating the negative picture, when fixed and thoroughly washed, in the following manner;—Take a saturated solution of the bichloride of mercury, and after diluting one part of it with six of water, pour a small quantity over the picture at one corner, so as to make it flow uniformly over the surface. The tone of the picture will be immediately deepened, and though the positive image has nearly disappeared, yet a peculiar whiteness will immediately supervene, and a fine, delicate, white, positive picture will emerge, its negative character being wholly destroyed. It is singular, however, that this picture can be changed to a deep-toned black negative, very much darker than the original one, "by immersing it after a thorough washing in a weak solution of hyposulphite of soda, or of ammonia." "It is very singular," as Mr Hunt remarks, "that the picture can be alternately changed from a *white positive* to a *black negative* many times in succession, and very often with improvement."

A new method of taking collodion pictures on glass, by Mr William Ackland, is well worthy of the attention of photographers.[2] He iodizes his collodion with the following mixture:—

Iodide of potassium	12 gr.
Solution of iodine, (4 gr. in 1 oz. of alcohol)	4 drops.
Alcohol	1 oz.

and it must be mixed with the collodion at least 12 hours before it is used, in order to allow any sediment to subside. He develops the latent picture with

Protosulphate of iron ... .2 dr.	Glacial acetic acid .... 2 dr.
Nitrate of barytes...........$1\frac{1}{2}$ dr.	Alcohol .... 3 dr.
Rain or distilled water ....10 oz.	

[1] See *Journal of the Photographic Society*, Nov. 22, 1858, p. 87.

[2] This method is elaborately explained, and occupies *thirteen* closely-printed pages in Mr Thornthwaite's *Guide to Photography*, 14th edit., 1857.

Photography.

And he fixes with one scruple of cyanide of potassium (a poison), dissolved in 8 oz. of rain or filtered water.[1]

When the picture has been fixed and dried it is varnished on the collodion side, and when this is dried it may be placed in a frame with a black velvet or cloth ground to form the positive shades. In place of using the black velvet back of the frame or case, it is usual to cover the *glass* side, not the *collodion* side, of the picture with a black varnish. In this case the sides of the portrait are reversed, anything on the right side appearing as it were on the left; so that the picture is not an accurate representation of the sitter. A soldier, for example, without his right arm, would appear to have lost his left arm; and a sitter blind on the left eye would appear blind on the right one. To avoid this, the black varnish may be applied on the collodion side after the application of the transparent varnish.

Transference of collodion positives to paper, &c.

The art of transferring collodion positives from the glass plate to glazed cloth or leather has been practised in Paris for a long time, and is now becoming more common in this country. As the pictures thus produced may be sent by post, and resist various kinds of injury, the art has become a very important one.

Sir W. Newton was the first who transferred collodion positives to paper. He passed over the collodion picture a varnish composed of 1 oz. of pure gum mastic dissolved in 8 fluid oz. of alcohol, and 2 drams of oil of poppies. A piece of thin paper, a little smaller than the glass, and saturated by a camel-hair pencil in the same varnish, is then placed in contact with the collodion film, so as to exclude air, and the whole is allowed to become dry by evaporation.

The following is the simplest method of transferring the picture to leather or cloth. Dry the glass plate, and having poured spirits of wine upon it, allow it to drop; then take the black leather or cloth (which may be glazed or not), and damp it uniformly with spirit of wine. Lay this on the picture, and pass the hand over it so as to expel air-bubbles, if there are any. Then turn over the plate, and observe if there are any air-bubbles beneath the collodion. Lay the plate on a flat surface with the glass side uppermost, and apply pressure with suitable weights for half an hour. After this operation the collodion picture will be easily detached from the glass plate. Mr Ostell of Carlisle adds 4 or 5 drops of nitric acid to half an ounce of spirit of wine, and he pours this over the positive collodion picture after it has been dried at the fire or otherwise. It is then laid on the leather or cloth, the air-bubbles expelled, and pressure applied for about half an hour, by placing the combined plate and leather in the printing-frame. By holding the glass side to the fire it will be seen when the glass is leaving the collodion film. Mr Ostell recommends a stronger film of collodion, having either more gun-cotton in it, or made stronger with a few drops of the nitrate bath. The picture may be transferred to paper by means of a varnish.

Mr Ross of New York pours upon the collodion, when it is still wet from the fixing, a solution of sulphuric acid diluted to three degrees, and leaves it for one or two minutes. The cloth is then heated till it is soft and pliable, and while there is still a thin stratum of humidity upon the collodion, the film is applied to the cloth, and any bubbles of air driven off by passing the finger lightly over it. It is useful to wet the cloth with a little alcohol before it is applied. One of the corners of the film is then raised to see if it adheres, and if it does not, a stream of water is passed between the glass and the film thus raised to produce their separation.

Mr Howell of Ashtabula, Ohio, prepares the glass plate by coating it with a thin film of wax. The picture is then taken in the ordinary way, and after it is fixed, washed, and dried, it is "covered by flowing" with a black varnish, made more adhesive by a little Canada balsam. When the varnish is nearly dry, the paper (previously cut to shape, and soaked in water) is laid on and pressed into close contact with the varnish by means of a small roller covered with a cushion of cloth.

Art. V.—*An Account of the Dry Collodion Process.*

Although the wet collodion process possesses a high degree of sensibility, yet it loses it upon the drying or consolidating of the film. This is a great disadvantage to the travelling photographer, or to any person who takes a picture at a distance from his studio; and in order to remedy the evil, he must either take a portable tent with him, admitting only yellow light, or employ one of those ingenious cameras which will enable him to excite the plate, and develop the picture in the interior of the instrument.

One of the earliest methods of preserving sensitive collodion plates was employed by Messrs Spiller and Crooks, who used nitrate of magnesia and nitrate of zinc, which, by their deliquescent properties, keep the plate of collodion slightly moist. When the plate of collodion has been excited in the nitrate bath for five minutes, it is then drained, and immersed in a bath consisting of—

Nitrate of magnesia......... 4 oz	Glacial acetic acid .... 1 dr.
Nitrate of silver...............12 gr.	Water ....12 oz.

where it is left five minutes, and then drained for about half an hour, by placing it upright upon blotting-paper. Plates thus prepared have been kept three weeks without deterioration. The picture is developed as in the wet process.[2]

Mr Shadbolt employs a syrup of 3 volumes of pure honey and 5 volumes of distilled water, stirred with a glass rod till the honey is dissolved. One volume of alcohol is added to it when it has been filtered (a work of some hours) through blotting-paper. A portion of this syrup is poured two or three times over the collodion when it has been excited in the usual way. Glycerine has been used in place of honey by Mr Llewellyn, Mr Pollock, and other photographers. Mr N. Maskelyne seems to have first discovered it.[3]

Barnes' *dry collodion* is thus composed:—

Plain collodion .... 4 oz.	Camphor.... .... 4 gr.
Solution of iodide of potassium...... .... 5 dr.	Etherial tincture of chloride of gold ....10 drops.
Pyro-acetic spirit, purified, 4 dr.	Tincture of iodine......... 2 dr.

To this mixture 1 oz. of old collodion and 4 oz. of new should be added, to give it firmness. Plates thus prepared have acted well at the end of six weeks.

The following process for dry collodion has been successfully used by M. Dupuis, officer of health to the French army of occupation at Rome:—The collodion is formed of

Ether, sp. gr. 60,...80 cubic centilitres.	Gun-cotton ......1 gramme.
Alcohol, do. 36,...40 do. do.	Iodide of zinc ...1 gramme.

The exciting bath consists of

Fused nitrate of silver. .10 gram.	Distilled water ....150 gram.

Acetic acid of commerce......15 gram.

The developing solution consists of

Pyrogallic acid........... 1 gram.	Distilled water ....300 gram.

Citric acid, crystallized.........1 gram.

Plates thus prepared by M. Dupuis at Rome on the 6th of May 1857 were brought to London by Sir David Brewster, and developed there on the 27th of June. Some had received the picture at Rome, and others were only prepared. After being kept fifty-one days, the plates gave very fine pictures.

The following dry collodion process, given by the Rev. J. Lawson Sisson, has been regarded by competent judges as both simple and certain:—Having placed four dishes in a row, pour distilled water into Nos. 1, 2, 3, sufficient to cover a plate. Into No. 4 pour a mixture of half an oz. of raspberry syrup and 3 oz. of distilled water. A plate of collodion, made sensitive in the ordinary way, is put, with the collodion side upwards, into No. 1. A second sensitive plate is prepared, and when ready, the plate is removed from No. 1 and placed in No. 2, and the second plate is placed in No. 1. A third sensitive plate being ready, plates 1 and 2 are moved on to the next dishes, and plate 3 placed in dish No. 1. In like manner, when a fourth plate is prepared, plate 1 is placed in the syrup dish No. 4; the others are moved onward, and plate 4 placed in dish No. 1. After preparing a fifth plate, plate 1 is lifted from the syrup dish, and is then placed upright upon blotting-paper to drain and dry. In this order the process is continued, the time required for coating and making sensitive a plate being exactly the time during which any plate should continue in one of the four dishes. Plates thus prepared are as sensitive and will keep as long as any of those prepared by the existing keeping processes.

One of the best dry processes is that of Dr Hill Norris, who roughens the edges of the glass to the extent of 1-12th of an inch and pours upon it collodion rather old, made with

Rectified ether .... 5 dr.	Soluble cotton .... 5 gr.
Absolute alcohol .... 5 dr.	Iodide of potassium .... 5 gr.

the iodide being dissolved in 5 drops of water, and added to the collodion. Immerse the plate in a 36-grain solution of nitrate of silver, perfectly saturated with nitrate of silver; and, when well washed and dried vertically, cover its surface with a solution of 9 grains of pure gelatine (Nelson's patent) in 1 oz. of water and ¼th oz. absolute alcohol. When dried quickly, the plate will keep sensitive for six weeks. Before developing, cover the plate for a minute or two with distilled water, and then develop it well with a saturated solution of gallic acid in water, to every ounce of which 10 minims of a 40-grain neutral solution of nitrate of silver has been added. The development usually occupies from two to four hours.[4]

[1] See *Phot. Jour.*, vol. v., p. 10, Aug. 21, 1858.

[2] See *Phil. Mag.*, May 1857; and *Phot. Jour.*, i., p. 223, and ii., p. 6.

[3] *Phot. Jour.*, vol. ii., p. 273. Mr Pollock adds 6 drops of glycerine to 1 oz. of collodion (ibid., p. 309).

[4] See *Phot. Jour.*, ii. 151, and iii. 84, 179.

M. Müller of Bolbec has given a dry collodion process in which he forms *two* solutions,—the *first* of albumen in distilled water, with 10 to 12 drops of *creosote:* the *second*, of honey, 250 grammes, animal charcoal, 5, and water, 100. These two solutions are mixed, every 20 of the first with ten of the second, and applied to the collodion film when excited. Plates thus prepared retain their sensibility more than a month.[1]

Art. VI.—*Account of the Oxymel Process.*

The oxymel process, as first proposed by Mr Llewellyn, has been published in many of our treatises on photography, and has undergone various modifications by himself and others[2] After much experience of the process, Mr Llewellyn has, so recently as August 1858, published the following as his process:—An excited collodion plate, washed in two or three waters, is plunged for a few seconds into a bath containing

Bromide of potassium ...... 5 gr.	Alcohol .... $\frac{1}{4}$ dr.
Water .... 1 oz.	

When all traces of the free bromide have been washed away for about five minutes in several waters, the plate is excited, and the film preserved by the following solution:—

Ordinary oxymel[3]. .... $\frac{1}{2}$ dr.	Citric acid .. .. $\frac{1}{2}$ gr.
Water .... 1 oz.	Nitrate of silver .... $\frac{3}{4}$ gr.

which is poured on and off the film two or three times, after which the plate is placed vertically to drain and dry. One ounce will be sufficient for many plates, 10 × 12. It must be kept from white light. It will keep for a day or more. Before developing, the film should be moistened with water, and the ordinary pyrogallic solution, with a few drops of an 8-grain solution of nitrate of silver, used to develop the picture.

Art. VII.—*Account of the Collodio-Albumen Process.*

This process, invented by M. Taupenot, consists in first collodionizing the plate, dipping it in the silver bath, washing it with distilled water, and pouring over it albumen iodized in the proportion of $1\frac{1}{2}$ per cent. The plate is then placed upright to drain and dry. The plate is excited during ten or twenty seconds in the aceto-nitrate bath, containing 10 parts of nitrate of silver, 10 of acetic acid, and 100 of distilled water. The albumen used by Taupenot consists of

Honey .... 10 parts.	Iodide of potassium...... $1\frac{1}{2}$ part.
Albumen............ ....100 parts	Yeast . .. . a little.

After fermentation, the liquid is filtered, and stored in bottles containing only from three to six fluid ounces.

The defect of this process is the production of blisters in the film at the time of exciting. M. Julien Blot prevents the blistering by the use of dextrine, which "permits the baking of the albumen without altering at all its iconographic properties, and gives the possibility of restoring the albumen film, if cracked by the heat, to its normal condition, by cooling, or by breathing over it." The plate will remain sensitive for eight days in winter.

For an elaborate account of Taupenot's process, we must refer the reader to the *Photographic Journal*, vol. iii., p. 102, which contains an able article by a French photographer. This article is followed by a long and valuable paper on the same process by Mr William Ackland.[4] A variation of this process by Mr Fothergill, in which no honey is used, will be found in the *Photographic Journal* for September 1858.[5]

Art. VIII.—*Account of the Wax-Paper Process.*

This process, which has been used with great success by M. Le Gray and Mr Roger Fenton, is one of considerable interest. The best paper is that made by M. Lacroix of Angouleme, or the Messrs Canson Brothers of Annonay. It is laid on a metallic plate, which is rubbed over while hot with a cake of pure white wax, and when it has absorbed the wax uniformly, it is placed between some sheets of smooth bibulous paper, and smoothed with a moderately hot iron till it becomes equally transparent throughout. It is then iodized by immersing it for ten minutes in a bath thus composed:—

Iodide of potassium .... 4 dr.	Honey .... 1 oz.
Bromide of potassium ...... $\frac{1}{2}$ dr.	Distilled water .... 1 pint.
Iodine..................... ...... 4 gr.	

After being drained and dried, it is excited by the following aceto-nitrate:—

Nitrate of silver.. .. .. 3 dr.	Animal charcoal . ... . 2 scr.
Glacial acetic acid.. ... ... 3 dr.	Distilled water . . . 8 oz.

After exposure in the camera for eight minutes, when the lens is 14 inches in focal length, and the stop half an inch, the picture is developed by immersion in a saturated solution of gallic acid in 20 oz. of distilled water, and when well washed, it is fixed by the usual hyposulphite. The transparency, if diminished, may be restored by holding it before a moderate fire.[6]

Mr Hunt[7] gives the following formula from Le Grey for iodizing the paper:—Into $5\frac{1}{4}$ pints of distilled water put 4000 grains of rice; steep them till the grains are slightly broken, so that the water may contain only the glutinous portion. In a little less than a quart of the rice solution dissolve

Sugar of milk . ...620 gr.	Cyanide of potassium.... . 12 gr.
Iodide of potassium... .... 225 gr.	Fluoride of potassium...... 7 gr.

The wax paper is dipped in this solution, and drained and dried. It is excited by $77\frac{1}{2}$ (and for portraits by 150) grains of nitrate of silver dissolved in 2325 grains of distilled water, to which is added 186 grains of acetic acid. The picture is developed in a bath of 60 grains of gallic and 40 fluid oz. of distilled water, to which 15 or 20 drops of aceto-nitrate of silver is added. It may remain in it from ten minutes to two hours.

Dr Keith of Edinburgh iodizes with the following solution:—

Pure water .... 4 oz.	Sugar of milk . ...3 oz.
Iodide of potassium.........750 gr.	Common salt .... 30 gr.
Bromide of ditto ....250 gr.	Iodine .... 8 gr.

in which the thin paper (Canson Brothers' or Turner's for negatives) must be soaked for ten hours, and then hung up to dry. The paper is rendered sensitive by immersion for ten or twelve minutes in a bath containing the following solution—

Nitrate of silver ....360 gr.	Glacial acetic acid ...... 13 dr.
Water .... 12 oz	or citric acid . . 20 to 30 gr.

The strength of this bath must be kept up by adding two or three grains of the nitrate for every sheet rendered sensitive. When the sheet is well washed in a large basin of water, and the superfluous moisture blotted off, it is ready for use when required.

To develop the picture, place the sheet in a saturated solution of gallic acid, having one grain of pyrogallic acid added to 4 oz. of the solution. After it has remained four or five minutes, add 12 drops of the aceto-nitrate, agitating the bath to mix it. The development will require from twenty minutes to several hours. When well washed in several waters, the picture is then fixed by the hyposulphite of soda.

Art. IX.—*Account of the Metagelatine Process*[8]

M. Le Gray and other French photographers employed gelatine or isinglass in the calotype process on paper; but it is to Mr Maxwell Lyte that we are indebted for its application to collodion for a preservative process. It is a well-known property of gelatine that, after it has been dissolved in hot water, allowed to gelatinize, melted and again cooled, and this process repeated many times in succession, the jelly gradually loses its tenacity and continues liquid even while cool. In this altered condition Mr Maxwell Lyte gives it the name of *Metagelatine*, and has found it superior to all other substances as a varnish for preserving the collodion film in a dry state. In order to prepare it, "take $1\frac{1}{2}$ oz. of fine white gelatine, and dissolve it in 10 fluid oz. of boiling distilled water; then add 2 fluid drs. of strong sulphuric acid which has been previously diluted with $2\frac{1}{2}$ fluid oz. of distilled water, and boil these together gently for a quarter of an hour Take the vessel off the fire, and let it stand for twenty-four hours; then boil gently again for another fifteen minutes, and again remove it from the fire, and let it cool for an hour or two. Heat up the liquid once more to a boiling heat, and saturate the acid by adding powdered whiting till effervescence ceases. Separate the sulphate of lime which is thus formed by pressure in a linen cloth, and then stir into the liquid about a tea-spoonful of animal black, and filter once more through paper till perfectly clear. Add water to bring up the liquid to the bulk of 18 fluid oz., and then add two drops of creosote to prevent the liquid from becoming mouldy."

In order to prepare the preservative syrup, Mr Lyte takes

Solution of gelatine.. ....5 oz.	Fine honey .... $\frac{1}{2}$ oz.
Distilled water..................5 oz.	

When the collodion plate is withdrawn from the nitrate bath, it must be held for an instant with its corner resting on blotting-paper. The syrup is then to be poured upon it like the collodion,

[1] See *Cosmos*, Nov. 12, 1858, p. 598.
[2] *Phot. Jour.*, vol. iii., pp. 24, 67, 109, 126; ibid., vol. iv., p. 9.
[3] Oxymel is composed of 10 oz. of honey, 1 oz. of water, and 7 fluid drams of glacial acetic acid.
[4] See *Phot. Jour.*, vol. iv.
[5] See vol. v., pp. 26 and 46.
[6] See Thornthwaite's *Guide*, &c., pp. 50–54.
[7] Hunt's *Manual*, &c., 5th edit., p. 85.
[8] See *Phot. Jour.*, vol. iii., pp. 223, 253, 287.

and run off at a corner. Fresh portions of syrup must then be poured on and off several times, till it takes evenly over the whole surface. When it is to be used in the camera it should be dipped in cold distilled water, and then excited, developed, and fixed in the usual manner.

ART. X.—*Account of the Bichromate Process—Chromatype, &c.*

We have already referred to the valuable photographic properties of bichromate of potash, discovered by Mr Mungo Ponton, and to the experiments of Becquerel and Mr Hunt to which it led.

The chromatype of Mr Hunt is founded on Mr Ponton's process, which we have already described. A solution of 1 dr. of sulphate of copper in 1 oz of distilled water, with ½ oz. of a saturated solution of bichromate of potash, is applied to the surface of good paper, which, when dried, is fit for use. It is changed to a dull brown by the action of light, and gives a negative picture if checked at this stage; but if the action of light is prolonged, the dull brown disappears, and we have a positive yellow picture on a white ground. "In either case," says Mr Hunt, "if the paper is removed from the sunshine, and washed over with a solution of nitrate of silver, *a very beautiful positive picture* results." In order to fix these pictures, the nitrate of silver must be removed by washing in *pure* water.

According to Mr Bingham, the paper is more sensitive by using sulphate of nickel in place of sulphate of copper. Another bichromate process, and a very valuable one, has been proposed by M. Joseph Sella of Biella in Piedmont, "following," as he himself observes, "the suggestions of Mr Ponton."

1. The paper, when immersed in a saturated aqueous solution of bichromate of potash, is dried in the dark between sheets of bibulous paper.

2. It is exposed in the camera about two-thirds of the usual time, and then immersed for half an hour in water, which must be changed three or four times.

3. It is then immersed for three or four minutes in a filtered solution of proto-sulphate of iron containing 5 gr. of the salt to 100 gr. of water. It is then washed in several waters, and soaked for half an hour.

4. The picture is then immersed in a solution of gallic or pyrogallic acid more or less concentrated, and in a few minutes the image will be developed, having a beautiful black tint bordering on violet, and one highly appreciated by artists.

If, instead of pyrogallic acid, we use the yellow prussiate of potash, the picture will be in Prussian *blue*; with acids, it will become *green*; and with alkaline solution it will become deeper, and border on violet. The process may be applied to albumen, gelatine, &c. Its advantages are, "economy of time and silver, ease of execution, certainty of result, and permanence of the picture."[1]

The following bichromatic process, by Mr William Macraw of Edinburgh, being an improvement on that of Sella, was communicated by Sir David Brewster to the British Association at Leeds in September 1858, and promises to be of great value, both from the extraordinary cheapness of the materials, and the permanence of the pictures which it gives. In proof of its excellence, we have now before us two beautiful photographs, one of a female figure, and the other of Sir Walter Scott's monument, which were shown to the meeting.

First, To 25 per cent. of a saturated solution of common salt add the white of eggs, to be well beaten up and allowed to subside; float the paper on the albumen for thirty seconds, and hang up to dry. *Secondly,* Make a saturated solution of bichromate of potash, to which add 25 per cent. of Beaufoy's acetic acid. Float the ordinary albumenized paper on this solution for an instant, and when dry it is fit for use. This must be done in the dark room. *Thirdly,* Expose under a negative, in a pressure-frame, in the ordinary manner, until the picture is sufficiently printed in all its details,—but not over-printed, as is usual with the old process. This requires not more than *half* the ordinary time. *Fourthly,* Immerse the pictures in a vessel of water in the darkened room; the undecomposed bichromate and albumen then readily leaves the lights and half-tints of the picture. Change the water frequently, until it comes from the prints pure and clear. *Fifthly,* Immerse the picture now in a saturated solution of protosulphate of iron in cold water for five minutes, and again rinse well in water. *Sixthly,* Immerse the pictures again in a saturated solution of gallic acid in cold water, and the colour will immediately begin to change to a fine purple black. Allow the pictures to remain in this until the deep shadows show no appearance of the yellow bichromate; repeat the rinsing. *Seventhly,* Immerse, finally, in the following mixture:—Pyrogallic acid, 2 gr.; water, 1 oz.; Beaufoy's acetic acid, 1 oz.; saturated solution of acetate of lead, 2 dr. This mixture brightens up the pictures marvellously, restoring the lights that may have been partially lost in the previous parts of the process, deepening the shadows, and bringing out the detail; rinse finally in water, and the pictures are complete when dried and mounted.

The advantages of this process may be briefly stated as follows:—*First,* As to its economy: bichromate of potash, at 2d. per oz., is substituted for nitrate of silver at 5s. per oz. *Secondly,* Photographs in this way can be produced with greater rapidity than by the old mode. *Thirdly,* The pictures being composed of the same materials which form the constituent parts of writing-ink, it may be fairly inferred that they will last as long as the paper upon which they are printed

The bichromate of potash is an essential element in the process of printing on carbon, invented by Mr Pouncey. Pictures thus printed have been submitted to the Paris committee, appointed by the Duke de Luynes to adjudge the prize which he has offered for the best process of producing permanent photographs;[2] and M. Gerard has found that the black material in them is truly carbon, and that they resist the prolonged action of concentrated nitrate and hydrochloric acids, aqua regia, cyanide of potassium, cyanide of potassium with iodine, and alkaline sulphides, none of which, though energetic agents, affected it in the least.

The following is Mr Pouncey's process, in so far as he has published it in his provisional specification of the 10th April 1858. He prepares the paper or other material which is to receive the picture by applying over its whole surface a composition of vegetable carbon, gum-arabic, and bichromate of potash. Upon this surface the negative is placed, and exposed to the light in the usual way. The positive thus produced is washed with water, which dissolves the composition at the parts on which the light has not acted, but does not affect the part on which the light has acted. Mr Pouncey sometimes substitutes for the vegetable carbon, bitumen or other colouring matter.

ART. XI.—*Account of Fothergill's Dry Collodion Process.*

This process has been much praised by practical photographers as simple in its application and perfect in its results. The object of the process is to protect the sensitive film from the action of the atmosphere by a varnish of albumen, which is done thus:—

Having coated the plate with collodion, place it in a bath of 35 gr. of nitrate of silver in an oz. of water, "saturated with iodide in the usual way;" and after it has been in half a minute, move it up and down, and when taken out pour lightly on it at one corner, *four drams only* for a stereoscopic size plate, of filtered water (a proportional quantity being used for larger plates), causing the water to flow freely all over the plate from 15 to 20 seconds, till all appearance of greasiness is removed. Having made a solution of albumen, consisting of 10 oz. of white of eggs, distilled water 6 oz, and strong liquor of ammonia 80 minims, agitated into a froth and strained for use, coat the collodion surface with this, letting it run several times from corner to corner, and having poured it off, place the plate in a dish of water, so as to cover it to the depth of 3-8ths of an inch. Wash it well with two waters, moving the dish backward and forward, so that the water may flow over the plate. When taken out, place it on end upon several thicknesses of blotting-paper, and put it in a dark place to dry. After exposure in the camera, moisten the picture with distilled water, and develop with

Pyrogallic acid	1 gr.	Alcohol	10 min.
Glacial acetic acid	20 min.	Distilled water	1 oz.

adding to each dram one or two drops of the silver bath.[3]

ART. XII.—*Account of the Salts of Iron Process—the Ferrotype and the Catalysotype.*

Under the name of the *energiatype,* Mr Hunt published an account of a process in which the salts of iron were used; but he afterwards adopted the more appropriate name of *ferrotype,* as applicable to all processes in which these salts were employed. Good paper is washed over with the following solution:—

Succinic acid, pure	5 gr.	Common salt	5 gr.
Water	1 fluid oz.	Mucilage of gum-arabic	½ dr.

The paper when dry is drawn over the surface of a solution of 60 gr. of nitrate of silver in one oz. of water. When dried in the dark the paper is of a pure white, and may be kept for a consider-

[1] *La Lumière,* June 7, 1857.

[2] MM. Garnier and Salmon have sent in competition for this prize positive photographs both in carbon and sulphide of mercury.

[3] This process, by Mr A. Keene, differs slightly from that of Mr Fothergill. (See *Liverpool and Manchester Phot. Jour.,* Aug. 1, 1858; and *Phot. Jour.,* Sept. 21, 1858.)

Photography.

able time in a portfolio, for use, carefully preserved from the least light. After exposure in the camera, the picture is developed by drawing the prepared side of the paper over a saturated solution of *protosulphate of iron* and 2 or 3 dr of *mucilage of gum-arabic*. The picture will appear almost immediately. The paper, when well washed, is fixed as usual.

Under the name of the *catalysotype*, Dr Woods of Parsonstown has given the following iron process :—A sheet of wove post is steeped for a few minutes in a mixture of *two* drops of hydrochloric acid in *three* oz. of water. When well wet, it is washed over with a mixture of half a dr. of the syrup of *iodide of iron, water* $2\frac{1}{2}$ dr., and *tincture of iodine* 1 drop. When dried with bibulous paper, it is washed over evenly, in the dark, with a 10 gr. solution of nitrate of silver in an oz. of water. The paper is now ready for the camera, and the sooner it is used the better. The exposure should be from *two* to *thirty seconds*, and in clear weather without sunshine, *fifteen seconds* on an average. The picture, invisible at first, develops itself "gradually till it arrives at a state of perfection, which is not attained by photography produced by any other process." The picture is then fixed with a solution of bromide of potassium, 15 or 20 gr. to the oz, and iodide of potassium, 5 gr. to the oz.

Dr Woods has more recently recommended the following formula, which gives a darker negative, and in which soaking in the hydrochloric solution is not necessary.

Syrup of iodine............ 2 dr. | Tincture of iodine...10 to 12 drops.
Distilled water . .. . 2 dr.

With this solution brush over the paper, dry it after a few minutes, and after exposure in the camera, wash it with 1 dr. of nitrate of silver in 1 oz. of pure water. Fix it after washing in a solution of iodide of potassium, 5 gr. to the oz. of water, and then wash it again.

ART. XIII.—*On the Nitrate of Uranium Process for obtaining Positives on Paper.*

This valuable process consists in substituting *nitrate of uranium* in place of nitrate of silver. M. Niepce de St Victor has described three methods of obtaining positive pictures with this salt,—viz., with nitrate of silver, and with the chloride and bichloride of mercury.

1. Dissolve 20 parts of the nitrate of uranium in 100 of distilled water, and on the surface of this solution, kept from light, float the paper (thin paper is preferable) for five minutes, and suspend it in the air free from light. When exposed under a negative from one to ten minutes in the sun, and from fifteen to sixty in the shade, the picture will be slightly visible, and may be kept in the dark one or two days before it is developed. In a bath of 6 parts of nitrate of silver in 100 of distilled water, immerse the picture rapidly, and it will be developed in thirty or forty seconds, having a grey sepia tint, which becomes brown when kept ten minutes in the bath. The proof is now to be washed in two or three waters, and will be permanent, because unassailable by boiling cyanide of potassium.

2. In using chloride of gold, immerse the picture in a bath of 2 grammes of chloride of gold in 1000 grammes of water, adding some drops of hydrochloric acid. The picture will appear instantaneously, its blue tone deepening into a black when the exposure to the sun has been double that which is required with the nitrate of silver. When developed withdraw it rapidly, wash it well, and fix it.

3. The bichloride of mercury gives to the picture grey-black tones, and the black of engravings. The paper prepared by the nitrate of uranium must be exposed *three* times as long as in the two preceding processes. It is then immersed in a bath of 100 grammes of ordinary water and of bichloride of mercury to saturation, at a temperature of 50° Fahr. After two or three minutes the proof loses its colour, and when it becomes white it is carefully washed, put into the silver bath, where it develops itself slowly, and in from ten to fifteen minutes arrives at a black. It is then washed in several waters [1]

M. Crespon of Nismes, M. Brebisson, and other photographers, have obtained very fine positives by this process; but M. Humbert de Molard has questioned its excellence and the permanency of the pictures produced by it; while M. Bayard asserts that he has produced as good and permanent pictures with the *ammonio-citrate of iron* and the nitrate of silver, or the chloride of gold.[2]

In the year 1855, at the meeting of the British Association in Glasgow, Mr C. J. Burnett described a new process for obtaining positives on paper by means of the nitrate or other salts of uranium. He exhibited specimens developed in four different ways: 1. By salts of silver, fixed by the hyposulphite of soda, and toned by an acid, neutral or alkaline, gold chloride bath, or by platinum palladiates or aurates. Paper thus prepared will keep very long in hot climates, especially if the picture is developed with salts of iron. One of Mr Burnett's specimens showed a radiation of actinism absorbed by a newspaper;[3] 2. By chlorides of gold, acid, alkaline, and neutral; 3 By ferrid-cyanide of potassium, tonable by a very weak iron bath, and 4. By the ferro-cyanide of potassium.

A uranium printing process, based on the fact that all bodies absorb light more or less, has been recently patented by Mr Wm. Clark. It is called "Photography by Absorption of Light," and is thus performed :—A sheet of paper that has been a number of days in the dark is impregnated by immersion in a solution of salt of uranium, which the patentee says "has the property of absorbing a very large quantity of light." He prefers a solution of the nitrate of the oxide of uranium. When of a nice straw-yellow colour it is dried, and kept in the dark. After exposure to the sun, under a negative, it is exposed for a quarter of an hour. The negative is removed, and the picture is brought out with a solution of 6 parts of nitrate of silver, and 100 of water. It is then fixed with water only. The chemical picture thus produced may be made black by a solution of chloride of gold, and red or blue by combinations of the salts of gold and silver [4]

In using the uranium process, M. Hagen obtains great sensitiveness by removing the size from the paper with boiling water. When pressed between sheets of blotting-paper, and still damp, it is floated on the uranium solution. Pictures of greater intensity are obtained by adding a little alcohol or ether to the silver salt.[5]

ART. XIV.—*Photography on Porcelain, Parian, Alabaster, Enamelled Glass, Ivory, and Enamelled Metals.*

So early as 1851 Mr Fox Talbot and Mr Malone took out a patent for taking negative photographs on semi-transparent unglazed porcelain, the results of which we have not seen. On the 14th July 1857 Mr Tunny and Mr Macraw exhibited to the Photographic Society of Scotland the results of processes, to which the one gave the name of *vitro-heliography*, and the other that of *vitrotype*. On the 5th November Mr Tunny communicated to the Photographic Society in Edinburgh the process by which he obtained portraits upon porcelain, parian, enamelled glass, and enamelled metal. A plate of any of these substances is coated with collodion and albumen, separately or combined. When collodion is used, excite the film in the ordinary nitrate bath. Lay the porcelain plate on its back in a vessel, cover the film with water, and lay the negative upon the film. It is next exposed for a second to diffused light, or for 5 or 6 seconds to gas-light; and the picture is developed by first pouring over its surface a solution of nitrate of silver, 12 gr to the ounce of water, acidulated with a few drops of acetic acid; and, second, by a solution of protosulphate of iron, 25 gr. to an ounce of water, with 25 drops of acetic acid. The picture will develop itself rapidly, and when complete it is washed copiously in water, and fixed as usual.[6]

Previous to Mr Tunny's communication, Mr Macraw had, on the 2d July, specified a patent, which he did not complete, for taking positives direct in the camera, on porcelain, china, earthenware, opal glass, ivory, bone, prepared wood, or white or coloured enamels. An unglazed slab of porcelain, coated with collodion, is excited in the nitrate of silver bath, and exposed in the camera. When taken into a dark room, the film is saturated with weak protosulphate of iron or pyrogallic acid, which is immediately washed off It is then momentarily exposed to subdued daylight or artificial light, and immediately treated with a developing fluid, when the latent image will appear as a positive, with the lights and shadows correct. The picture is then developed as usual. The picture thus obtained is left-handed; and in order to remedy this, Mr Macraw places a negative photograph of the object to be depicted on the porcelain at such a distance in front of the camera, with a mirror placed behind the image at an angle of 45°, as that a well-defined image is obtained on the porcelain.[7]

We have now before us two very fine female portraits, of great softness and delicacy, executed on porcelain by Mr Macraw.

In July 1857 Mr C. J. Burnett pointed out the importance of burning in photographic portraits in porcelain, and he described processes for this purpose, and exhibited specimens which he had produced by them.[8]

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1 *Phot. Jour.*, iv. 169, 200; *Comptes Rendus*, &c., xlv. 811; xlvi. 448, 489.
2 See *Cosmos*, Sept. 3, 1858, p. 277, and Oct. 1, 1858, p. 395.
3 See *Photographic Notes*, March and April 1857; and *Liverpool and Manchester Phot. Jour.*, Aug. 1 and Dec. 1, 1858.
4 *Phot. Notes*, vol. iii., p. 278, Dec. 18, 1858.
5 *Phot. Jour.*, vol. v., p. 75, Nov. 22, 1858.
6 *Phot. Jour.*, vol. iv., p. 88, Nov. 21, 1857.
7 See *Report of the British Association for* 1858.
8 *Phot. Jour.*, vol. iv, p. 15, Aug. 1857.

Photographs under the name of *alabastrine* have been advertised as a new discovery by Messrs Squire & Co. They are, however, only glass positives with another name, and are produced by what is called the alabastrine solution, the composition of which is a secret.

ART. XV.—*On the Recent Discoveries in Photography of M. Niepce de St Victor.*

Having exposed to the sun for a quarter of an hour an engraving which had been kept several days in the dark, he applied it to a sheet of sensitive paper, and after four hours' contact in the dark, he obtained a negative picture of the engraving. If the distance between the engraving and the paper is one-eighth of an inch, or if a film of collodion or gelatine is interposed, the picture will still be obtained, but not if the film consists of mica, glass, or rock-crystal. If we take an opaque tube, closed at one end, and lined with white paper, and expose the open end to the sun for an hour, and if at the end of twenty-four hours we place a sensitive paper on the open end of the tube, we shall obtain a negative image of the opening. If we place a sheet of white paper that had been in the dark in the camera, to receive for three hours a picture brilliantly illuminated by the sun, and having taken it out, apply it to a piece of sensitive paper, it will in twenty-four hours reproduce in the dark a very visible copy of the picture in the camera

This "persistent activity," or "storing up of light," as M. Niepce calls it, he exhibits in the following experiment:—A glass or paper negative having been placed on a sheet of paper that has been several days in the dark, he exposes it for a sufficient time to the sun's rays, and after taking out the paper in the dark, he develops the picture with a solution of nitrate of silver, and fixes it by merely washing it in pure water.[1]

In another Memoir, just published, M. Niepce has described another action of light, which opens up a new and immense field to photography, in so far as it proves that almost all chemical actions are fit to give photographic pictures. Take a solution of any soluble substance whatever, and impregnate with it a sheet of paper. Allow the impregnated sheet to dry in the dark; expose it under a negative to the sun, and having taken it out in the dark, treat it with any re-agent capable of transforming the soluble substance, or entering into combination with it, and we shall have a visible image, the chemical becoming a photogenic action. The process may be reversed with the same result, by impregnating the paper with the re-agent and developing with the soluble substance. The principal re-agents to be employed are the salts of gold and silver, the dyes of turnesol and curcuma, and iodide of potassium for common paper sized with soap. If nitrate of uranium is the soluble substance, and red prussiate of potash the re-agent, the picture will be of a fine blood-red colour, and will be fixed by washing in pure water. If the picture is put into a solution of a salt of copper without washing, it will take different shades according as the heat is more or less intense. If the picture is treated with the prussiate of iron instead of the prussiate of potash, its colour will be a beautiful blue.[2]

ART. XVI.—*On the Processes for Printing Positives.*

When a good negative picture—that is, one in which the lights are black and the shades white—has been produced, positive pictures may be obtained by placing the negative above paper or any other substance sensitive to light; cover it with a thick plate of colourless glass, pressed against it in what is called a copying-frame, and exposing it to the sun, or to daylight, or to artificial light. The best copying-frames are those which have a jointed back to allow the artist to observe the progress of the picture without displacing the negative.

The best paper for positives are Turner's positive, and the new German positive, or *papier Saxe.* When the paper is cut of the proper size, it is soaked for five or ten minutes in a solution of 110 gr. of muriate of soda (common salt) in 24 oz. of water; or in a solution of 1 scr. of muriate of ammonia in 10 oz. of water. They are then hung up, or pinned up with "photographic pins" to dry. The sensitive solution (which was first suggested by Mr Alfred Smee) is obtained by dissolving 108 gr. of nitrate of silver in 3 oz. of water, and adding liquor ammonia, drop by drop, until the dark precipitate which is formed by the first drops is nearly dissolved, a slight turbidity remaining A sheet of the salted paper, when dry, is laid on a flat board in ordinary light, with its smooth side uppermost, and marked with a pencil. It is then brushed over with a camel-hair pencil or a pellet of cotton, and when dry may be placed in the copying-frame beneath the negative, and exposed to the sun. When it is printed it is soaked for an hour or two in water, and then fixed and toned in a bath thus composed:—To a solution of 4 oz. of hyposulphite of soda in 6 oz. of water add 2 dr of a solution of chloride of gold in 4 oz. of water; and afterwards add a solution of 30 gr. of nitrate of silver in 1 oz. of water. The picture is kept in this bath from 10 minutes to an hour, till it has acquired an agreeable tint, and is sufficiently fixed.

The sensitive solution most commonly used is a solution of 1 dr. of nitrate of silver in 1 oz. of distilled water. It is applied to the paper in the same manner as the ammonio-nitrate, and the picture is toned and fixed in the same manner.

The paper may be albumenized by the following process:—Take the white of an egg 1 oz., and water 1 oz., beat them into a froth, adding 10 gr. of muriate of ammonia or soda to each ounce of the mixture. Float the paper upon this solution for a few minutes, pressing out any air-bubbles, and then hang it up to dry. A hot iron is then passed over its surface to set the albumen, and render it insoluble. When wanted for use it is excited by a solution of 60 gr of nitrate of silver in 1 oz. of water; and it is toned and fixed by the process already described. All positives, however produced, must be long soaked in hot and cold water repeatedly changed.

ART. XVII.—*On Microscopic Photographs.*

In our article on the MICROSCOPE[3] we have devoted a separate chapter to the "Application of Photography to the Microscope," and we have briefly referred to microscopic photographs, or those which are so exceedingly minute that the objects are invisible to the unassisted eye. Mr Dancer of Manchester seems to have been the first photographer who executed these remarkable productions. It was obvious that no new principle was involved in the execution of these portraits; but one could not but admire the dexterity and delicacy of manipulation in taking photographs between the 30th and 40th of an inch square, in developing and fixing them, and in placing them between two plates of glass, with Canada balsam interposed

Mr Dancer did not describe the optical process which he employed; but Mr Shadbolt, who executed and exhibited photographs from the 20th to the 40th of an inch in diameter so early as March 1854,[4] has given a drawing and description of the method which he employed.[5] In this delicate art a *structureless collodion* is necessary, which is obtained by the formula—

Pure ether .... 5 dr.	Chloroform.................. 20 min.
Alcohol (60 overproof)..... 3 dr.	Iodide of potassium...... 5 gr.

Soluble cotton[6] till the solution is slimy.

After adding the chloroform to the ether and cotton, and *one* dram of alcohol, add the other 2 dr. of alcohol containing the iodide.

An achromatic object-glass, 1 or $1\frac{1}{2}$ inches in focal length, is made the lens of a small camera, and the negative picture to be reduced is placed in front of it at such a distance that the image in its focus is sufficiently minute; or it may be stuck into the sub-stage of the microscope, as done by Mr Shadbolt, and the focusing and union of the actinic and luminous rays effected by another object-glass in its place in the microscope. Mr Jackson[7] and Mr Hardwick[8] had small cameras, the one made by Ross, and the other by Horne and Thornthwaite. Either daylight or artificial light may be employed in illuminating the negatives, which may be taken directly from living figures.

ART. XVIII.—*On the Production of Photographs from Coloured Objects.*

Although M. Biot in 1840 regarded it as an illusion to attempt to obtain the colours of nature photographically, yet in the same year Sir John Herschel actually procured upon photographic paper a coloured image of the solar spectrum; and by subsequently using paper long kept, he obtained a better representation of it, *light upon a dark ground.* Mr Hunt frequently obtained coloured pictures of the spectrum, *dark upon a light ground;* but the most beautiful were upon "the daguerreotype iodidated tablets." By preparing metallic plates with chlorine, M. E. Becquerel obtained, and exhibited to the Academy of Sciences, "a photographic image of the solar spectrum, and coloured photographs from the camera obscura." These colours, though durable for a long time in the dark, resisted every attempt to fix them. M. Niepce de St Victor has been more successful, by using the purest silver; and he is said to have obtained "all the colours of a picture by preparing a bath composed of the deuto-chloride of copper." Some of these *heliochromes* in the possession of Mr Malone were, as seen by Mr Hunt, "perfectly coloured in correspondence with the drawings of which

[1] See *Comptes Rendus,* &c., tom. xlv., p. 811, Nov. 1857, and tom. xlvi., pp. 448 and 489, May 1858.
[2] Ibid., tom. xlvii., p. 866, Nov. 29, 1858. [3] Vol. xiv., p. 801. [4] *Phot. Jour.,* i., p. 194. [5] Ibid., iv., p. 79.
[6] The linen of old cambric is recommended by Mr Hardwick (*Phot. Jour.,* iv. p. 82). [7] *Phot. Jour.,* iv. 81. [8] Ibid., iv. 93.

they were copies;" but no successful mode of fixing them has yet been discovered, though M. Niepce de St Victor has made a hundred attempts to do this.

The colours of nature have been produced accidentally by several photographers. In taking a stereoscopic picture on collodion of ruins covered with ivy, a gentleman in Durham, who signs himself "Magnet," was surprised to find the *ivy green*, the trunks of old trees *brown*, the stones *gray*, and "the whole with the colours varied in a high degree." The colours were not altered in fixing the picture, but in drying it they lost their lustre, with the exception of the green, which remained perfectly distinct. The same effect was produced in a second picture, taken in a bright sun in twenty seconds. The collodion employed was perfectly colourless, and was two months old. It gave a thin film. It was prepared with iodide of potassium and a little bromine.[1]

M. Raymond,[2] a French photographer, has observed similar colorific effects. When a picture upon collodion began to be developed under the combined action of the pyrogallic and acetic acids, he exposed it to light without previously washing it; and he observed it *transform itself quickly into a direct positive, and assume with more or less perfection the colours of the model.* The most perfect picture he obtained required a quarter of an hour for its development. It lost none of its brightness by an exposure of some months to the air, and even after two years it was not completely effaced.

Some of the colorific effects observed by photographers are *the colours of thin plates*, and have no connection whatever with the colours of nature. The action of light upon the collodion film changes either its thickness directly, or indirectly by changing its solubility; so that the light and dark parts of the picture exhibit different tints in Newton's scale of colours. We have observed this effect in very thin films of collodion on glass, and also in the same films after having been transferred to paper.

ART. XIX.—*On the Applications of Photography.*

Our limits will not permit us to dwell at any length on the numerous and important applications of this beautiful art. The employment of photography in the arts of painting and sculpture has been recommended by artists of the highest name. "Instead of superseding the arts of design, photography will supply them with new materials—with collections of costume, with studies of drapery and of form, and with scenes in life and facts in nature which, if they possess at all, they possess imperfectly, and without which Art must be stationary, if she does not languish and decline."[3] The instantaneous process, as it is called, of taking pictures on collodion in half a second has enabled the artist to delineate "a thoroughfare in London with its noonday crowd," to seize the momentary attitudes and expressions of passion, and to fix on his tablet the gestures of the orator and the furious movements of the lunatic. Such pictures have been erroneously represented as the results of *mere mechanical dexterity*, to which the mind of the artist had not imparted "the impress of thought;" but if the portrait is taken with *optical truth*, which has yet to be done, and if, in the twinkling of an eye—if in half a second, a portion of time less than the duration of the expression of thought or sentiment—a portrait is taken, that portrait must be perfect, and superior to anything that art can produce. It is absolute truth, to which art cannot arrive. It is as true as the portrait of the sitter seen by reflection in the most perfect mirror; and though the artist might improve the material picture by a deviation from truth, he cannot add a single iota to its expressions of thought or of feeling.

To the sculptor, photography, whether simple or binocular, is of inestimable value. He can fill his portfolio with copies of all the treasures of the Vatican, the British Museum, and the repositories of art in Berlin, Munich, and other European cities. "They all exhibit to him forms more than human, though human still, embodying all that is true and beautiful in what might be man;" and when taken binocularly, they may be raised by the stereoscope into true relief, and studied, as if the originals were placed before him. The living, the dying, and the dead may thus be modelled without the rude contact of a mask, and those noble forms perpetuated which affection or gratitude has endeared.

To the pursuits of the architect, the engineer, and the mechanist, photography is equally applicable; and in the diffusion of knowledge, and for the purposes of education, its power will be speedily recognised. Nor will it be less influential in humanizing the humbler classes of society. Portraits of their families in beautiful frames and morocco cases can be purchased for a shilling, and even for sixpence each. The emigrant may carry to his distant home the portraits of those from whom he has been obliged to part, and the humble peasant may adorn his cottage not only with likenesses of his family and friends, but with accurate photographs of various objects in art and in nature which he may desire to contemplate.[4]

The calico-printer may multiply his patterns photographically; and the carpet manufacturer and general decorator may fix in paper all the beautiful patterns which are given by the kaleidoscope.[5]

In the sciences of astronomy, zoology, geology, meteorology, ethnology, electricity, and magnetism, photography has been advantageously employed. The spots of the sun, the surface of the moon, the forms of the planets, and even groups of stars, have been delineated by their own light; and it has been stated "that the photographic moon indicates an atmospheric stratum of considerable density." Mr De la Rue has obtained pictures of this luminary analogous to binocular ones, which, when aided by the stereoscope, exhibit her as a solid globe. The meteorologist registers photographically in his absence the indications of the barometer, thermometer, and hygrometer; the variations of the earth's magnetism are recorded for every minute on chemically-prepared paper, and the electricity of the atmosphere, brought down into the observatory, is made to exhibit on paper the number of its variations and the intensity of its action. The ethnologist has begun to collect accurate pictures of the different races of man. The zoologist has obtained forms of animal life which the painter had attempted in vain to procure. The geologist has obtained delineations of phenomena which defied the highest efforts of his pencil; and the botanist has transferred to imperishable tablets those beautiful and complex forms of vegetable life which we seek in vain in the richest botanical collections.

The last, and certainly the least application of photography, is one which was introduced last year at Nice. The Duke of Parma had his portrait at full length placed upon his visiting-cards. Some English gentlemen imitated his example; and it has been partially followed in London and in Paris.[6] In order to diminish the expense, M. Besson of Paris takes 24 negatives at once on the same sheet of paper with a 24-lens camera; and he is thus able to print 24 cards at the same time, and greatly reduce the expense of their production.

ART. XX.—*On the method of taking correct Photographic Portraits.*

In our article OPTICS,[7] we have devoted a separate section to prove that all portraits taken by large lenses[8] are monstrous representations of the human form, and that all pictures of solid bodies so taken are incorrect. The defects of such lenses may be shortly enumerated.

1. They introduce into the picture parts of the solid figure which cannot be seen from any one point of sight

2. Every picture taken by a large lens is a combination of an infinite number of incoincident pictures, as seen from every point of the lens.

3. A large lens introduces into a picture objects eclipsed by or placed behind other objects.

4. In portrait lenses consisting of two separate lenses there are eight surfaces, each of which reflects back upon the sensitive surface a portion of light more or less intense.

5. In such lenses their combined thicknesses is such as to injure the distinctness of the picture, if there is any defect (as there must be, however small) in the homogeneity of the glass.

6. In the images formed by such lenses, lines which should be straight are curved, and curved lines have not their proper curvature.

7. With the most perfect lens, the parts of objects at different distances have different degrees of distinctness on the gray glass. The degree of indistinctness increases with the diameter of the lens, because it is measured by the section of a cone of rays whose base is the lens itself.

8. In passing through such a thickness of glass, many of the actinic rays are lost by absorption.

From all these objections small lenses are free; and as very sensitive photographic processes have been discovered, we would press

[1] *Phot. Jour.*, April 21, 1858, vol. iv., p. 204. The editor of *Cosmos* has published these observations in his No. for the 26th Nov. 1858, p. 651, as made by *M. Muguet* (a misprint for *Magnet*, not for *M. Magnet!*) and refers to the *Bulletin de la Société Française* as his authority!

[2] *Cosmos*, Nov. 26, 1858, p. 653.

[3] Brewster's *Treatise on the Stereoscope*, chap. x., p. 166.

[4] The application of simple and binocular photography to these various purposes has been treated at great length by Sir David Brewster in his *Treatise on the Stereoscope*, chaps. x., xi., xii., and xiii.

[5] Brewster's *Treatise on the Kaleidoscope*, 2d ed., ch. xxi., p. 148.

[6] The expense of these cards was L.1, 10s. per 100.

[7] Vol. xvi., pp. 569, 570.

[8] Lenses above half an inch in diameter (vol. xvi., p. 571).

upon the photographer the necessity of abandoning large lenses, and employing single plano-convex lenses of rock-crystal $\frac{1}{4}$ inch in diameter, such as we have described in the article OPTICS.[1]

In addition to the deformities produced by large lenses, photographic portraits are rendered hideous in consequence of every imperfection of the human face being *magnified*.

Those who already possess large lenses and large cameras, and are unwilling to abandon them, might obtain good portraits by taking them at considerable distances; and if the picture is deemed too small, it may be enlarged to any size in the copying camera. Very small portraits may be taken by the achromatic lenses of compound microscopes placed in cameras an inch or two long (art xvii.), and the picture subsequently enlarged.

Should it be wished to take a portrait as seen at a certain distance by two eyes, it should be taken by an achromatic lens 6 inches in focal length, and having all its surface covered, with the exception of two apertures, each a quarter of an inch in diameter, and placed at the distance of $2\frac{1}{2}$ inches.[2]

The defects of large lenses have an important bearing on stereoscopic photography, which is at present practised in open violation of scientific principles. (See article STEREOSCOPE.)

ART. XXI.—*On Photographic Apparatus.*

The most essential part of photographic apparatus is the camera, which has been described in its simplest form in our article OPTICS. Many ingenious forms of this instrument have been devised and constructed for sale; some portable, and some not; while others have been so constructed that the photographer may perform in their interior all the operations of developing and fixing his negative pictures.

A camera of the common form, as made by Mr Ottewill, is shown in the annexed figure 1, where A is the tube holding the lens or lenses, and BC the body of the camera, the back of part of which slides into the front part, in order that the person or landscape to be photographed may be distinctly represented on the ground glass at D. The adjustment is completed by a rack and pinion at S (figs. 4 and 5), which moves out and in the tube holding the lens or lenses. In order to ascertain when the part of the object which is wished to be most distinctly seen is most sharply depicted on the ground glass, or is in the true conjugate focus of the lens, Sir David Brewster first suggested the use of what is called a focusing glass, which is a tube with an eye-piece of one or more lenses, which has its or their focus at the end of the tube. When the end of the tube is placed on the ground glass, the observer will ascertain when the image is distinct. The roughness of the glass, however, makes such a method very imperfect; and therefore Sir

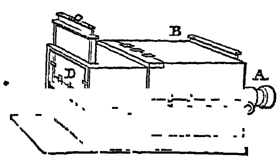

Fig 1.

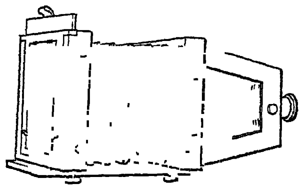

Fig 2.

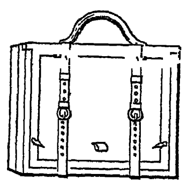

Fig 3

David Brewster long ago proposed either to cut a hole in the glass, or polish the central part of it, or fit up the camera precisely like a telescope, and thus obtain the most perfect adjustment of the luminous focus of the lens, the usual means being taken to obtain a coincidence of the luminous and actinic focus.

The portable form of the camera, as constructed by Captain Fowkes, is shown in the annexed figures—when it is open (fig. 2), and when it is shut (fig. 3).[3]

A section of the tube containing the achromatic lenses of almost every camera is shown in figs. 4 and 5, where AB, CD, are

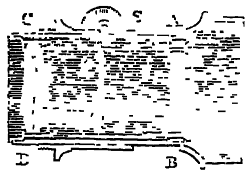

Fig. 4.

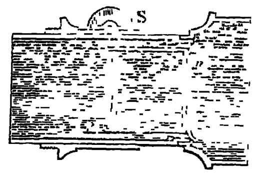

Fig. 5.

the two lenses used in taking portraits, with a suitable stop, *mn*, between them. In order to take landscapes, the lens CD is removed, and the lens AB placed as in fig. 5, with the stop *mn* in front of it. Mr Skaife uses what he calls a *pisto lcamera*, with a single lens three-fourths of an inch in diameter, to produce photographs on small concave lenses.[4]

In all these cameras the picture is inverted on the glass, so that the artist cannot possibly form a correct judgment of the *posé* of individual figures, or of the grouping of several figures whose portraits are required. We would recommend, therefore, the use of an erecting camera,[5] for the single purpose of enabling the artist to judge of the *posé* or grouping of the picture. When the artist is satisfied with this, the erecting camera should be replaced by the inverting one. (See arts. xvii. and xx.)

Among the various lenses used by photographers or proposed by optical writers, that of M. Petzval has been ascertained, not only by theory, but by direct experiment, to be the best. It has been the practice to test a lens by the pictures which it produces; but the picture thus used as a test is influenced by various causes, so that it is impossible to separate the effect produced by these causes from that which is due to the lens. The lens of every camera should be made the object-glass of a telescope, and tried with different eye-pieces and different apertures; and from the data thus procured a photographer of any optical knowledge will have no difficulty in ascertaining the value of his lens. With large apertures, it will doubtless be found, especially from the projected pictures of rectilineal objects, that straight lines are much bent into curves; and the photographer will learn, what so few of them know, that if he wants a *true picture* he must attend to the aperture of his lens. M. Petzval has proposed the excellent test of copying a map on the scale of a fifth part of the original, and observing the difference between the copy and the original.

In almost all the cameras used in taking portraits, the focal length of the lens exceeds, and is sometimes double, the focal length of the eye; so that all the irregularities in the human skin are magnified, thus adding imperfections not generally visible to those of large and imperfect lenses.

In an article of limited extent like the present, we cannot find room for drawings and descriptions of copying and enlarging cameras; of the ingenious pieces of apparatus invented by Mr Claudet, such as the photographometer, dynactinometer, and focimeter; and of the various pieces of apparatus which are used in photographic processes. For an account of these, we refer the reader to the Abbé Moigno's *Repertoire d'Optique Moderne*, parts ii., iii., iv.; Hunt's *Manual of Photography*, 5th edition, 1857; Hunt's *Practice of Photography*, 1857, Thornthwaite's *Guide to Photography*, 14th edition, 1857; and Ross and Thomson's *Plain Answers to Common Questions regarding Photography*, 1853. (D. B.)

PHOTO-LITHOGRAPHY, the name of a new art which we owe to Mr Macpherson of Rome. A photograph, impressed on the surface of a lithographic stone, is treated in the ordinary way, and copies afterwards taken of it. Two different processes have been patented in England, one by M. Poitevin, and the other by Mr Newton as the invention of Messrs Culling and Bradford of Boston.

In M. Poitevin's patent the stone is covered with one or more films of a mixture of albumen or gelatine, and a concentrated solution of bichromate of potash. This film is then dried if a negative picture is to be copied upon it; but it may be used in a moist state if it is to receive the picture in the camera. When the surface is dry it is moistened with a sponge, and while moist the lithographic ink is applied to the surface by a ball or dabber, or other means, when it will be found to adhere only to those parts which have been affected by light.

In Messrs Culling and Bradford's process, a film of prepared gum-arabic is used which has been deprived of its power of intimate union

[1] See the *Photographic Journal*, vol. iv., p. 83, where this subject is treated at considerable length.
[2] On the subject of photographic portraiture, we would refer the reader to a clever article in the *Art-Journal*, No. xlv., p. 273.
[3] An improved camera on this principle, by Mr Kinnear, is described in the *Phot. Jour.*, vol. iv., pp. 116, 165.
[4] *Phot. Jour.*, vol. v., p. 98, Dec. 11, 1858.
[5] This camera may be a very common one, with a small single lens, and may be constructed at a small expense.

with the stone, while at the same time it is rendered capable of becoming fixed or insoluble by the action of light. When this film is submitted to the action of a solution of soap, the parts acted upon by light are not injuriously affected by it, and an insoluble soap is formed on the stone to produce the printing surface. The exciting solution is

Water .... 1 qt.	Sugar or molasses .... 160 gr.
Gum-arabic .... 4 oz.	Bichromate of potash...... 160 gr.

The sugar retards the immediate fixing of the gum upon the stone, and the chromic salt causes it to be more firmly fixed, or to be less soluble when exposed to light. When the film is dried, it may be exposed in the camera, or placed under a negative.

In the first of these processes the blacks are produced by the parts on which the light has acted, and on the second by those upon which it has not acted. (D. B.)

PHOTOMETER (from φῶς, *light*, and μέτρον, *a measure*) is the name of an instrument for measuring the intensity of light, whether it proceeds from a luminous body, or is reflected or refracted at different angles from opaque or transparent bodies. In our article on OPTICS,[1] we have referred to the photometrical researches of Bouguer and Lambert, whose methods of comparing different degrees of illumination we shall now explain.

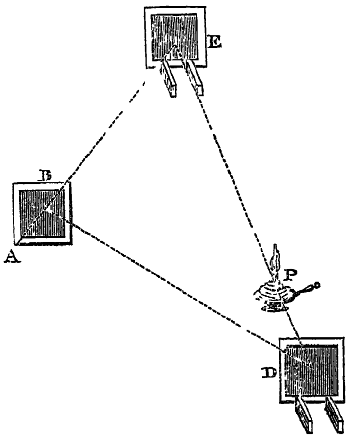

Fig 1.

In order to measure the light reflected from a mirror B, Bouguer placed the light P between two surfaces of paper D, E, equally white and parallel to each other. He then placed his eye at A, so that he could see at the same time the paper E directly, and the image of the paper D reflected from the mirror B. When the direct and reflected images were brought into contact, the light P was moved along the line ED, so as to throw more or less light upon E and D, till their degree of illumination appeared perfectly equal. The light of E seen directly from A is then to the light reflected from B as EP^2 is to DP^2.

The method used by Lambert is shown in the annexed figure. Upon a plane white surface ABCD draw a line ILK, uniformly black; place a plate of glass EFGH at right angles to the white surface, so that the angle HLK is a few degrees less than a right angle. When the white surface ABCD is equally illuminated, the observer at O views the part IL projected into LQ, and the anterior part KL, seen by reflection at PL; and when he finds the position of the eye at O when the lines LQ and LP are of equal paleness, he measures the angle of incidence In one experiment he found this angle $75\frac{1}{2}$ degrees; and supposing the glass to be perfectly pellucid, he concluded that at that angle the quantity of reflected light was exactly equal to the quantity of transmitted light.[2]

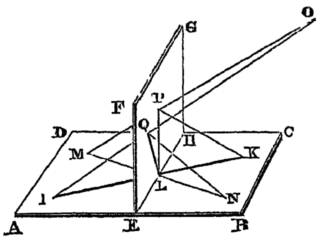

Fig 2.

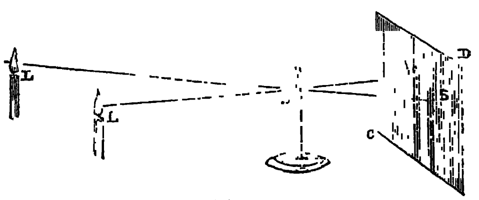

Fig 3.

The method of equal shadows given by Count Rumford is shown in fig. 3, where L, L are the two lights to be compared, S an opaque cylindrical rod, and CD a screen of white paper. The lights are then placed at such distances from S that the shadows A, B are equally dark. In this case the squares of the distances of the shadows from the lights, that is LB^2, LA^2, are a measure of the relative intensities of the light The rays LB, LA must be equally inclined to the surface of the screen.[3]

The ingenious photometer of the late Mr William Ritchie, founded upon Bouguer's method, is shown in fig 4, where ABCD is a section of a rectangular box, CF, DF the plane mirrors cut from the same plate, EG a rectangular opening covered with oiled or fine paper, and F a small division of blackened card to prevent the lights mingling with each other. The lights to be compared are then placed in the same straight line parallel to AB or CD, and equidistant from them, at the distance of 6 feet from each other, and the box is moved along this line till EF, GF are equally bright. The illuminating powers of the lights will be directly as the squares of their distance from the centre of the photometer[4]

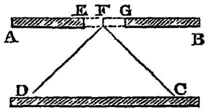

Fig 4.

The photometer of Sir John Leslie,[5] which was merely his differential thermometer with one of its balls blackened, exhibited the difference of temperature of the two balls, and was not a measurer of light. Mr Ritchie invented a photometer having some resemblance to it, but differing essentially in principle. It is shown in fig. 5, the lower part of which is a differential thermometer, surrounded by two air-tight cylinders of tin ABCD, EFGH, composed of two plates of fine and thick glass AB, FG, and two circular tin plates CD, EH, the dotted line representing circular pieces of black bibulous paper. The light of one flame enters the glass plate AB, and the other FG. The heat is assumed to be absorbed by the thick glass, and the light is absorbed by the bibulous paper and converted into heat, the amount of which is shown on the differential thermometer. When each branch of the thermometer is at zero, showing that the light converted into heat is equal on the two cylinders, then the intensities of the lights are directly as the squares of their distances from the instrument.[6]

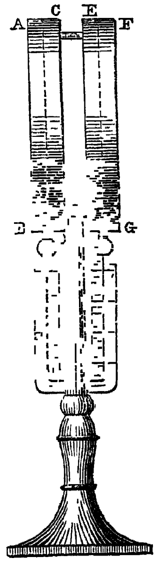

Fig. 5

The photometer used by Professor Potter for measuring the light reflected at different angles by plane metallic specula, will be found in Brewster's *Journal of Science*, October 1830, vol. iii., new series, p. 284.

A photometer, in which a variable light is produced by rotation, has been long ago proposed by Sir David Brewster. An opaque or a semi-transparent arm, ground glass for example, having its breadth decreasing to a point as it recedes from the centre of rotation, is made to revolve in front of a uniformly illuminated white surface, so as to produce every degree of illumination from absolute darkness to the light of the surface. Any law of variation may be obtained by the form of the sides of the revolving arm being either rectilineal, curvilineal, or in steps, and by the angular distance between their extreme points. All light less bright than the surface may thus be measured by comparison with the reduced light at a distance from the centre of rotation. The same principle may be applied by reducing to equality with the other the brightest of two unequal lights received on a white surface by looking through the slits of a revolving disc.

Photometers have been constructed by viewing through a binocular instrument differently illuminated surfaces, and reducing them to an equality by different circular apertures applied to each eye. A photometer of this kind has been described by M. Doppler,[7] and another has been recently proposed by Mr Mungo Ponton.[8] Many objections, both physiological and optical, may be urged against the accuracy of such instruments.

The transition of a polarized ray from evanescence to light of a given intensity, and the determination of the law of variation by Malus, must have suggested to every person familiar with that class of phenomena the construction of a photometer.[9] (D. B.)

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1 Vol. xvi., p. 335.
2 *Photometria*, part ii., c. i., p. 156.
3 *Phil. Trans.*, 1794, p. 67.
4 *Edin. Trans.*, vol. x., p. 443.
5 See Brewster's *Journal of Science*, April 1825, vol. ii., pp. 321, 339; and vol. iii., p. 105.
6 *Phil. Trans.*, 1825, p. 141.
7 Moigno's *Repertoire d'Optique*, &c., partie iv., p. 1752.
8 *Edin. Trans.* 1855-6, vol. xxi., p. 363.
9 See OPTICS, vol. xvi., part vii., § 1, pp. 633, 634.

PHRASE, in *Music*, signifies a passage of melody or of harmony which contains a musical idea more or less complete in respect of cadence. A melodic phrase may consist of two or three sounds only, rhythmically disposed, but generally consists of more. It may begin on an accented or an unaccented part of the measure, and end on either. A compound phrase consists of two or more simple phrases symmetrically disposed, so that the whole may present a regular ordonnance, and a satisfactory balancing of its component parts. Several of such phrases joined together form a period, and the most regular period consists of four symmetrical phrases or numbers. As there are various kinds of phrases, some vague and some symmetrical, so there are various kinds of periods. A melodic phrase may occupy one measure, or even less; or it may extend over two, three, or even more; and may either be confined to the key in which it began, or may modulate into another. The well-known air by Galuppi—adapted to the English words, "Taste life's glad moments"—offers, in its first eight measures, an example of four phrases, each of two measures, symmetrically arranged, and confined to one key. A harmonic phrase consists of a succession of chords forming a more or less determinate cadence; and may be prolonged by introducing dissonances, so as to avoid the perfect cadence. (See MUSIC, § *Melody*.) (G. F. G.)

PHRASING, in *Music*, applies to the executant of a piece of music, and signifies the presentment of each phrase or period with elegance and propriety, and the adorning of it with such accents and graces as are suitable to its character, and are calculated to give it the best effect. (G. F. G.)

PHRENOLOGY.

PHRENOLOGY, a term derived from Φρήν, mind, and λόγος, discourse, designates a science which professes to be a philosophy of the human mind founded on the physiology of the brain. It was first offered to public consideration on the continent of Europe in 1796 by Dr Gall, a German physician. (See GALL.) In Britain, it attracted little attention until 1815. It has met with strenuous support and determined opposition during the last half century, and its claims as an established science are still *sub judice*.

Phrenology claims preference over all other systems as a professedly practical science of mind. Starting from its fundamental principle, that the brain is the essential organ of the mental powers, it attempts to show in what respects, and by what methods, the mental nature of man can be developed, and his material and moral welfare advanced. In other words, it systematically applies our knowledge of the anatomy, physiology, and pathology of the brain to education, legislation, religion, morals, the fine arts, and the science and art of medicine.

The principles of phrenology are as follows:—1. Phrenology maintains that the mind and the body are inseparable in this world, and cannot be investigated apart from each other. It is man as a "concrete Ego," and not as an immaterial Ego, that it examines. This principle is controverted by the doctrine of "spirits," and the views of speculative theologians and metaphysicians, but it is evidently in concurrence with the daily practice and common sense of mankind. 2. The brain is the immediate organ of the mind; or, in other words, all the modifications of our consciousness, known as feeling, thought, and will, take place within that portion of the body contained within the skull, *i.e.*, the encephalon or cerebral organs. This is a doctrine founded also on the common sense of mankind, and admitted by a preponderating majority of philosophers and physiologists. 3. The brain is a double organ, one-half of which may act independently of the other. That is to say, just as we can see with one eye, hear with one ear, or see or hear differently with the two organs, so the one-half of the brain may act independently of, or differently from, the other half. This principle is now admitted by the best modern writers, as it was by the most distinguished of the ancients. Nevertheless, as in seeing and hearing, the two organs of the senses usually act consentaneously, so in thought and will the two mental organs, or cerebral hemispheres and their connections, commonly act consentaneously. 4. Phrenology affirms that there are separate and distinct mental faculties, and that each has its corresponding seat or organ in each of the cerebral hemispheres; in other words, although consciousness is one, its modes of manifestation are diverse, according to the development of certain corresponding portions of the cerebrum. There is an exception to this principle in the love of the sexes, which has only one organ, and that the cerebellum. This principle has been much controverted, on grounds which we will shortly examine. 5. It is further maintained that power of mind is, *cæteris paribus*, dependent upon size or development of the cerebral hemispheres; and since what is true of the whole must be true of the parts, it follows that the power of particular faculties is also, *cæteris paribus*, dependent on the size of special organs. This doctrine has also been much controverted.

Phrenologists have founded upon these principles:—1. A system of psychology, in which the nature, mode of action, sphere of operation, and relations of distinct mental faculties, are set forth. 2. A system of physiognomy, founded upon (*a*) the form of the skull, as determined by the size and form of the cerebral hemispheres, or of particular portions of them; (*b*) upon the natural language of the feelings and faculties, as displayed in the attitudes, &c. 3. A practical sociology, or the application of these systems of psychology and physiognomy, in connection with the fundamental principles of cerebral physiology, to the welfare of society and the ordinary business of life.

Organology of Phrenology.—We will notice some of the most important of the phrenological principles, still *sub judice*; and first as to the Organology of Phrenology. This doctrine is twofold in its nature, being psychological, as it respects the arrangement of the modes of consciousness into faculties; anatomical and physiological, as it respects the assignment of a portion of the brain to each faculty. The proofs adduced by the advocates of phrenology in support of these doctrines are as follows:—

(*a*.) As to the psychological division into faculties and the like. 1. It is an undisputed truth that varying mental states characterise the different stages of man's development. Reasoning powers appear later than emotional states; a child observes much sooner than he reflects; he fears and loves before he venerates. 2. But it is not only the individual man, at various stages of his life, that manifests various faculties. Man, when examined in the mass, as in families, races, or nations, presents great varieties of faculties, desires, sentiments, instincts. Metaphysicians do but re-echo popular opinion when they arrange these varying states of consciousness under such generic terms as the instinctive, emotional, and intellectual faculties. Every thoughtful father is anxious to discover whether his son has congenitally or "naturally" any predominant faculties, modes, or powers of action, so that his course of life may be so shaped as to give scope to the free exercise of the so-called "talents" he possesses. It is within the experience of every observing man that there are so-called "talented families," one member of which excels perhaps

Phrenology in mathematics, another in poetry, another in music, another in painting, and so on. It was, in fact, this diversity of character which first suggested to Gall to observe whether there was any connection between it and diversity of external form. Observing accordingly, he at last connected these diversities of character with diversities of physiognomy, and at last was led to the idea that the variety of faculties was connected with varieties in the form and size of the cranium, and therefore with the form and size of the brain. The observation of races of mankind led to similar results. Thus the psychological observation of the faculties preceded the physiognomical observation of the organs. It follows, therefore, that the psychology of phrenology is not dependent upon either the physiology or the physiognomy of the science; or, in other words, it may be considered and applied as a distinct system of mental philosophy, independently of the latter.

It being determined by observation and induction that there are distinct faculties, sentiments, propensities, and the like, and it being also determined that the brain is the organ of the mind in general, it remains to determine, further, whether special portions of it are the seat or mechanism of special faculties or propensities, the existence of which is as necessary to the manifestation of those special mental states as the existence of the organ, as a whole, is necessary to the manifestation of mind as a whole. The following are the arguments adduced in favour of a multiplicity of cerebral organs:—

1. It is noticeable, that in every organism there is a division of labour or function, with corresponding distinctness of organ. "In the economy of the human frame," Mr Combe remarks, "there is no ascertained example of one nerve performing two functions, such as feeling and communicating motion, or seeing and hearing, or tasting and smelling. The spinal marrow consists of three double columns; the anterior column of each lateral division is for motion; the posterior for sensation; the middle for respiration;" or at least their functions *are* different, however physiologists may vary in opinion as to the nature or character of those functions. In like manner as to the general functions of the organism. Each function has an organ for itself; the stomach, for instance, digests food, the liver secretes bile, the heart propels the blood, the eyes see, the ears hear, the tongue tastes, and the nose smells.[1] This is the argument founded on differentiation of structure and function, and is by no means so forcibly put by phrenological writers as it might be. 2. We have seen that the various mental powers of man are manifested in succession from childhood to adult life. And concurrently with this order of manifestation there is an order of development of the component parts of the brain. In childhood, for example, the middle part of the forehead generally predominates; in later life, the upper and lateral parts become more prominent,—changes in strict accordance with the consecutive order of evolution of the observing and reasoning faculties. 3. Genius is almost always partial; which it ought not to be if there were no partial development of the organ, and if the whole brain were the seat of all and every faculty; in that case every faculty would be equally manifested, and none would be above another in power. 4. The phenomena of dreaming, insanity, and idiotcy are equally at variance with the theory of singleness of the organ of mind, but quite consistent with the theory of its plurality. Were the organ single, it is clear that all the faculties should be asleep or awake at the same time, and to the same extent; or, in other words, there could be no such thing as dreaming. But that change of the functional activity of the brain which constitutes sleep being only partial in its intensity, or in the extent to which it involves the brain, those portions which are less affected are partially active, so that partial manifestations of the consciousness take place which in an infinite variety constitute dreaming. Again, in partial idiotcy, whilst some faculties are manifested to a singular extent, others are absolutely deficient. Concurrently with this partial development of the intellect there is a partial development of the cerebrum. But, independently of the observed phenomena, it is a just *à priori* inference, that if the brain were a single organ, there would not be this remarkable absence of some mental powers with the presence of others. Not dissimilar are the conclusions to be drawn from the phenomena of mental disease, occurring in persons with ordinary development of the body and mind. Just as in idiotcy and dreaming, so in monomania there is a morbid manifestation of special mental states. Now, the same argument, *à priori*, applies here as in the other instances; and it is inferred that there is a special disease of a portion of the brain upon which the special morbid manifestation depends. Partial injuries of the brain, and their accompanying phenomena, come under this category of disease, but are more demonstrative of the general principle.

All these phenomena are of daily occurrence, and the conclusions to which they point have been forced upon the attention of philosophers and physiologists from Aristotle and Galen downwards. The Aristotelian philosophy arranged the faculties under three heads, namely, the judgment, imagination, and memory. In the thirteenth century, Albertus Magnus divided the cranium phrenologically into three regions, so as to correspond to this arrangement: the anterior portion was allotted to the judgment or intellect, the middle to the imagination, the posterior to the memory. Petrus Montagnana published a similar chart in 1491.[2] Mr Combe figures in his "System"[3] a more elaborate craniological chart of this kind, published in 1562, at Venice, by Ludovico Dolce, in a work upon strengthening and refreshing the memory. In the second volume of the *Phrenological Journal*, drawings of human and comparative physiognomy are given from a work by John Baptista Porta (1596), entitled *De Humana Physiognomia.*

Modern anatomists and physiologists in general, from Willis downwards, have asserted the principle of multiplicity of cerebral structures as organs of mental powers, or seats of mental states. Willis made careful dissections of the brain, with a view to determine the seat of the various faculties, or, in his own words, the particular "canals" or "passages" through which the "animal spirits" pass when various mental states are induced or manifested. His dissections and engravings of the brain are interesting even now; for in some respects he taught doctrines similar to, and even in advance of, those of modern physiologists. He made the *corpora striata* the seat of consciousness, in connection with doctrines as to diversity of function of other portions of the encephalon. "As to the offices and uses of the *corpora striata*, though we can discern nothing with our eyes, or handle with our hands, of those things that are done within the secret conclave or closet of the brain, yet by the effects, and by *comparing* rationally the *faculties* and acts *with the workmanship of the machine*, we may at least conjecture what sort of works of the animal function are performed in these or those, or within some other parts of the head; especially because it plainly appears that the offices of the interior motions and senses, as well as of the exterior, are acted by the help of the animal spirits ordained within certain and distinct paths, or as it were small little

[1] *System of Phrenology*, 5th ed., p. 24.
[2] Gall, *Sur les Fonctions du Cerveau*, 8vo, Paris, 1822–1825, vol. ii., pp. 354, 355.
[3] Vol. i., p. 33.

pipes."[1] Willis's researches were instituted in relation to the current theory of the animal spirits (subsequently replaced by the *vis nervosa* and "nervous fluid"), as the efficient agents of sensation, motion, and thought, and which were generated in the brain. This was the doctrine of Galen, and held its ground until the commencement of the eighteenth century. In accordance with this theory, the Arabian writers, following Galen, fixed upon the ventricles of the brain as the special seat of the mental faculties; one of the anterior ventricles they made the seat of common sensation; the other of the imaginative faculty; the third ventricle was the seat of understanding, and the fourth of memory. These doctrines were also maintained by Duns Scotus, Thomas Aquinas, and other philosophers as late as Descartes; Caspar Bauhin was the first to question them, and to maintain that the "animal spirits" were generated in the substance of the brain and distributed directly from thence through the nerves to the organs of sensation and motion. Plater, Varol, Spigel, Caspar Hoffmann, and others, also opposed the ventricular theory of localization, especially the last mentioned, and who in consequence drew down upon him the anathemas of those who supported the ancient theories. He was particularly charged by Riolan the younger with ignorance, and with unsettling, by his new dogma, both the entire pathology and therapeutics of the brain; for he actually had the temerity to fix the seat of epilepsy and apoplexy in the substance of the brain, and not in the ventricles, as Galen taught. "And this is the argument," Prochaska remarks (from whom we have taken the preceding facts), "with which physicians are accustomed to meet new dogmas when opposed to their own, even if true; lest they should be compelled by shame to unlearn, when old, those theories which they have learnt in youth. Harvey was met with almost a similar argument, and considered as an audacious man."[2]

It was after the "animal spirits" were ejected from the ventricles that Malpighi, Sylvius, and Willis attempted to show that they were secreted by the cortical substance, whence they were received by the medullary substance, to be transmitted by it to the nerves of the whole body. To these, therefore, is due, and of these more especially to Willis, the first indication of the established doctrine of modern physiology, and which Gall and Spurzheim more fully developed—namely, that the cortical part of the brain, or the cineritious neurine, is ganglionic, or the seat of *action* or energy; and that the medullary or fibrous is a conducting structure, analogous to the trunks of the nerves. Willis retained some of the other Galenical doctrines; but he peculiarly advocated that the cerebrum subserves to the animal functions and the voluntary motions, the cerebellum to the involuntary; that a perception of all the sensations takes place in the ascending fibres of the *corpora striata*, and that through the descending fibres voluntary movements are excited; that the understanding and imagination have their seat in the *corpus callosum*, and the memory in the convolutions, which are its "storehouses."

A host of physiologists supported or opposed the doctrines of Willis; but amidst the innumerable controversies which arose, the doctrine of mental organology, or of cerebral differentiation of structure, with specialization of function, continually advanced. In 1784 Prochaska summarized the views of previous inquirers generally, and indicated the advance which the doctrine had reached at this period, when Gall began his researches and teaching. The 3d section of the 5th chapter of Prochaska's *Dissertation* (1784) is headed, "Do each of the divisions of the intellect occupy a separate portion of the brain?" In answer to this proposed problem, Prochaska proceeds thus: "It is our consciousness, and a certain peculiar feeling, which convinces every one that he thinks with his brain. But since the brain as well as the cerebellum is composed of many parts variously figured, it is probable that nature, which never works in vain, has destined those parts to various uses, so that the various faculties of mind seem to require different portions of the cerebrum and cerebellum for their production. Since, however, the *sensorium commune* reflects the sensorial impressions into motor by definite laws peculiar to itself, and independently of consciousness, and since we have laid down that the *sensorium commune* comprises the *medulla oblongata*, *medulla spinalis*, and the origin of all the nerves, it follows that the cerebrum and cerebellum, together with their connections, the *sensorium commune* excepted, constitute the organs of the faculty of thought; and as in some animals these are entirely wanting, it is fair to conjecture that the faculty of thought is also wanting, and that they exist solely in virtue of the *vis nervosa* of the *sensorium commune*, and of the nerves with which they are endowed."[3] Prochaska thus eliminated the hemispheres with the *corpus callosum* and cerebellum from those portions of the encephalon which he allotted to the sensorium,—namely, the ganglionic origins of the cerebral nerves, the *crura*, the *medulla oblongata*, and *medulla spinalis*,—and constituted them the organs of mind.

This was the state of knowledge when Gall first attempted to allocate portions of the hemispheres to special faculties. But in doing this both Gall and Spurzheim limited the term *medulla oblongata* to that portion of the central axis which extends from the lower border of the *pons Varolii* to the occipital foramen, and thus deviated from the anatomical definitions of their predecessors,—for Prochaska was not alone in his doctrines. Long previously Willis had stated, "where the *corpus callosum* is thought to end, there the *medulla oblongata* begins," and he anatomically describes it accordingly. All the successors of Willis used the term *medulla oblongata* more or less in a similar sense. Hence the older writers marked three great divisions of the encephalon—the cerebrum, brain, or hemispheres, including their commissure, the *corpus callosum*; the cerebellum or little brain, with its crura, and the head of the spinal column; and the *medulla oblongata* or oblong medulla, including from the *corpora striata* downward. The *medulla spinalis* and *oblongata* were also termed the *cerebrum prolongatum*, the *prolonged* brain,—the theory being, that this portion of the central axis arose, or was prolonged from, the cerebrum. Now the *medulla oblongata*, thus defined, was considered to be the point of origin of the encephalic nerves, and (through its continuation into the spinal cord) of all the nerves of the body. In this way it came to be considered the seat of sensation (the *sensorium commune*, the common centre of consciousness), or point of union between the sensory nerves on the one side, and the hemispheres on the other. This doctrine disappeared almost wholly with the advance of Gall's views, and the ganglia constituting that portion of the *medulla oblongata* situated above the *pons Varolii* were considered to be part of the brain or cerebrum. It is only within the last few years that Dr Carpenter has revived it as a new theory, giving the name "sensory ganglia" to these structures, instead of *sensorium commune*.

With this explanation, we can better understand Prochaska's conclusions as to a plurality of organs of the mental faculties.[4] When he proceeds to discuss the question,—after

[1] *Two Discourses concerning the Soul of Brutes, which is that of the Vital and Sensitive of Man*, by Thomas Willis, Doctor in Physick, Professor of Natural Philosophy in Oxford, &c.; Englished by S. Pordage, Student in Physick, folio, 1683, p. 27.

[2] *The Principles of Physiology*, by J. A. Unzer, and a *Dissertation on the Functions of the Nervous System*, by George Prochaska; translated and edited for the Sydenham Society by Thomas Laycock, M.D., &c., &c., 1851, p. 371.

[3] *Op. citato*, p. 446.

[4] Ibid. *loc. citato.*

alluding to the obscurity of the subject, and remarking that he is of opinion with Haller, that "careful dissections of the brains of fatuous persons, apoplectics, and such as have other disorders of the understanding," are the only means of throwing light upon it; and after advancing various arguments in support of the doctrine of organology, he adds, "It is therefore by no means improbable that each division of the intellect has its allotted organ in the brain [or hemispheres], so that there is one for the perceptions, another for the understanding, probably others also for the will, and imagination, and memory, which act wonderfully in concert, and materially excite each other to action. The organ of the imagination, however, amongst the rest, will be far apart, I should think, from the organ of perceptions, since the organ of perceptions being asleep and at rest, the organ of the imagination may be in action, a condition which produces dreams;" an argument identical, as we have seen, with that brought forward in support of the doctrine by modern phrenologists. It thus appears, therefore, that when Gall promulgated his views, the doctrine of plurality of mental organs was one which had been universally admitted since the time of Galen. The only questions that arose were as to the portions of the encephalon to be allotted to each: theologians, philosophers, schoolmen, physicians, anatomists, physiologists, all adopted without question the general principle. Mr Combe is completely justified, therefore, in his conclusion, "that the presumptions are all in favour of a plurality of mental faculties manifesting themselves by a plurality of organs."[1] Modern physiologists have, however, objected to these doctrines. Dr Carpenter, for example, says that it "seems to be a fundamental error to suppose that the entire intellect can be *split-up* into a certain number of faculties; for each faculty that is distinguished by the psychologist expresses nothing else than a *mode of activity*, in which the whole power of the mind may be engaged at once,—just as the whole power of the locomotive steam-engine may be employed in carrying it forwards or backwards, according to the direction given to its action. And if this be true, it must be equally erroneous to attempt to parcel out the cerebrum [meaning the hemispheres] into distinct 'organs' for these respective faculties; the whole of it (so far as we [Dr Carpenter] can form a judgment), being called into operation in every kind of intellectual process which occupies the attention at the time."[2] The analogy drawn between the human mind and a steam-engine is rather too wide to help in the elucidation of an argument, and need not be examined, the more especially because Dr Carpenter really elsewhere expresses other and sounder views on this point. After noting the correspondence between the development of the brain, and the manifestations of intelligence in lower animals, and specially the "very decided evidence furnished by the great enlargement of the cerebrum [the hemispheres], and the corresponding alteration in the *form* of the cranium, which present themselves in those races of dogs most distinguished for their educability," Dr Carpenter adds, "This general inference, drawn from comparative anatomy, is borne out by observation of the human species. When the cerebrum [cerebral hemispheres] is fully developed, it offers innumerable diversities of form and size among various individuals; and there are *as many diversities of character.* It may be doubted if two individuals were ever exactly alike in this respect."[3] We have placed within brackets an interpolation of the meaning of the word cerebrum in accordance with one of the senses in which it is used by the writer. Dr Carpenter evidently means to say (in common with the best of modern neurologists), that the hemispheres of the brain of man and the higher animals present as many diversities in form and size as there are diversities of individual character. Now, the phrenologists say no more, except that they have carefully observed, and to a certain extent determined by observation, the relations which these diversities in the form and size of the hemispheres bear to the diversities in the characters of individuals. We may add, that one of the most distinguished of living physiological psychologists fully admits the phrenological doctrine of plurality of faculties and organs, although he is by no means in favour of phrenology generally. "The phrenologists rightly regard it as probable," Sir H. Holland remarks, "or even as proved, that there is a certain plurality of parts in the total structure of the brain corresponding to, and having connection with, the different intellectual and moral faculties. The undoubted natural diversity of these faculties makes this probable, seeing that we must regard a certain organization as ministering in the present life even to the higher powers of our nature. The partial and varying effects of accident, disease, or other less obvious change in the brain, in producing derangement of the mental functions, furnish more direct evidence, and such as we cannot refuse to admit."[4]

On the side of modern psychology, we have equally strong testimony. Mr Herbert Spencer, one of the most profound thinkers of the day, remarks,—"No physiologist who calmly considers the question in connection with the general truths of this science can long resist the conviction that different parts of the cerebrum subserve different kinds of mental action.. Localization of function is the law of all organization whatever; separateness of duty is universally accompanied with separateness of structure; and it would be marvellous were an exception to exist in the cerebral hemispheres. Let it be granted that the cerebral hemispheres are the seat of the higher psychical activities; let it be granted that among those higher psychical activities there are distinctions of kind, which, though not definite, are yet practically recognisable; and it cannot be denied, without going in direct opposition to established physiological principles, that these more or less distinct kinds of psychical activity must be carried on in more or less distinct parts of the cerebral hemispheres. To question this, is not only to ignore the truths of physiology as a whole, but especially those of the physiology of the nervous system."[5] Mr Spencer further adds,—"either there is some arrangement, some organization in the cerebrum, or there is none. If there is no organization, the cerebrum is a chaotic mass of fibres incapable of performing any orderly action. If there is some organization, it must consist in that same physiological division of labour in which all organization consists; and there is no division of labour, physiological or other, of which we have any example, or can form any conception, but what involves the concentration of special kinds of activity in special places."

Now, although phrenology thus rightly connects those operations of the mind, or states of consciousness which are intellectual in their nature, with special centres of activity situate in the hemispheres, is it equally correct in placing the mere propensities or instincts, *i.e.*, when devoid of ideas, exclusively in the same category? We think not, for it has been clearly shown, from arguments founded on the comparative anatomy and pathology of the encephalic structures, that this portion of the phrenological organology is very doubtful, and more particularly as to the seat of the sexual instinct, although we are not at all clear that doctrines like those of Dr Carpenter (certainly not new) are more valid.[6] Just as Gall and Spurzheim used the term *medulla oblongata* in a more limited sense than preceding

[1] *System of Phrenology*, 5th ed., vol. i., p. 33.

[2] *Human Physiology*, 5th ed., pp. 598–9.

[3] *Op. citato*, p. 541–2.

[4] *Chapters on Mental Physiology*, 8vo, 1855, chap. ix.

[5] *Principles of Psychology*, 1855, p. 607.

[6] *Principles of Comparative Physiology*, 4th edition, p. 692-703.

anatomists, and thereby gave rise to discrepancies of opinion and to novelties of doctrine more apparent than real; so, it is to be feared, will be the case with Dr Carpenter's peculiar and varying use of the terms "cerebrum" and "brain," to which we have previously referred. If we must have a change in terms, the philosophical nomenclature of Professor Owen or Lamarck is the most in accordance with the laws of development of the encephalic structures. Lamarck termed the hemispheres the *hypocephalon*, and the ganglionic structures below them the *cephalon* or brain proper, inasmuch as these are to be found in all vertebrate animals, and are essential structures, while in man and others the hemispheres are only superadded or superimposed structures.[1] A classification of the convolutions, first begun by Gall, and carried out by his disciples, has been attempted by some of the most distinguished physiologists of the day,—viz., MM. Foville, Leuret, and Owen. It is very probable that a more philosophical application to phrenology of recent discoveries in comparative neurology will ultimately force on a modification of its organology as to the mere instincts. In especial, the doctrines of Willis on this point will perhaps have renewed attention and development given to them. When the phrenologist takes a larger grasp of this part of his system, and brings more comprehensive methods of psychological analysis and of physiological research to bear upon it, he will be better able to reconcile conflicting facts and conclusions. In particular, it will probably be found that the instincts and propensities have a two-fold relation to the organism, so that when manifested in connection with higher psychical states (as they almost always are in man), they are in relation with changes both in their own special or primary seats (the brain proper), and in the superadded structures (the hemispherical convolutions) the seat of the higher psychical faculties. Perhaps it will some day be proved that the several layers of gray and white matter which make up the hemispherical ganglia have themselves distinct functions, as ganglionic and conducting tissues. It is generally admitted that Baillarger's arrangement of six layers,—namely, three gray and three white—is well founded, while Baillarger himself is inclined to adopt the views of Foville and Gratiolet, who have shown that there is a seventh layer, one of white or conducting matter, accompanying the innermost layer of gray matter throughout its whole extent.[2] We might add more on this head, but it is obvious enough already that much has yet to be done before mental organology can be placed on a satisfactory foundation.

The Dynamics of Phrenology.—The neurological anatomy generally of phrenology does not differ in any essential respects from the doctrines of neurologists generally, or at least more than these differ from each other. Having indicated the special points of difference, we need only refer to Mr Solly's valuable work on *The Human Brain* as an admitted text-book of phrenologists in other respects. We now proceed to examine the dynamics or cerebral physiology of phrenology. It is a fundamental principle that *power* of mind is, *cæteris paribus*, dependent upon *size* or development of the cerebral hemispheres; and since what is true of the whole must be true of the parts, it follows that the power of special faculties is also, *cæteris paribus*, dependent on the size of special organs, *i.e.*, portions of the hemispheres. No principle of phrenology has been more controverted than this, yet it is one upon which there is a singular unanimity amongst all classes of observers, whether popular, psychological, or physiological. A talented modern metaphysician remarks, in summary of the teachings of all the most distinguished physiologists,—"There is an indisputable connection between size of brain and the mental energy displayed by the individual man or animal. It cannot be maintained that size is the only circumstance that determines the amount of mental force; *quality* is as important as quantity, whether in nerve, muscle, or any other portion of the animal structure. But just as largeness of muscle gives greater strength of body as a general rule, so largeness of brain gives greater vigour of mental impulse."[3] This, the doctrine, we repeat, of all the best physiologists, is none other than the doctrine of all the phrenologists. Yet, when enunciated by them, it has usually been treated with derision, or if seriously controverted, controverted most usually on false premises, or on a false statement of the doctrine,—as, for example, that phrenology teaches that size corresponds absolutely to manifestation. But those physiologists, strange to say, who controvert the doctrines when applied by phrenologists to the hemispheres, adopt it themselves when they wish to demonstrate the functions of other portions of the encephalon. It is particularly from the facts of comparative anatomy that evidence can be deduced as to the functions of the complicated encephalon of man; and it is upon these, with especial reference to *size* or extent of organic development in lower animals in relation with *manifestation*, that the latest views as to the functions of the cerebellum and of the cerebral ganglia are founded. Now, the method of research applicable to various portions of the encephalon generally is equally applicable to the various portions of the hemispheres. If size of portions of the encephalon, taken in correspondence with energy of psychical manifestation, indicates in lower animals the functions of those portions of the encephalon, surely the size of portions of the hemispheres, taken in correspondence with energy of mental manifestation, indicates the functions of those portions, and proves the law of *energy = size*. Hence it must be conceded to the phrenologists that the law, *within the limits* and *under the conditions laid down*, is founded on both facts and general principles.

Laws of Action of the Brain as the Organ of Mind.—The phrenologists do not differ from neurologists in general as to the laws and modes of action of the nervous system, except in so far as they differ on points of anatomy or organology. Gall and Spurzheim had the duty of combating errors as well as of developing truths. In this particular they were of great service to neurology, inasmuch as by uprooting errors they cleared the ground for the more accurate views of the functions of the nervous system recently promulgated. It is certain, however, that being so fully occupied with their new views as to the anatomy and organology of the encephalon, they neglected any deep inquiries into its laws of functional activity, and in particular omitted to apply the general laws of nervous action, first lucidly developed by Unzer, then summarized and extended by Prochaska, and in more recent times resuscitated, and very ably applied by Marshall Hall to the pathology of the *medulla spinalis* and encephalon, as far as the *tubercula quadrigemina*. The early cultivators of phrenology, however, taught the important general doctrine, that the modes of action of the organs are instinctive in their nature. In September 1844 Dr Laycock read a paper before the British Association for the Advancement of Science, in which he showed that the laws of reflex action were not limited to the *sensorium commune*, as held by Prochaska, nor to the spinal system as Dr Marshall Hall then taught, but were the laws of action of the instincts and of every por-

[1] *Philosophie Zoolog.*, tom. ii., p. 223. His words are, "Or, cet *hypocephale* est l'organe spécial dans lequel se forment les idées et tous les actes de l'intelligence; et le *cerveau* proprement dit, cette partie de la masse médullaire principale que contient le centre de rapport des nerfs, et à laquelle les nerfs des sens particulier viennent de réunir, ne sauroit lui seul donner lieu à de semblables phénomènes."

[2] *Annales Med. Psycholog.*, tom. i., 1855.

[3] *The Senses and the Intellect*, by Alexander Bain, A.M., 1855, p. 11.

tion of both the cerebro-spinal and sympathetic systems.[1] Dr Laycock subsequently developed his doctrines so as to demonstrate their application to the fundamental laws of consciousness and thought.[2] In 1845 Mr Combe applied Dr Laycock's discoveries to an elucidation of the modes of action of the cerebral hemispheres, according to the phrenological doctrines, but more especially showing their capability of explaining the production of the natural language of the faculties, and the nature of the various forms of impulsive insanity.[3] Some years subsequently (1853) Dr Carpenter also adopted Dr Laycock's views, and gave them a special application to those various states which agree in the common characteristic of mental activity without volitional control, and which he designated by the unfortunate phrenological[4] term of unconscious "cerebration."[5] Dr Carpenter has, however, added to the doctrines the theories of Willis and Lamarck as to the so-called "sensory ganglia" Later psychological writers of great eminence have referred to Dr Laycock's views, and noted their value in explaining the laws of cerebral action in mental operations. On the doctrines thus put forward by Dr Laycock, Mr Morell remarks:—"We certainly see in them the most complete co-ordination established between psychology and physiology in the widest extent."[6] Now, since the very foundation of phrenology is mental organology, this exhaustive co-ordination between physiology and psychology is of fundamental importance to its further development; and that, whether we consider phrenology as a new system of philosophy or of cerebral physiology. This new field of mental dynamics the scientific phrenologist should therefore cultivate.

Phrenological Psychology and Physiognomy.—The middle and close of the eighteenth century, until the outbreak of the French Revolution, was a period remarkable for the culture and development of neurology and physiological metaphysics. Stahl had given the latter a great impulse by his revival of the Aristotelian doctrine of the soul, and his application of it to the phenomena of healthy and morbid action, and the treatment of disease. After the promulgation of the Stahlian doctrines, neurological anatomy and physiology were widely cultivated, especially in Germany. During the period named, Pfeffinger, Haase, Lobstein, Metzger, Sömmering, Meckel, Hirsch, Wrisberg, Boehmer, Asch, Bang, Andersch, Murray, Bose, Platner, Brunn, Heineken, Behrends, Ludwig, Ebel, Isenflamm, Thaer, Ploucquet, Baur, Zinn, and others, investigated the anatomy, physiology, and pathology of the nervous system, some of whom have left their names connected with their discoveries.[7] Very distinguished systematic writers also flourished during this period, as Albinus, Winslow, Vieussens, Haller, Bonnet, Unzer, Prochaska, Vicq d'Azyr, and others. Gall pursued his medical studies in the midst of all this struggle after a knowledge of the anatomy and physiology of the nervous system, for, being born in 1757, he would probably be at the university of Vienna about 1777. His first attempts at observation were purely physiognomical. He found himself excelled in powers of memory of words by fellow-students and schoolmates who had prominent eyes. After much reflection, he conceived that if a memory for words was indicated by an external sign, the same might be the case with the other intellectual powers; and thereafter all persons distinguished by any remarkable faculty became the object of his attention. He thus became acquainted with individuals remarkable for the determination of their character, and he observed a particular part of their heads to be very largely developed. This fact first suggested to him the idea of looking to the head for signs of the dispositions or affections. Gall at first therefore endeavoured to establish a cranial physiognomy, and in this respect was a follower of Lavater, then popular: it was only after a more extended study that he was convinced of the need to investigate the anatomy and physiology of the brain. "In every instance," says Mr Combe, "where an individual whose head he had observed while alive happened to die, he requested permission to examine the brain, and frequently was allowed to do so; and he found, as a general fact, that on removal of the skull, the brain, covered by the *dura mater*, presented a form corresponding to that which the skull had exhibited in life." This general principle being established, it necessarily followed that, if the mental character corresponded to a particular form of skull, or a predominant faculty to a special development of a portion of it, the character or the faculty was manifested in connection with a particular development of the brain; and the solution of the problem put by philosophers and physiologists, from Aristotle downwards, became possible. Thus, by the method of observation and induction, Gall built up his physiognomical system, which professes to supply the elements for determining the mental character from the form of the head. His psychology was perhaps the weak point in his doctrines; for he had to shake off the trammels of the old philosophy in which he had been educated. This led in particular to a less definite application of the conclusions to be drawn from pathological phenomena, as local diseases or injuries of the brain, and morbid developments of it in idiots, imbeciles, the insane, and incorrigible criminals.

Psychological Arrangement of Phrenology.—Gall's psychology, as well as his first physiognomical conclusions, although founded upon researches continued through many years, were subsequently modified to a great extent; in the first instance by himself, on the acquisition of fresh data, afterwards by his disciples, more especially Spurzheim. Individual phrenologists differ to the present day as to the number of the faculties and the locality of the corresponding organs; and it is acknowledged by all that more remain to be discovered. There are certain general principles, however, which appear to be settled. The term *faculty* is used by them "to denote a particular power of feeling, thinking, or perceiving, connected with a particular part of the brain." (Combe.) "A faculty is admitted as primitive—1. Which exists in one kind of animal, and not in another; 2. Which varies in the two sexes of the same species: 3. Which is not proportionate to the other faculties of the same individual; 4. Which does not manifest itself simultaneously with the other faculties,—that is, which appears or disappears earlier or later in life than other faculties; 5. Which may act singly; 6. Which is propagated in a distinct manner from parents to children; 7. Which may singly preserve its proper state of health or disease."[8] Spurzheim largely modified Gall's arrangement of the primitive faculties (which was almost wholly empirical), and from time to time altered his own, until finally, in 1825, he fixed upon the psychological arrangement now generally adopted by phrenologists of the present day, although admittedly imperfect. He placed the faculties in two orders, corresponding to the feelings and the

[1] See this essay, "On the Reflex Functions of the Brain," in *Br. and For. Med. Review*, Jan. 1845, vol. xix., p. 298.

[2] "Further Researches into the Functions of the Brain," *Brit. and For. Med. Chirurg. Rev.*, 1855, vol. xvi., p. 155.

[3] *Elements of Phrenology*, 6th ed., 12mo, 1845.

[4] First used by Dr Engledue, and with disastrous results to phrenology. (*Phren. Journ.*, vol. xv., p. 295, &c.)

[5] *Human Physiology*, 4th ed., pp. 799–800, note, and 811, sqq.

[6] "On Modern English Psychology," *Brit. and For. Med. Chir. Review*, vol. xvii., April 1856, p. 356. Compare also Mr Morell's *Elements of Psychology*, part i., p. 99.

[7] *Scriptores Neurologici Minores Selecti*, &c., edidit Chris. Fred. Ludwig, tom. iv., Lipsiæ, 1795.

[8] Spurzheim *apud* G. Combe, *System of Phrenology*, vol. i., p. 171.

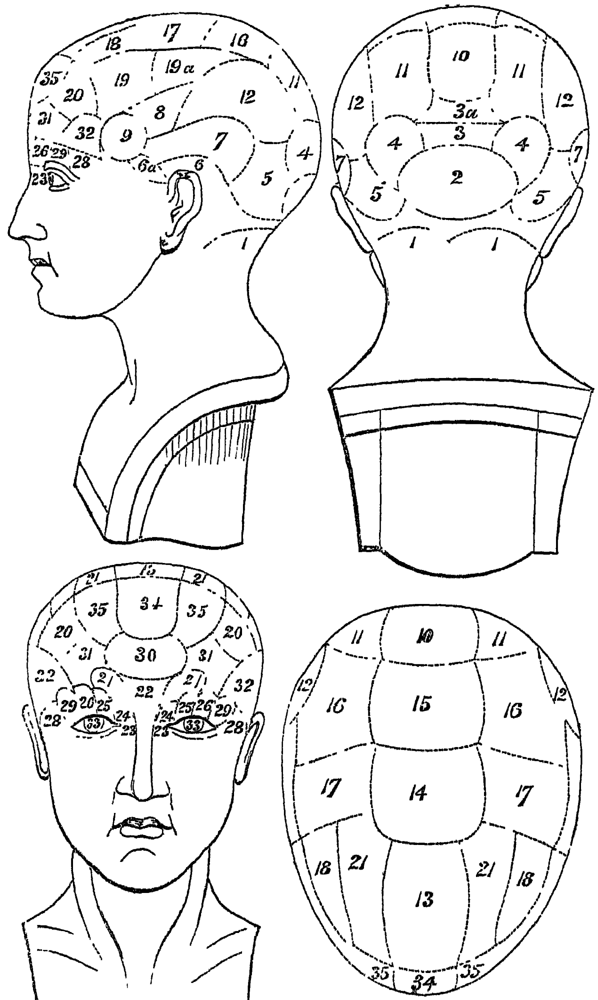
intellectual powers of metaphysicians in general, and termed them the *affective* and the *intellectual* faculties. The feelings were arranged in two genera,—those of the propensities and the sentiments. A propensity is an "internal impulse," which impels only to certain actions; in common language, is an instinct. A sentiment is an internal impulse or inclination to action, with an emotion superadded; in common language, an emotional instinct, emotion, or passion. Acquisitiveness, for example (a propensity), is the mere impulse to acquire. Veneration (a sentiment) gives a tendency to worship, accompanied by a particular emotion, which latter quality is the reason of its being denominated a sentiment.[1] The intellectual faculties make us acquainted with objects which exist, and their qualities and relations. Spurzheim divided them into four genera: "The first includes the external senses and voluntary motion; the second, those internal powers which perceive existence, or make man and animals acquainted with external objects and their physical qualities; and the third, the powers which perceive the relations of external objects. These three genera are named *perceptive faculties*. The fourth genus comprises the faculties which act on all the other powers—which compare, judge, and discriminate; these are named the *reflective faculties*.[2] Complex faculties, sentiments, and propensities arise out of combinations (in excess or defect) of the primitive. Veneration, Hope, and Wonder in normal combination constitute the sentiment of religion; if in excess, of superstition. Large Acquisitiveness and Secretiveness will constitute the propensity to steal, if Conscientiousness and the reflecting faculties be defective; if these be large, they will constitute good elements in a noble character. This psychological arrangement may be considered as the basis of a system which is wholly independent of organology, or even of cerebral physiology. Considered as simply a system of metaphysical nomenclature, many are disposed to agree in opinion with Archbishop Whately, who thinks that, as such, it is "far more logical, accurate, and convenient, than those of Locke, Stewart, and other writers of their school."[3]

Physiognomical Arrangement of the Organs of the Faculties.—Each faculty, or group of faculties, has a corresponding portion of cerebral matter allotted to it. With the exception of the sexual instinct, this consists in certain convolutions of the hemispheres. The skull being moulded upon the convolutions in youth and middle age (though not in old age or in cerebral atrophy, when the convolutions shrink, but the cranium remains unchanged), it is practicable at these ages to mark out on the surface of the head the size and extent of the organs of the faculties,—*i.e.*, to form a chart of the development of the various convolutions. We subjoin a phrenological chart of this kind,[4] as well as a psychological arrangement of the organs, the numbers of which correspond to the numbers of the chart:—

Order I.—Feelings.

Genus 1.—*Propensities common to Man with the Lower Animals.*

1. *Amativeness.* Sexual love, instinct, feeling.—2. *Philoprogenitiveness.* Parental affection for young, affection for young and tender beings. *Abuses*—Pampering and spoiling children, foolish affection for pet animals.—3. *Concentrativeness.* Gives the desire of permanence in place, renders permanent emotions and ideas in the mind. *Abuses*—Aversion to move abroad, morbid dwelling on internal emotions and ideas to the neglect of external impressions. —3 *a. Inhabitiveness* A modification of the preceding and following, but the organ doubtful.—4 *Adhesiveness.* Attachment to persons, friendship, love of society; generally strong in women. *Abuses*—Attachment to worthless individuals, union for worthless ends.—5. *Combativeness.* Courage to meet danger and to overcome difficulties; propensity to oppose and attack whatever excites opposition, and to resist injustice; enables man to meet difficulties and dangers. *Abuses*—Love of contention, and propensity to provoke and assault. —6. *Destructiveness.* Desire to destroy noxious objects, or for the well-being of the individual (as to food, clothing, &c) *Abuses*—Cruelty, murder, anger and severity in conduct and language.—



6 *a Alimentativeness*, or appetite for food. *Uses*—Nutrition. *Abuses*—Gluttony and drunkenness. This is also the supposed site of the organ of *Love of Life*.—7. *Secretiveness* Propensity to conceal the person, or the thoughts, words, and actions; an ingredient in prudence. *Abuses*—Lying, deceit, duplicity, cunning.—8. *Acquisitiveness* The desire to possess, and propensity to accumulate articles of utility, to provide against want *Abuses*—Selfishness, avarice, theft —9 *Constructiveness.* Desire to build and construct.

Genus 2 —*Sentiments.*

(*a*) *Sentiments common to man and the Lower Animals.*—10. *Self-Esteem.* Self-respect, self-interest, love of independence, personal dignity. *Abuses*—Pride, disdain, love of dominion, overweening conceit, great selfishness —11. *Love of Approbation.* Desire to obtain the esteem of others, to acquire fame, praise. *Abuses*—Ambition, vanity, thirst for unmerited praise.—12. *Cautiousness.* The desire to shun danger, circumspection, prudence. *Abuses*—Undue fear, excessive timidity, unfounded apprehensions, despondency.—13. *Benevolence.* Desire to give happiness to others, mildness of disposition, universal sympathy and charity. *Abuses*—Profusion, injurious indulgence of the appetites and fancies of others, facility of temper.

(*b*) *Sentiments proper to Man.*—14 *Veneration.* Tendency to respect whatever is great and good, gives origin to religious adoration. *Abuses*—Superstition, love of antiquated customs, abject

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[1] Mr Combe, *A System*, &c., vol. i., p. 180.

[2] Mr Combe, *loco cit.*

[3] Testimonial to Mr Geo. Combe, *Phren. Journal*, vol. x., p. 109.

[4] Prefixed to Mr Combe's *Elem. of Phren.*, 12mo, 6th ed., 1845.

subserviency to authority.—15. *Firmness.* Determination, steadiness of purpose, perseverance. *Abuses*—Stubbornness, infatuation, tenacity in evil.—16. *Conscientiousness.* Sentiment of justice, respect for the rights of others, openness to conviction, the love of truth. *Abuses*—Ignorant adherence from conscientious motives to noxious principles, excessive refinement in views of duty and obligation, excessive remorse or self-condemnation —17. *Hope.* Tendency to expect future good, sentiment of faith. *Abuses*—Credulity as to attainment of things desired, absurd expectations.—18 *Wonder.* The desire of novelty, admiration of the new, the unexpected, the surprising *Abuses*—Love of the marvellous and occult, belief in false miracles and supernatural absurdities.—19. *Ideality.* Love of the beautiful and splendid, desire for excellence; the poetic feeling. *Abuses*—Absurd enthusiasm; preference of the fanciful, showy, and glaring, to the neglect of the duties of life.—19 *a.* The function of these convolutions is not yet determined.—20 *Wit.* The sentiment of the ludicrous, feeling of mirth —21. *Imitation.* Disposes to copy the manners, voice, actions of others, and the appearances in nature generally.

ORDER II.—INTELLECTUAL FACULTIES.

GENUS 1.—*The External Senses.*

GENUS 2.—*Knowing Faculties.*

(*a.*) *Knowing Faculties which perceive the Existence and Qualities of External Objects.*—22. *Individuality.* Takes cognisance of existence and simple facts —23. *Form.* Renders man observant of form of objects.—24 *Size* Gives the idea of space, and the power to appreciate dimension and distance.—25. *Weight.* Communicates the perception of momentum, weight, and resistance; aids equilibrium.—26 *Colouring.* Takes cognisance of colours and their harmonies.

(*b.*) *Knowing Faculties which perceive the Relations of External Objects.*—27. *Locality.* Gives the idea of direction in space.—28. *Number.* Gives the talent for calculation —29. *Order.* Communicates the love (or the power) of physical arrangement —30. *Eventuality.* Takes cognisance of occurrences or events —31. *Time.* Is the faculty of perceiving duration.—32. *Tune.* Is the source of melody and harmony.—33. *Language.* The faculty of acquiring a knowledge of arbitrary signs to express thoughts, of inventing and recollecting them, and of readily using them.

GENUS 3.—*Reflecting Faculties, which Compare, Judge, and Discriminate.*

34. *Comparison.* The faculty of discovering analogies, resemblances, and differences.—35. *Causality.* Traces the dependencies of phenomena, and the relation of cause and effect.

Phrenologists are not all agreed as to the details of this arrangement, and have proposed others. Dr Vimont criticises it on some points; Mr Robert Cox has published a very able and interesting essay on its defects;[1] Mr Sidney Smith, in his *Principles of Phrenology*, has some acute remarks; Mr Joshua Toulmin Smith gives an almost entirely new arrangement in his *Synopsis of Phrenology*, based on philosophical views more advanced than those of Spurzheim. It is improbable that, in the present state of knowledge, any arrangement can be made complete. The difficulties inherent in the subject itself are perhaps insurmountable. But imperfect though these conclusions may be, they are worthy of respect, as being well-tried deductions from observations made on many fields of research by numerous observers. The collections of crania, casts, drawings, and the like, in the possession of private persons or public societies, may be taken as some slight index of the extent and industry with which these observations have been made. Gall's own collection contained 354 skulls, casts of skulls, brains, &c., illustrating the phrenology of man; 120 heads of quadrupeds; and 138 heads of birds. A manuscript descriptive catalogue of this collection is amongst the MSS. in the museum of the Phrenological Society of Edinburgh. It is a copy of that drawn up by Dr Dauncey, the pupil and friend of Gall, and contains the record of the facts and correspondence of each subject, as observed by the latter.[2] The Edinburgh museum is remarkably rich in crania and casts of crania illustrative of characteristics of nations and races. Of these there are 313, besides 150 miscellaneous skulls, many of great interest. It contains also 280 busts and 100 masks of eminent or notorious individuals.

In 1817 a Mr Deville, a lamp-manufacturer of London, was a member of the institution of civil engineers. He had been originally a pot-boy, then a journeyman plasterer, and afterwards kept a shop for the sale of plaster figures, which he cast. He had risen to a respectable position simply by the force of his natural powers. Mr Bryan Donkin, a civil engineer, was an early auditor of Gall at Vienna, and subsequently a friend of Spurzheim. He was also, like Mr Deville, a member of the institution of civil engineers; and when, in 1817, he with others determined to make a collection of casts as records of phrenological facts, Mr. Deville was applied to for his assistance, which he rendered as a matter of business for three or four years. In 1821 he became interested in phrenology, and began to form a collection of casts on his own account. Already, in 1826, Spurzheim said it was finer than any he had seen elsewhere. At Mr Deville's death in 1846, this collection consisted of about 5450 pieces; of these 3000 were crania of animals, and the remainder (2450) illustrations of human phrenology. There were 200 human crania, and 300 casts of crania; amongst the latter, those which Baron Cuvier permitted Mr Deville to take from all the authenticated human skulls in the Museum of Comparative Anatomy of Paris. Mr Deville was a practical observer, and possessed the large number of 1500 casts of heads taken by himself from persons while living. Amongst these were 50 casts of persons remarkably devoted to religion; 40 of distinguished painters, sculptors, architects, &c.; 30 of eminent navigators and travellers; 80 of poets, authors, and writers; 70 of musicians, amateurs, and composers of music; 25 of pugilists; 150 of criminals; 120 pathological cases illustrative of insanity, &c. Perhaps the most interesting of all are 170 casts which illustrate the changes caused in the cranial conformation of from 60 to 70 individuals by age, special devotion to one pursuit, and the like. Mr Deville's account of some of these has been published.[3] Other instances of this kind may be mentioned. Dr Vimont, a disciple of Gall, and the author of an important work (*Traité de Phrenologie Humaine et Comparée*), saw that the illustrations which Gall drew from comparative anatomy and psychology were too few and too imperfect. He therefore resolved to develop this branch of phrenology; and in 1827, when competing for the prize for physiology of the French Institute, sent in a "few fragments" of his researches in this direction. His Memoir was accompanied by 2500 crania of animals; 1500 of these belonged to animals the manners and habits of which were well known to him. In addition, there were 400 wax models of cerebra, and an Atlas of more than 300 drawings. This Memoir was the basis of his great work; and the Atlas of 120 plates (folio) which accompanies it contains 600 separate drawings, all beautifully done. Again, Dr S. G. Morton of Philadelphia has a collection of skulls, human and comparative, made for the purpose of comparing the characters of the skulls of the different races of men, and these again with the skulls of lower animals, more especially with reference to the internal capacity of the cranium, as indicative of the size of the brain. This collection contained in 1841 above 1000 crania, of which more than five hundred were human skulls. One hundred of these belonged to ancient Egyptians, the same number to native-born Africans, and a still greater number to ancient Peruvians, Mexicans, and nomade Indians of the American continent. It was this collection which sup-

[1] *Phrenological Journal*, vol. x., p. 154.

[2] "Catalogue, Numerical and Descriptive, of Heads of Men and Animals which composed the collection made by the late Dr Gall, transcribed by Mons. A. A. Royer," &c., *Phren Jour.*, vols. vi. and vii.

[3] *Phren. Jour.*, vol. xiv., p. 32.

plied the materials for Dr Morton's magnificent work, *Crania Americana*.

Modes of Determining the Size and Activity of the Organs.—In practically determining whether the organs thus indicated externally are present in any person, the phrenologist depends primarily upon the size of the cranium, or extent of certain portions of it—considering that the bony covering corresponds (with certain recognised exceptions) to the contained viscus in its subdivisions, both in magnitude and form. Various instruments have been invented, and rules are laid down, both for measuring the size of organs and for avoiding the fallacies into which the observer may fall, in consequence of anatomical or pathological conditions interfering with the determination of size, or the universal application of the general law of size=power. Thus the development of the frontal sinuses, the differences coincident with age and size in the development of the skull and the thickness of the bony parietes, the influence of morbid states of the organ, as in hydrocephalus and the like, are examples of sources of fallacy against which the phrenological observer must guard.

Nor, when he has at last accurately determined the dominant size of an organ, does the practical phrenologist draw absolute conclusions therefrom. The organ is but living tissue, liable to be influenced in power and functional activity by various vital conditions, of which he takes a due estimate. The following are the points to be attended to phrenologically in estimating the value of size of a cerebral organ with reference to functional activity:—(*a.*) The temperament of the individual modifies the power or activity, so that in a person of lymphatic temperament there will be no more manifestation of a faculty with a large organ, than in a person of a neuro-bilious temperament (more active) with a moderate or even small organ. It is therefore necessary to mark well the difference between power and activity in reference to both size and temperament. (*b.*) Conditions of the organ as regards *health* have great influence. In mania, very forcible manifestations may proceed from a brain or an organ unusually small. In old age, atrophy or disease is not uncommon. (*c.*) Education or activity increases the size, and therewith the power of an organ; it may also increase the activity by improving or modifying the condition independently of size. (*d.*) The combination of two or more organs may increase the power or force of manifestation of a faculty. (*e.*) The combination of temperament or quality, of size, and of exercise, may have a greater effect than each singly, or any two in combination; and this effect is still further intensified if two or more organs so modified act together. "Thus, in playing on a musical instrument, the organ of Time co-operates with the organ of Tune; and the music will be good or bad in proportion to the perfection of *both* organs in point of *constitution, size,* and *exercise.*" (Mr Combe.) (*f.*) There are circumstances as yet unknown which modify the *condition* of the brain. "We are not at present acquainted with the external signs of the highest of all qualities of brain which, when combined with adequate size, constitutes genius; whether it consists in an extraordinary development of the gray matter, in a peculiar fineness of constitution, or in some other form of endowment of the brain, we are uncertain."[1] There are also other circumstances, as habits, age, sex, race, and the like, which must be taken into account in estimating the relations of organ to manifestation of faculty.

Every faculty of the mind, and every state of consciousness, is represented in the facial movements, or in the general movements of the head, trunk, limbs; *i.e.*, it is signified in expressions and attitudes. If, then, these be considered as a language, and duly read, or, in other words, if physiognomy proper be brought in as an aid, the observer may be directed in his observations by the predominant attitudes, &c. These are termed by phrenologists the natural language of the faculties. "The laugh of Destructiveness is bitter, and that of Self-Esteem is scornful; that of Benevolence is soft and pleasing, that of Love of Approbation is insinuating, that of Secretiveness is sly. . . . . The crying of a child animated by an injury which has roused its Destructiveness is quite different from that of one excited to cry by mortified Love of Approbation. . . . . When the organ of Self-Esteem predominates in size over all other organs, it gives a cold, selfish, imperious air to the individual. He carries his head high, his look is full of disdain, and his walk and speech are solemn and pretentious."[2] This natural language is also used for determining the locality of organs, because, according to Spurzheim and his disciples, "the motions are conformable to the seat of the organs. If, for instance, a faculty, the organ of which is situated in the posterior part of the brain, be active, the general motions are backward; and if its organ be in the forehead, then the motions are forward."[3] In the portraits of Sterne, this principle of the phrenologists is said to be illustrated by the attitude in which that humourist is painted; he sits leaning on his hand, with his fore-finger resting over the organ of Wit.

Combinations of the Faculties.—These occur in varying extent in all forms of mental action: two or several may be predominantly active or powerful; few, if any, act singly. The action of the faculties or organs in combination is a very important branch of phrenology. Gall divided men into six classes, with leading characteristics founded on the combinations of organs or faculties into groups. For example,—1. Individuals with the organs of the highest faculties and qualities completely developed, while those of the faculties man has in common with lower animals (the mere animal organs) are small, present a high type of moral character. Their conduct is in accordance with reason and justice. 2. Men with a converse development are more allied to the animal; they are the slaves of sensuality and error. 3. If the organs of both groups are large, the man often manifests the most opposite qualities; there is often a struggle between the higher and lower sentiments and motives of human nature: "the flesh lusteth against the spirit." 4. Certain organs are sometimes highly developed, while others are at par or a maximum. This class includes men of great but partial genius, or of great strength of character. 5. Or there may be men of general ability, but with some marked deficiency of mind or feeling. 6. And lastly, in the sixth class are the average of mankind, with a moderate and nearly equal development of all the organs. There are also combinations in *activity* as well as of size. It is evident that these combinations of organs may vary almost *ad infinitum.* The six classes above given Dr Gall allows "are subject to thousands of modifications."[4] Mr Combe tried to state in methodical order the effect of the combinations so far as observed, but found it to be so difficult that he contented himself with setting forth three rules to be followed, appending copious illustrations to each. "The reader," Mr Combe observes, "in whom the reflecting organs are amply developed will not only easily comprehend the rules here laid down, but be able greatly to enlarge the sphere of their application."

Regional Phrenology.—Now, this physiognomy of groups of allied or related organs is one of some special interest, not only because certain modifications of the doctrine of Gall have been founded on it, but also because of its important bearings upon ethnology. Observers finding that the discrimination of special organs is far more difficult,

[1] *Phrenology applied to Painting and Sculpture*, by George Combe, 8vo, 1855, p. 101.
[2] Mr Combe, *op. cit.*, pp. 75, 76.
[3] *Phrenological System*, p. 269.
[4] Mr Combe's *System*, &c., vol. ii., p. 297.

and the results much more unsatisfactory than that of groups of organs, have turned their attention to a few large regions of the head. Many who oppose phrenology as it is in its details, admit freely that the development of certain cranial regions is coincident with certain definite manifestations of character, both individual and ethnic. They admit the connection, *e.g.*, of intellectual power with well-developed anterior convolutions—of the higher sentiments and emotions with the middle convolutions—of the instincts and propensities with the posterior and basic; or, more definitely (with a distinguished anatomist and physiologist, Dr Carus of Dresden), they divide the head into distinct *regions* rather than *organs*, and assign faculties, feelings, instincts, to the corresponding regional portions of the encephalon. This may be termed *regional phrenology*. Dr Carus' views attracted a good deal of attention at the time he published his *New Cranioscopy*, in opposition to that of Gall and Spurzheim.[1] They are founded mainly upon the laws of development of the nervous system in vertebrates, or rather upon comparative psychology in relation to the comparative anatomy of the brain. He divides the head from before backwards into three regions, making the auditory foramen the starting-point of each line of demarcation. Mr Combe rejects Dr Carus' doctrine, but, like him, also divides the head into three regions. The first includes the organs of the intellectual faculties (*vide* chart); the second, the moral and religious sentiments peculiar to man; the third, the sentiments and propensities manifested by him in common with the lower (vertebrate) animals. Mr Combe has laid down rules for measuring these regions.[2] Mr Morton proposes, and has followed another method.

Ethnographical Phrenology.—Phrenology has investigated the coincidences between the natural talents and dispositions of nations and the development of the organ of mind. These ethnological researches are, indeed, amongst the most interesting of phrenology, and have an important bearing upon diplomacy, legislation, and the art of government. Regional physiognomy has been most used in this department. As we have no space for the examination of the questions mooted, we simply refer the reader to the works of Gall, Spurzheim, Combe, Vimont, &c.

Comparative Phrenology.—We have seen that the same method of research has often been applied to the higher vertebrate animals (mammals and birds) as to man. A comparative phrenology supplementary to, and corroborative of, human phrenology, has been the final result. Dr Spurzheim states that the heads and skulls of birds which sing and of those which do not sing, and the heads of the different individuals of the same kind which have a greater or less disposition to sing, present a conspicuous difference at the place of the organ. The heads of males, for instance, and those of females of the same kind of singing birds are easily distinguished by their different development.

Gall seems to have compared the skulls of animals of *different* species, with a view to determine the situation of an organ. His disciples have objected to this method as unphilosophical,—animals of the *same* species should alone be compared. Dr Vimont of Paris is the most recent and able investigator of the cranial physiognomy of animals, and is justly regarded by phrenologists as the highest authority. He has been led by direct observations to the opinion, that the cranial conformation is as indicative of the feelings, instincts, and faculties of mammals and birds, as it is of those of mankind. In the Atlas to his elaborate work already noticed, Dr Vimont gives cranioscopic charts of dogs and birds. Birds, of all vertebrates, he states, have the most regular cranioscopical development.

Applications of Phrenological Doctrines.

In his lucid and acute criticism of phrenology, Mr G. H. Lewes remarks that it has two distinct aspects. "It is a doctrine of psychology, and it is an art of reading character. The scientific doctrine is based on the physiology of the nervous system, to which is added psychological analysis and classification. The art is based on empirical observation of coincidences between certain configurations of the skull and certain mental phenomena."[3] These two aspects comprise two corresponding groups of applications of phrenology, which are really independent of each other. The scientific doctrines are capable of application deductively, although no special observations be made as to the configuration of the skull; they may be held to constitute the basis of a system of moral and mental philosophy, with its *à priori* truths, in which the physiognomical element is secondary. On the other hand, the art may be, and most usually is, practised without much, and sometimes with very little, knowledge of the scientific doctrines. Hence it is necessary to distinguish clearly between these two applications.

1. *Applications of Phrenology to Philosophy and Mental Science.*—To phrenology may be fairly conceded the grand merit of having forced the inductive method of inquiry into mental philosophy, and thus laid the permanent foundations of a true mental science. For two thousand years or more philosophy had ignored in all its various systems the great fact, that in the order of nature there is no consciousness manifested without a material organ. Two principles of inquiry arose out of this circumstance, and still continue their influence:—(*a.*) It is denied that the phenomena of consciousness are dependent at all upon organization. No physiology ever can explain, or help to explain (it is held), one purely mental phenomenon. Its analogies may sometimes suggest a mental law, but that at most is all it can do. Thought and the laws of thought can only be studied in self-knowledge. This is the actual teaching of an existing sect of philosophy; and all who attempt to investigate the necessary connection of mental and vital phenomena are stigmatised and repudiated by it as "materialists,"—a term implying, in their vocabulary, not only scepticism as to their philosophy, but heterodoxy as to the principles of sound morals. (*b.*) Another sect admits that mind is in some way or other connected with organization; but they hold, either that the nature of that connection is much too difficult and mysterious for investigation, or they admit the principle to be only partially true, and that the higher mental phenomena of man have no necessary connection with organization. Hence the practical result of both classes of doctrines has been to exclude the anatomy and physiology of the brain from the science of Thought. Now Gall and his disciples, in starting from their fundamental generalization that the phenomena of consciousness have all, necessarily and without any exception whatever, their corresponding phenomena in the living organism, established the other principle, that psychological and neurological researches, to be successful, must be inseparable. Deductions from the mere phenomena of consciousness, they affirm, can never establish singly a science of mind, because these phenomena are ever changing from moment to moment with the ever-varying conditions of the living organism, and especially of the encephalon. A knowledge, therefore, of the physiology of the encephalon is absolutely necessary to a knowledge of mind. This is the primary and fundamental application of phrenology to mental philosophy. "We may point to Gall," Mr Lewes therefore justly observes, "as having formed an epoch in the history of philosophy by inaugurating a new method."[4] This new method soon

1 *Grundzüge einer neuen und wissenschaftlich begründeten Cranioscopie*, von Dr Carl Gustav Carus, &c., Stuttgart, 1841.
2 In Morton's *Crania Americana*, p. 278. 3 *Biographical History of Philosophy*, p. 634. 4 *Op. cit.*, p. 645.

cleared away some of the useless questions of speculative philosophy. It established the principle, that there are connate tendencies or faculties, both affective and intellectual, which are inseparably connected with the structure that serves as the organ of mind. But it also established that other principle, that if the organ is not developed, or, if developed, not rendered functionally active by the appropriate stimuli, the faculty is not manifested. Hence, while phrenology taught the plurality of organs and of faculties, it also taught that the fundamental faculties cannot be created by education; they can only be evolved or developed by it.

Phrenology, as we have seen, founded upon these great principles a new theory and classification of the faculties. It attempted to discriminate between those which are simple and fundamental, and those which are complex or secondary—the result of two or more of the fundamental faculties acting in combination; and it pointed out what states of consciousness were attributes of all the faculties. Thus, pain or pleasure is an attribute of all the faculties; memory of all those that are intellectual, and dependent wholly upon the condition of the respective organs: judgment is the same. With this new classification a new but imperfect terminology was constructed, the terms of which have penetrated into the literature and language of the present day. As a system of practical philosophy, or of practical mental science, phrenology teaches those laws by which man exists and acts as a rational being, and maintains that he can only be governed and educated in accordance with those laws. It professes to discover the varying capabilities of races of men for civilization; or, in other words, their innate capacity for instruction and development, and thereby indicates the general principles of government as applicable to races. It maintains that men must be educated with reference to the connate predominance or defect of this or that organ or faculty; that is to say, that which is naturally defective must be developed, that which is in excess repressed; so that a harmonious balance of all the powers (the *summum bonum* of mental development) may be attained. External circumstances of parents or of offspring involving the health, or a long persistence in the exercise of some or one of the faculties,—such as minister to theft, licentiousness, gluttony, and the like,—will lead to the disturbance of this balance. These circumstances must be anticipated and obviated by society; and when individuals are plainly governed by an over-mastering faculty, and thus led into crime, they must be restrained by society, and put into circumstances such that they may be enabled to exercise a self-control. In other words, an enlightened prison discipline can only be based safely on phrenological doctrines. Healthy action of the organs is necessary to healthy manifestation of the faculties. Hence the laws of hygiene, deduced from an accurate physiology and the facts of experience, must be applied to man's corporeal wellbeing, if we would elevate him as a thinking and moral agent. For this reason, the phrenologists are amongst the most strenuous advocates for such an education of the people as shall put every man in the position to know and apply the laws of healthy existence to the wellbeing of himself and his offspring. Such culture, they also argue (and on the most irrefragable grounds), is as essential to the welfare of a nation as to the wellbeing of individuals. Without it, civilization can never advance beyond a limit which it is not impossible to trace out; with it, to fix a limit to man's progressive development would be difficult.

We will not here specify more particularly the applications of the doctrines of phrenology to theology, the arts, medicine, and domestic life. The whole subject is one beyond our plan, if it were not beyond our limits. We can only refer the reader to the systematic works of Gall, Spurzheim, Mackenzie, Andrew and George Combe, Vimont, Broussais, Caldwell, Friederich, Bray, Brigham, Sampson, and others, in which social questions are treated phrenologically. The general principles of the science thus applied are based upon an admitted science of human physiology, or on the common-sense of mankind; while the physiognomy that is used is of that regional character which few intelligent men question. It is mainly, therefore, in the conflicts of phrenology with dogmatic theology and speculative philosophy that doubts have been raised as to the soundness of its general principles and of its practical applications. With these at present we have no concern.

2. *Phrenology as an Art.*—Many animals are instinctive physiognomists. Every passion or emotion has its language, and this language can be read more or less accurately by the organism or being concerned in the reading. This, for obvious reasons, is markedly true of social animals, and most particularly of man. The history of a man's mental life is often written so ineffaceably on his features that no efforts of his can conceal from his fellow-men those lines which the workings of bad passions and of evil propensities have left. We have seen that phrenology, as a physiognomical science and art, originated in the strong desire which Gall had to read by external signs the characters of those about him. Many of his disciples—the large majority perhaps—have been attracted to his doctrines with the hope of gratifying a similar desire. It is not surprising, then, to find that what has been termed *practical phrenology*, or the art of reading character, has been the main object of culture and research since Gall, and has become, in the eyes of the public and of literary men, the principal department of phrenology,—nay, phrenology itself. Now it cannot be doubted that, amongst those persons thus attracted to phrenology, there is a large proportion who have a natural bias to physiognomical observation and research, and who therefore are endowed with those faculties which are necessary to constitute a successful physiognomist. Thus endowed, it is not surprising that they can practise the art of reading character with results for the most part so striking, as to impress both themselves and others with a strong conviction of the truth of the principles upon which the art is founded, and of the value of the methods by which it is practised. Their instinctive powers of perception, naturally great, are developed by exercise, and their conclusions corrected by the cranioscopical experience of those who have preceded them. Besides, they do not neglect, when practising their art, those other physiognomical characteristics by means of which persons, not phrenologists, can often discover with surprising accuracy the character and ruling motives of those about them. While examining the configuration of the skull, the phrenologist also observes the habit of body, gait, gestures, features, tones of voice, and facial expression of the subject of his inquiry; and it is from the results of all these observations that he determines the character. Thus the elements of a successful art of physiognomy—not necessarily phrenological—are numerous, and a higher value is placed upon phrenological physiognomy as an art, than can be fairly conceded to it if estimated independently of the skill of the artist and of the collateral aids he uses to help his conclusions.

The practice of phrenology having mainly fallen into the hands of a sort of professional body, the members of which claim for it and for themselves, without any special education, a larger share of public confidence than they are entitled to have conceded to them, its pretensions have undergone every form of criticism and attack. Now, it is not a difficult task to show that, apart from the follies and frauds of ignorant charlatans, the phrenological art of reading character, however useful, is, and always must be, a conjectural art. At every step of the process there are sources of uncertainty, some of which are wholly irremoveable. 1. It is a fact, that the determination of the fundamental faculties is as yet incomplete. 2. The organs of some of the faculties re-

cognised as fundamental have yet to be discovered. The discovery of the functions of certain convolutions is impeded by the circumstance that their relative size cannot be detected. This is confessedly applicable to those convolutions which correspond to the inner longitudinal surface of each hemisphere, to the superior surface of the cerebellum (upon which they rest), and to the wings of the sphenoid bone at the base of the skull. Now these surfaces may be roughly estimated to constitute from one-fifth to one-sixth of the entire surface of the convolutions. 3. Changes in the cranial bones give rise to varying thickness or thinness of the bony parietes, not easy, if not sometimes impossible, to detect during life. 4. This source of difficulty is increased when we remember that this condition of the bones is often the effect of obscure morbid states of the brain itself or of its membranes, or both; which states, although not easily recognised, profoundly modify the mental manifestations. We say nothing of minor sources of error provided against by phrenological rules, such as the varied size of the frontal sinuses,[1] the development of the hair and of the muscles attached to the cranium, and the condition of the other soft parts; nor of the difficulties afforded by atrophy of the convolutions, by age and sex, and by combinations of organs. But even were these difficulties overcome, greater remain behind, in the varying *vital conditions* which influence the manifestations of the organs independently of size. Some of these of the highest importance—*e.g.*, those connected with genius—are confessedly unknown; others require for their due estimate an amount of knowledge we are far from possessing. The connate powers of the blood and tissues generally known as *temperaments* vary greatly. Rules have been set forth for estimating their influence on the health and vigour of the body and mind far from satisfactory to those who have studied the physiology and pathology of "temperaments." In truth, there is no one branch of medicine which is more imperfectly developed; none in which there is a larger amount of floating, crude, indefinite knowledge. We feel we may be permitted to speak with some authority on this point, since we have made these innate conditions of the blood and tissues the subjects of special observation and inquiry for several years past, with a view to both the practice and teaching of medicine. But, besides the *temperaments*, there are *diatheses*, or constitutions predisponent to particular forms of diseased action which are often grafted on the former, often arise out of them, and always modify them greatly. Then these temperaments and diatheses are hardly ever met with in the typical form, but are commingled with each other in ever-varying proportions; so that the most practised observer may be at fault in his diagnosis.

But the condition of each organ, as regards health and disease, in the *same* individual, modifies its manifestation. Thus an active small organ may be in the same individual more powerful than an inactive large one. But this question of condition of special organs involves a knowledge of some of the most abstruse problems in the physiology and pathology of the nervous system. Certain faculties and organs, for example, are intimately associated, as to function, with the condition of certain viscera. A weak fatty heart or a diseased colon are not unfrequently in direct relation with various forms of melancholia. An aberration in the functions of the ovaria is sometimes the immediate cause of moral insanity in women; so that the very qualities for which the individual was remarkable are reversed,—*e.g.* truthfulness and candour are changed into habitual falsehood and dissimulation, affection for relatives into malice, and the like. The physiological influence of certain viscera upon the natural activity of organs, or groups of organs, is very remarkable. Thus, when the ovaria or testes are removed, various faculties are exalted or weakened; when they are developed or brought into unusual functional activity, various faculties are correspondingly weakened or exalted. This is particularly seen to be the case with animals in which the reproductive function is periodic. In birds, especially of the social or gregarious kinds, the development of the ovaria and testes is accompanied with a manifestation not of amativeness or philoprogenitiveness only, but of combativeness, cunning, constructiveness, time, tune, conscientiousness, &c. Further, changes in the composition of the blood have a direct influence upon special organs in the same individual. Thus, certain poisons introduced therein excite special faculties into action. We may mention alcohol, opium, haschich, henbane, and belladonna as striking examples. In some diseases, similar elective affinities are observed. In certain forms of pulmonary phthisis the patient is gay and hopeful to the last, even when the most extensive and most fearful disease is present—not in the lungs only, but in the liver, spleen, intestines. The *materies morbi* of gout seems to stimulate the organs of Combativeness and Destructiveness; for the gouty patient is so often irrepressibly irritable that a fit of the gout has been termed a fit of madness.

These are some of the many modes in which the condition of special organs may be influenced *dynamically*, and both power and activity be developed irrespectively of size. Of the whole of the latter class, it may be said that we have hardly attained to so much knowledge as even to discover the extent of our ignorance. It is not surprising, therefore, that with so many and such great sources of fallacy, cautious physiologists and pathologists, while granting its uses, hesitate to practise seriously the art of reading character, and feel indisposed to place more confidence in the professors of it than they feel in themselves.

But a weightier source of objection to the art, in the opinion of many, is to be found in the fact, that those least qualified by culture to practise it have most commonly exercised themselves therein. Persons without any education in physiology and pathology, or with little more than scraps of information gathered at random, do not hesitate to profess their capability to solve the most important practical questions in mental science. To the intelligent and instructed they are but mere charlatans, whose ignorance and pretensions would curse with fatal blight any science or art, however well established or noble. We are bound to add that Mr Combe (the great loss of whom by death while these pages were being written we have to lament), and others, frankly acknowledge that applied phrenology is an estimative art only—such, in fact, as is applied medicine itself.[2] But then every accomplished physician finds, as his knowledge and experience increase with his years, that his youthful confidence in the certainty of medicine was not well founded; he becomes more and more convinced of its conjectural character as a science, more cautious and prudent, therefore, in the application of its principles, and more reliant on a learned experience. If, then, doubts, or at least a hesitating caution, be a duty of the physician as to the art of medicine, based on the experience of ages, how much more are they justifiable as to an art confessedly imperfect in important details, and hardly half a century old? It is not difficult to understand from these considerations why the young and enthusiastic followers of Gall and Spurzheim cool in their estimate of phrenology as they get older, and even pass over to the ranks of its opponents. Thus, by not a few medical science and art are treated; and so, *à fortiori*, must phrenology be, since it is only a department of the great science of medicine, resting, as medicine itself rests, upon the great but imperfect science of life. (T. L.)

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[1] Dr Vimont says he has examined the frontal sinuses in more than five hundred human crania, and has not found them alike in two. (*Traité de Phrenologie, &c.*, tom. i., p. 83.)

[2] Mr Combe, *On the Functions of the Cerebellum*, &c., p. 190.

PHRIXUS. See HELLE.

PHRYGIA, an important province of Asia Minor, of which the ancient boundaries are exceedingly various and indistinct. Phrygia proper was, according to Ptolemy, bounded on the N. by Pontus and Bithynia; W. by Mysia, Troas, the Ægean Sea, Lydia, Mæonia, and Caria; S. by Lycia; E. by Pamphylia and Galatia. The once extensive territory inhabited by the Phrygians was limited during the conquests of Cyrus to *Lesser Phrygia* on the Hellespont, and to *Greater Phrygia.* The former, as far as can be ascertained, included Troas, and bordered in the E. on Bithynia and the Greater Phrygia, and in the S. on Lydia. The Greater Phrygia, again, formed the central country of Asia Minor, bounded on the N. by Bithynia and Paphlagonia, E. by the river Halys, and S. by Mount Taurus.

The origin and nationality of the inhabitants of Phrygia is a subject wrapt in great obscurity. Some regard them as Thracians (*Bryges*), others as Armenians, and others again as of mixed origin. It seems most probable that at some very remote period they had descended from the Armenian highlands; for, as we may gather from numerous hints afforded by ancient writers, there must have been a time when the Phrygian race formed by far the most important part of the entire population of Asia Minor. The Pelasgian races seem to have belonged to the Great Phrygian stock; and the Trojans, Mysians, Mæonians, Mygdonians, and Dolionians are all traceable to the same origin. Moving westward, the Phrygians seem at an early period to have settled about the central parts of Emathia in Europe. These Phrygians (or *Brygians*) are met with in all directions; and indeed this important race seems at one time to have constituted the main element of the population of the greater part of Thrace, Macedonia, and Illyricum. Yielding gradually to the pressure of the northern peoples, the Phrygians seem to have migrated back to Asia—an event dated by Xanthus about ninety years before the Trojan war, and which may serve to account for the Thracian origin assigned to them by tradition. The Phrygians are repeatedly alluded to in the Homeric poems (*Iliad*, ii. 862; iii. 185; x. 431; xvi. 717; xxiv. 535); and are generally admitted to be one of the most ancient nations of Asia Minor (Herodotus, ii. 2).

The religious ideas of the Phrygians seem to have exercised a great influence over the mythological development of the Greeks. Phrygia was a country rich in all kinds of produce. Agriculture was their chief occupation; they bestowed much care on the cultivation of the vine; and the country was distinguished for the excellent breed of its sheep, and for the fineness of their wool. Phrygian marble was much prized, and gold seems to have been found in its streams. It possessed well-built towns in the time of Homer (*Iliad*, iii. 400), which were great commercial emporia. Such were Pesinus, Gordium, Celænæ, and Apamea, the last of which was long a chief centre of trade for the whole of Asia Minor.

After the overthrow of the Persian power in Asia Minor by Alexander the Great, Phrygia seems gradually to have lost its original boundaries in the distribution of territory which ensued, as well as by the frequent changes to which it was subjected by subsequent conquest.

PHRYNICHUS, a tragic poet of Athens, was the son of Polyphradmon or Phradmon, and the disciple of the celebrated Thespis, being a little earlier than Æschylus. He gained the tragic prize, B.C. 511, and is said to have introduced several improvements into the dramatic art, bringing on the stage female characters, and making the actors adopt the use of masks, instead of disfiguring their faces with the lees of wine. Suidas mentions the names of nine of his tragedies, and ascribes to another Phrynichus, son of Melanthus, a tragedy entitled *The Sack of Miletus*, which recalled so forcibly to the Athenians the melancholy fate of that Greek city, that they punished the poet by a fine of a thousand Attic drachmæ, or, according to Ælian, banished him from Athens. As the son of Phradmon is said to have died in Sicily, probably at the court of Hiero, where Æschylus also took refuge, it is not unlikely that this tragedy may have been his production.

PHRYNICHUS, one of the last and most noted writers of the old comedy at Athens, flourished B.C. 435, and was the contemporary of Eupolis, Euripides, and Aristophanes. He obtained the second prize, B.C. 405, the year before Athens was taken by the Spartans. Plutarch states that in one of his plays he defended Alcibiades when he was accused of having mutilated the statues of Hermes. Aristophanes ridicules Phrynichus for introducing too frequently on the stage characters in low life. The fragments of Phrynichus have been collected by Morel, *Ex Veterum Comicorum Fabulis quæ integra non extant*, Par. 1553; by Hertelius, *Vetustissimorum Comicorum Sententiæ*, Bâle, 1560; and by Grotius, *Excerpta ex Tragœdiis et Comœdiis, Gr. Lat.* Par. 1626. (See also Meineke, *Frag. Com. Græc.*; and Bergk. *Reliq. Com. Att. Ant.*)

PHRYNICHUS ARRHABIUS, a Greek grammarian, was a native of Bithynia, and flourished about the middle of the second century, in the reigns of Marcus Aurelius and of Commodus. He had devoted much time to the study of the Greek language, which he pretended to speak and write in the utmost purity. He made a collection of all the words used in the Attic dialect, of which an abridgment has been preserved under the title *A Selection of Attic Verbs and Nouns.* He rejected every word which could not be found in some work of Plato, Thucydides, or Demosthenes, and was particularly severe on the style of Menander. This little work, published first by Calliergi, Rome, 1517, was reprinted at Venice, 1524; but the best edition is that of C. A. Lobeck, with learned annotations, Leipsic, 1820, 8vo. Phrynichus had also collected examples of every different kind of style, in the form of a dictionary, divided into thirty-five books, which he dedicated to the Emperor Commodus. Some fragments of this work remain, which have been published by Montfaucon in the *Bibliotheca Coisliniana*, pp. 465–69.

PHUKOK, or KOTHROL, an island in the Gulf of Siam, off the coast of Cambodia, from which it is separated by a navigable strait. It is about 7 miles long, and 3 broad; and it has a harbour in N. Lat. 10. 17., E. Long. 104. 16. The surface is well wooded, and produces the eagle-wood (*Aquilaria Agallochum*), which yields a fragrant resin, used in India as a cure for gout. The natives are employed in spearing the *tripang*, or sea-cucumber (*Holothuria*), an animal which is used in China for the preparation of soups.

PHULOWDEE, a town of India, in the rajpoot state of Jodhpoor, 147 miles N.E. of Balmeer, and 1180 N.W. of Calcutta; N. Lat. 27. 8., E. Long. 72. 28. It stands on a hill, and seems to have been formerly surrounded with a wall, part of which still remains in a ruinous condition. Pop. estimated at nearly 15,000.

PHYLACTERY (φυλακτήριον, *a safeguard*) was a name applied in general to any amulet or preservative against any kind of evil. The term was employed, in particular, to denote those strips of parchment worn by the Jews, and inscribed with particular passages of Scripture. (Deut. vi. 4–9; xi. 13–21; Exod. xiii. 1–10, 11–16.) These phylacteries were folded up, and inclosed in a small leather box, and worn upon the forehead, nearly between the eyes, or upon the left arm near to the heart, being attached by straps of leather. They were considered as thus reminding the wearers to fulfil the law with the head and heart.

PHYSHARMONICA, a musical instrument, in which the immediate sonorous bodies are springs of steel or of brass, vibrated by a current of air.

PHYSICAL GEOGRAPHY.

(1.) Geography, or a description of the earth, may be considered under several distinct points of view, necessitated by the nature of so extensive a subject; three of which, however, are well distinguished from each other, and present it under aspects of primary importance, practical and scientific.

Political Geography considers the surface of our globe as parcelled out into states and empires, inhabited by communities and races of the great human family, variously affected by the different characters of soil and climate, by which their lands, manners, and occupations are modified; and continually encroaching on each other, and altering their mutual boundaries by conquest or colonization. This view of geography is therefore essentially arbitrary and conventional, as well as in a perpetual state of change from age to age. Commerce and statistics, aptitude for military occupation or defence, facilities for internal and external communication, and products available for human wants, form its chief subject-matter; and cities and towns, the centres of population, power, and enlightenment, its most important landmarks.

(2.) *Descriptive Geography*, while it neglects the boundaries of states, or uses them only for such convenience as they may afford for the subdivision of its subject, concerns itself principally with the exact delineation, in charts, of the coast-lines of continents and islands, internal seas or lakes—with the courses and embankments of rivers, the configuration of the surface of the land, as consisting of mountains, valleys, and plains, whether delineated in charts by conventional shading, or marked out by level lines, or described in words. Its scope embraces, moreover, a particular and detailed account of their external aspect, soil, scenery, and animal, vegetable, and mineral productions, which characterize and diversify each district; irrespective, or but little respective, of their uses to man, or of their connection *inter se*, or of the causes which have operated to produce them. Of all these, it would be the business of a perfect "Descriptive Geography" to exhibit a true and faithful picture, a sort of daguerreotype, without note or comment.

(3.) Such comment, or at least one of such comments, it is the object of Physical Geography to supply. Taking for granted such knowledge as we possess of the general laws of physics, and of the mode in which they are carried out into action, under given circumstances of time and place; and basing itself on the detail of particular features afforded by the last-mentioned department of the general science—it calls attention to those laws as displayed in operation whenever, so to speak, they project in relief, and stand forward as luminiferous examples (*instantiæ luciferæ*) of the application of theoretical views on the great scale. Its aim is to exhibit the heap of particulars gathered and stored up by descriptive geography, as constituting a harmonious whole, bound together by mutual relations and interagencies, and subordinate to a great scheme of providential arrangement. And this it does, not by going over the items *seriatim*, and following up the order of description with a running comment, but, by seizing on whatever is illustrative at one point, and comparing it with what is similarly illustrative at another; by bringing into notice the causes which either evidently are acting, or by reasonable implication must be presumed to have acted, to produce the more striking and characteristic phenomena of such regions as offer anything remarkable; and of such as do not, by shewing how this very monotony is itself the result of a prevalent uniformity of causation, of which a rational account can be rendered, and which it illustrates no less strikingly by the absence of salient features, than the complications observable elsewhere do by their number and variety.

(4.) With these general laws, with the principles which govern their application, and with the methods which science affords of deductively tracing out their application from the abstract enunciation of the laws themselves, under specified circumstances, to precise and intelligible results, the physical geographer must be conversant; so far at least, that he must possess a familiar acquaintance with physical principles, and such an insight into their application as shall enable him to take on well-grounded trust the conclusions of others more advanced in such knowledge. For all such knowledge in its detail, we must refer our readers to those articles of the present work which treat specifically of the several branches of physics, appeal to which is involved in any part of our treatment of the subject. But some of its leading points require to be briefly recapitulated, as embodying the first elements and material *out of* which, as well as exhibiting the ground-plan and general design *on* which, the whole superstructure has to be raised.

(5.) And first, then—from Astronomy we learn that the figure of this our earth is nearly that of an oblate ellipsoid of revolution, having an equatorial diameter of 7925·65 British statute miles, and a polar one of 7899·17 such miles, or, neglecting the ellipticity, which is only one 290th part of the mean of these diameters—nearly that of a globe whose diameter (the mean of these extremes) is 7912·41 statute miles. Calculating on this *datum*, we find that its superficial area (sea and land both included) is about 197 millions of *square*, and its solid contents above 259 thousand millions of *cubic* statute miles. Its average density, as collected from a mean of several independent determinations, differing much less *inter se* than the evident difficulty of such an inquiry would lead us to expect, may be taken at $5\frac{1}{2}$ times that of pure water, which is fully double that of the average material of the earths and rocks of which its surface consists. And hence we may compute its absolute weight, which is about 5842 trillions (5842×10^{18}) of tons; while at the same time we conclude either that the interior portions of it are to some considerable extent metallic; or, which is more probable, condensed by the immense pressure they have to sustain, some conception of which may be formed from this—that if a channel, only three-quarters of a square mile in sectional area, were opened from the bottom of the sea to the centre of the earth, the whole ocean would flow into it—taking, that is to say, the increase of density of water (according to the experiments of Perkins) at 0·474 per cent. for every additional 100 atmospheres of pressure, and *supposing the same ratio to hold good under all pressures.*. This, of course, cannot be supposed to be really the case. One of two things must happen, either the water would be compressed into solidity, or must be sustained from so doing by an increased elasticity, the effect of an exceedingly high temperature.

(6.) This, indeed, we have every reason to believe, really exists within the earth. Not only is it a general fact that the thermometric temperature of the ground does increase in descending, in all regions of the globe wher-

ever deep mines have been sunk, or borings executed, at an average rate of about 1° Fahr. for every 90 feet of depth; and not only do the phenomena of volcanoes and hot springs indicate unmistakeably the still further increase of heat beyond the reach of artificial excavation, but the fact itself, that the mean density of the globe is so small as $5\frac{1}{2}$, must be held conclusive evidence of an excessive internal temperature. It is not by solidifying that fluids can escape from further condensation. Solids, as well as fluids, are compressible; even the densest metals increase in density by hammering; and though the rate of compressibility of matter in the solid state is vastly smaller than in the fluid, it is not conceivable that, under a pressure of 300,000 atmospheres, much that we usually look upon as very solid substance would not be reduced to a small fraction of its bulk. Nor will it avail to look to the support of the upper strata by the spherically vaulted form of the lower, so as to relieve the internal portions of their load. The lateral thrust, in an equilibrated arch or vault, vastly exceeds the weight laid upon it; so that nohow can the conclusion be evaded that the internal portions of the earth, whether fluid or solid, actually do sustain this almost inconceivable force, and we can look to no power but the expansive force of heat which can counteract its condensing effect.

(7.) Whatever be the intensity of that heat, and whether the central portions of the globe be solid or fluid, there can be no doubt that the density of the materials of which it consists in proceeding downwards, must follow an increasing progression. ASTRONOMY, grounding its conclusion on some observed facts in the moon's motion, otherwise inexplicable, assures us that, as a matter of fact, it does so. This being the case in the absence of any cause to produce disturbance (and we can perceive none of power enough to act at *great* depths,[1] so as to produce upward currents), the lower strata must preserve their level, and the whole interior of the earth, considered on the great scale, must be in a state of absolute quiescence, enough so at least, at all events, to prevent the central heat from being carried to the surface by the material transfer of heated and molten matter. Under such circumstances, we learn from THERMOTICS (see HEAT), that the escape of heat from the interior, through the external shell of the earth out into the air, and free space, must be of most inconceivable slowness—so much so, that no appretiable share in producing or maintaining the warmth of the *surface*, can be attributed to it, and that the difference of climates and local temperature is the result entirely of external influences, which it belongs to METEOROLOGY to develope. (See our article on that subject.)

(8.) From the principles of DYNAMICS, we learn that the deviation of one 290th from exact sphericity in the earth's figure, is a consequence of its rotation on its axis, and is essential to the maintenance of the equilibrium of the ocean, so that a shifting of the axis would entail the submersion of the existing land; but from the same source we learn that from natural causes (as known to us), no such shifting ever can have taken place, or ever will; and this deduction from theory is confirmed by Astronomy, which shews that the latitude of places, as determined by the most delicate observation, are absolutely invariable. Were the earth a sphere, this might be drawn into an argument against its internal fluidity, since the external shell, floating on an ocean of fluid, might at first sight be supposed capable of drifting at random from its relative place, without a displacement of the general axis of rotation. But (even were the conclusion a valid one, which it is not), the rigidity of the elliptic shell which can only *fit* the elliptic (though fluid) supporting nucleus in one position, will act as a retaining force, and prevent any, the smallest deviation; since, to disturb the whole external shell on the whole internal fluid, would be in effect to change the figure of the latter, and call into action all the antagonistic forces which resist such change.

(9.) If then, as GEOLOGY assures us, the continents can be proved by unmistakeable evidence to have been submerged, and the ocean-bed laid dry, not once only, but repeatedly, nay, that the process is actually going on, though slowly, under our eyes, we must look elsewhere than to a change in the axis of rotation for the causes of such a fact. Yet more, we learn from dynamical principles, that all the influences exterior to the earth, by which the waters of the sea are kept in agitation, act through the intervention of these waters in antagonism to the existence of the continents for the time being, and perpetually tend to degrade and destroy them, and to spread their materials over the bed of the sea, filling up its hollows and doing their best to bring on a state of perfect smoothness, in which the whole earth would be covered with sea, having a dead level for its bed. The land, then, is maintained in its elevated position by internal force, locally exerted, and varying its locality from age to age, according to laws which belong to the domain of geological, rather than geographical science. Whatever be the nature and ultimate origin of that force, it is manifested to us in action from time to time in the volcano and the earthquake, which thus we learn to regard as very far from purely destructive arrangements in the great scheme of nature; since, without the agency of which they are part and parcel, there would by this time have been no dry land whatever. The fact that all our present continents consist of beds or strata, which have resulted from the destruction of former ones, and the distribution of their materials at the bottom of the sea, and of granitic masses forcibly thrust up through those strata, disturbing and dislocating them, leads direct to the conclusion that, had the primeval world been constructed as it now exists, time enough has elapsed, and force enough, directed to that end, been in activity, to have long ago destroyed every vestige of land, but for the reproductive efficacy of these internal forces bringing up continually new lands to replace the old.

(10.) Hence, then, we come to perceive that the actual configuration of our continents and islands, the coast-lines of our maps, the direction and elevation of our mountain chains, the courses of our rivers and the soundings of our oceans, are not things primordially arranged in the construction of our globe, but results of successive and complex actions on a former state of things; *that* again, of similar actions on another still more remote; and so on till the original and really primeval state is pushed altogether out of sight and beyond the reach even of imagination; while, on the other hand, a similar, and, so far as we can see, an interminable vista is opened out for the future, by which the habitability of our planet is secured amid the total abolition on it of the present theatres of terrestrial life.

(11.) But the revelations of geology do not stop here. They assure us, further, that in each of those successive submersions and reconstructions of the continents, fresh corresponding races of animals, and a new and different clothing of vegetation have been introduced—the one perishing off as the others have come into existence; nay, that even the denizens of the ocean itself have had no exemption from this great law of change—which, however,

[1] Such as exceed 100 miles, for instance.

has not operated either by a gradually progressive variation of species, nor by a sudden and total abolition of one race, and introduction of another entirely new, but by a series of overlappings, having the last portion of each in co-existence with the earlier members of the newer series. Higher forms of being, moreover, appear at every stage of the process, up to the final and culminating point of humanity, and the existing order of things. And by the indications afforded by the exhumed remains of these successive creations, the geologist finds himself enabled to co-ordinate the succession of strata, and to assign to each its epoch in the past history of the world.

(12.) From METEOROLOGY we learn to refer the great system of aquatic circulation, which transfers the waters of every one region of the ocean, in the course of time, to every other, to the action of our Trade-winds, and their compensating currents, the Anti-trades; themselves the results of solar action in combination with the earth's rotation on its axis. By the oceanic currents thus arising, the material carried down by rivers, or abraded by the action of the waves (increased in their efficiency by the extent of sloping beach, produced by the rise and fall of the tides), is carried off and dispersed abroad, or, it may be, collected by subsidence in deep and comparatively motionless hollows, or in eddy-pools. There are features in the outlines of our continents on the great scale which bear obvious reference to some such process. Thus, the excavation of the Gulf of Mexico and the Caribbean Sea is an evident effect of the continued and powerful action of the Gulf Stream, or rather of the general set of the great South Atlantic current on that part of the American coast which issues thence at present in the concentrated form of the Gulf Stream, and which, unless counteracted by other causes, must sooner or later cut through the Isthmus of Darien, leaving a chain of islands like those which, on a larger scale, serve to keep up an ideal connection of the continent of Asia with the great mass of Australia, which thus we may be led to consider as forming the same sort of southern appendage, past or future, to the eastern part of the great Europo-Asiatic continent which Africa does to its western, and which South America does to North. Looking only at the land in great masses; regarding Africa as South Europe, and Australia as South Asia, we may still form a tolerably general conception of the distribution of land and sea by regarding the land as chiefly collected in the northern hemisphere in a mass which, but for the narrow interval of Behring's Strait (not more than 40 miles across), would be continuous, and which sends down three great lobes into the southern, where they appear as three projecting apexes pointing towards the south pole, which they approach by not very unequal degrees of remoteness, and surround at not very unequal intervals of longitude; much as the thumb and two first fingers of the hand in the attempt to grasp with them a globe of a couple of inches in diameter.

(13.) But although the southern hemisphere, as compared with the northern, is more aquatic, yet, if we would divide the globe into two hemispheres, the one of which shall contain the greatest quantity of land, and the other of water, it must be cut by a plane perpendicular—not to the axis of rotation, but (singularly enough) to the diameter passing through the south-west corner of England. A chart of the two hemispheres projected on the horizon of this point (or, which comes very nearly to the same thing, on the horizon of London) exhibits the one containing all the great continental masses, except Australia and the small tapering extremity of South America, while, with these exceptions, and those of the great islands of Sumatra, Borneo, and New Guinea, the other is nearly all occupied by water. The fact is instructive, as it proves the force by which the continents are sustained to be one of *tumefaction*, inasmuch as it indicates a situation of the centre of gravity of the total mass of the earth somewhat excentric, relatively to that of the spheroidal figure of the ocean-surface—the excentricity lying in the direction of our antipodes; and is therefore a proof of the comparative *lightness* of the materials of the terrestrial hemisphere.

(14.) As regards, then, the general configuration of the land and its distribution over the surface of the globe, in referring it to the causes above indicated, we have done all that is possible in the present state of geological knowledge. It must be accepted as part and parcel of the arbitrary *data* of our subject. Not that speculation has been wanting as to the ultimate origin of that configuration. The globe has been likened to a great crystal, formed by cooling from fusion—its angles and edges cropping out from the general spherical surface—its great mountain chains, and the deep clefts of its sea-valleys to the corrugations on the surface of a molten mass formed in the act of setting, by crossing systems of crystallization. And more recently[1] a suggestion has been put forth, attributing the forms of the continents, not to any effect of crystallization, but to the contraction of dimension due to the cooling of a homogeneous fluid nucleus, modified by the resistance of the surface already solidified to a further change of dimension; in a word, to a crumpling or shrivelling of the exterior crust arising from the withdrawal of support from within. It is not easy, however, to see (though the author cited thinks otherwise) how such a cause, acting on a homogeneous spheroid, equably invested in every part, could result in anything other than a further flattening inward of the already flattened polar portions, *i. e.*, in an increase of external ellipticity, or, in other words, in the production of an annular equatorial continent—and to suppose an original difference of resistance (from which, no doubt, undulated forms, both of meridians and parallels, might so arise) is only to shift what is arbitrary in the assumption a step farther away; since by properly assuming the law of resistance to flexure, any given form of crumpled surface might arise. Although, then, it is certain that such a cause, acting under any conditions, must produce *some* protuberances, and, under fitting ones, *might* produce those actually existing, we are still as far from a rational explanation of the *observed* forms on this, as on any other supposition.

(15.) There are, however, local peculiarities in the outlines of the land where the effect of causes now in action is distinctly traceable, as we shall hereafter take occasion to shew when speaking of Deltas, Sand-spits, and some other features of coast lines, evidently originating in tidal action combined with that of currents, and, in one or two instances (as in the Spit of Arabat), of winds. There are other peculiarities also, of which no such account can be rendered, but which yet, being of frequent occurrence, would seem to point to some general cause, determining the direction of those movements by which the rise of the land from the sea-bed has been effected. We allude to the very evident tendency of the outlines of coasts to run out into peninsular projections, having a meridional direction, or a near approach to such. Not to speak of the three great prolongations of the northern continents into the southern hemisphere, we may instance as cases in point the peninsula of Hindostan, and on a smaller scale those of Cambodia and Carpentaria, the Malayan, Corean,

[1] "Discours sur la condition Physique de la Terre." Par M. Jean Reynaud.

and Kamschatkan peninsulas, and those of California and Florida. Nay, even the more continental masses of Greenland and Scandinavia (including Sweden, Norway, and Lapland) may be cited as coming under this law.

(16.) *Of the Atmosphere.*—We must refer our readers to our article on METEOROLOGY for an account of the nature and constitution of the atmosphere, and the general laws which regulate its movements, and the circulation of heat and moisture operated by them over the surface of the globe. The effects of these movements in producing the modifications of climate prevailing in different regions, belong, however, to the proper object of this essay, but must be deferred until we have brought the reader acquainted with those features in the arrangement of the land and water upon which these modifications depend. There are, however, one or two points which it is right to mention here, and first, as to the total mass of the atmosphere. It is stated in the article referred to as being one 180,000,000th part of the total mass of the earth. This requires correction; the true proportion is one 1,125,000th. The absolute weight there set down (11⅜ trillions of pounds avoirdupois) is, however, correctly computed. 2dly, We have to regret the omission of all mention in that article of Lieutenant Maury's most valuable and important works,—*The Wind and Current Charts*, and *Sailing Directions*. Neither those works, nor his more recent one on *The Physical Geography of the Sea*, had then reached us. Though compelled, as we shall hereafter find ourselves, to dissent from several of the philosophical views put forward in the last-mentioned work, we do so with the most grateful recognition of the zeal and indefatigable industry he has exhibited in the collection and arrangement of a vast mass of facts, and the ability and success with which he has been able to combine them for practical use. The *Wind Charts*, now in process of publication by the Board of Trade, are founded entirely on the numerical data so collected and arranged, and will exhibit, on simple inspection, the prevalent wind, and its average deviations, both in direction and intensity, for each quarter of the year, in every area of 10° in longitude and latitude over every part of the sea, and in particular regions, where necessary, in closer detail.

OF THE SEA.

(17.) *Extent, Mean Depth, entire Content, and Mass of the Sea.*—From a careful measurement of its extent, as laid down in charts, it has been concluded that the dry land occupies about 49,800,000 square statute miles. This does not include the recently-discovered tracts of land in the vicinity of the Poles, and allowing for yet undiscovered land (which, however, can only exist in small quantity), if we assign 51 millions to the land, there will remain about 146 millions of square miles for the extent of surface occupied by the ocean. Its mean depth cannot, of course, be stated with any certainty. There are phenomena in the formation and progress of the tide-wave, and of certain other great undulatory movements, which are incompatible with an average depth under four or five miles. *See* art. 80. Most of the soundings which have been taken far from land, and in deep water, fall, however, far short of these limits; but as some have attained the higher of them, and as there are numerous instances where 20, 30, 40, and even 50 thousand feet of line run out have failed to give distinct evidence of the bottom having been reached, a *mean* depth of four miles may be taken as one quite as likely to be beyond the truth as within it; the more so, as a great proportion of the vast area of the Pacific is so abundantly bestrewn with islands as to authorize a reasonable suspicion that its average depth is less than that of the Atlantic, where islands are comparatively rare, and of which the depth has been ascertained over no inconsiderable portion of its whole extent. Calculating on these data, we find for the total cubic contents of the sea, 788 millions of cubic miles, and for its mass or weight (taking the specific gravity of sea-water under a pressure of two miles 1·0151) 3,270,600 billions of tons, or one 1786th part of the total mass of the globe.

(18.) The most remarkable general feature which the sea presents to the physical geographer is its *continuity*. With exception of the Caspian Sea, the little Sea of Aral, and a few other quite trifling salt-water lakes (trifling, that is, in comparison with the whole amount of water), the ocean is one and undivided, throwing its arms round the globe in such a way as to justify the notion and description of it by the ancient tragedian, "*περι πασαν ειλισσομενος χθον' ακοιμητῳ ῥευματι.*" Even the most closed and the deepest indentations which it makes into the land—the Mediterranean and the Red Sea—have deep water at their entrance, and a sufficient breadth of opening to admit a free communication with the general area.

(19). *Composition of Sea Water.*—The sea consists wholly of salt water; and it is this continuity of all its parts, conjoined with the system of circulation of its waters in currents, caused by the regular and perpetual action of the winds, which ensures the uniformity, or near approach to uniformity, of its saltness in every part. As the sea continually receives the drainage of all the land, besides having, in the course of countless ages, washed over and over again the disintegrated materials of successive continents, it must of course hold in solution all the saline ingredients capable of being separated and taken up by such lixiviation in cold water; in fact, in greater or less quantity, every soluble substance in nature—such, at least, whose existences in extremely dilute solution are not incompatible. By far the larger proportion, however, consists of chloride of sodium (common salt), after which occur chlorides and sulphates of magnesia and lime in some considerable abundance. And in much more minute, but yet appretiable quantity, occur salts of potash and ammonia, the iodide and bromide of sodium, carbonate of lime, silica, and other matters too numerous to mention. The sulphate and carbonate of lime, and the silica, however minute the percentage of the two latter, are yet of vast importance in the economy of animated nature, as furnishing all the lime and silica out of which the shells of Mollusca, the structures of the coral and other similar insects, and the shells and carapaces of the siliceous infusoria, &c., are derived. But besides these saline and earthy ingredients, metallic salts in excessively minute quantity have been shewn to exist in sea-water. Thus, copper is present to such an extent, that clean and polished iron dragged in the wake of a ship, during even a short voyage, has been observed to come up with a film of that metal precipitated on it.[1] Silver also is found in combination with the old and worn coppering of ships to such amount as to make it worth while to extract it. It has been computed from some analyses of such copper, compared with the total distance run through by the ship, and the time of its remaining attached, that at least two millions of tons of silver are thus held in solution in the whole ocean.

(20.) The mean specific gravity of sea water taken up at a small depth (a few feet) below the surface (so as to be out of reach of the *immediate* influence of *recent* rain), reduced to 62° Fahr., may be stated at 1·0275, which

[1] Query, whether iron so dragged in a ship's wake might not take up a portion of the copper dissolved off the ship's bottom.

experiment shows to correspond to a *total* percentage of saline contents, irrespective of the difference of the ingredients, of about 3·505, so that it is incorrect to state, as some have done, that the saline contents do not add to the bulk. This of course is to be understood of water taken up in open sea, out of reach of the influence of rivers, icebergs, &c., which produce local variations to which we shall presently recur. Beyond such influences, however, there are meteorological causes in action which produce a perceptible deviation, dependent on geographical situation, from the exact average. Thus, in those portions of the ocean, on either side of the equator, swept by the trade-winds, especially towards their northern and southern limits, the saltness of the surface water may be expected to be, and is in fact found, somewhat in excess of what prevails either on the equator on the one hand, or beyond the tropics on the other. For these winds arrive from higher latitudes deficient both in heat and moisture (METEOROLOGY, art. 111), and take up both in their progress towards the equator, while they return little or none of the fresh water so taken up, in the form of rain, till their arrival at and near the equator itself. There, however, they at once precipitate a large proportion of the water so absorbed, a process which, being in constant operation, must in some degree freshen the surface. Thus, Captain King, in his South American Survey in 1829-30, found the maxima of specific gravity in the Atlantic to occur in latitudes 27° N. and 20° S., the mean result for both being 1·02808 at 62° F., while in the equatorial region, from 5° N. to 5° S., the mean of his results is only 1·02723. Ruschenberger and Porter, as reported by Maury, found the Atlantic maxima in 17° N. and 17° S., and in 20° N. and 17° S. respectively. The mean of all gives 18° N. and S. So also, in the Pacific, Captain Beechey, in his survey of Behring's Straits in the Blossom (1825-8), found the maxima to occur in latitudes 22° N. and 20° S., their mean being 1·02937 (reduced to 62°),[1] that of the equatorial zone being 1·02791. On the other hand, beyond these limits in the ultra-tropical regions, where the anti-trade winds prevail, the whole of their residual moisture is discharged in rain or snow, while at the same time, owing to the habitually lower temperature of these regions, evaporation from the sea-surface is very much diminished. And, accordingly, the results of both King and Beechey indicate a slight though very perceptible progressive diminution of specific gravity in proceeding towards either pole—the mean of Captain Beechey's results between 55° and 60° of both north and south latitudes in the Pacific giving 1·02580, and those of Captain King, in the corresponding region of the South Atlantic, 1·02551—results on the whole in excellent accordance with each other, and which leave no room for doubt as to the general fact in question.

(21.) At the mouths of great rivers the sea is often superficially freshened to a considerable distance from shore. This is the case with the Amazon River to such an extent, that fresh water may be taken up from the sea surface when out of sight of land, and the sea itself is rendered sensibly less saline at two or three hundred miles from its mouth. At the time of the inundations of the Nile also, the water is perceptibly freshened out of sight of land.

(22.) In the Euxine, and still more in the Sea of Azof, the supply of fresh water from the rivers feeding them is greater than their waste by evaporation, and their communication with the Mediterranean being restricted by the long and narrow channels of the Bosphorus and the Dardanelles, out of which a current always sets in calm weather, they have become materially fresher than the general average. The Euxine water has a specific gravity of 1·01410; and the Sea of Azof, which is shallow and of small extent, and receives a considerable river (the Don), probably less. So also in the Baltic, which is a shallow sea communicating with the main ocean by a shallow and obstructed channel, the specific gravity varies from 1·00476 at Tunaberg, to 1·020437 off the Scaw Point, at the entrance of the Cattegat—[Thomson].

(23.) With respect to the Mediterranean, it has been held, on the authority of Halley, that its evaporation is materially greater than the extra supply from its rivers, and that, therefore, it must be increasing in saltness by the continual indraught of sea water from the Atlantic, unless relieved (as has also been supposed) by an undercurrent of salter and heavier water flowing outwards. This opinion has recently been called in question by an authority entitled to every respect; but from the best consideration we have been able to give the subject, we feel compelled to acquiesce in Halley's conclusion. A few words will suffice to explain the grounds of our conviction on this point. The total area of the Mediterranean, Euxine, and Azof seas, amounts to 1,150,000 square miles, and may be regarded nearly enough for the purpose of such a calculation, as traversed medially by the isotherm of 63°. Now, this is the mean temperature of July at Tottenham, at which, for that month, the observations of Howard assign an average evaporation of 4·111 inches, which, continued over the year, would give 49·33 inches. Dalton's determination for Liverpool for the same month is 5·11 in., corresponding to 61·33 in. per annum. The observed annual evaporation at Marseilles exceeds 85 Paris inches (*Kamtz*, i. 446). So that we shall be quite within limits in taking 50 inches per annum as the average evaporation over the whole surface in question. As regards the quantity restored by rain, Palermo,[2] as an insular station, well situated about the middle breadth of the Mediterranean, gives 22·3 in. for the fall of rain, which may be taken as the average supply from that source, leaving 27·7 in., or in round numbers, 28 in. for the excess of evaporation. This, computed as extending over the whole area, gives 508 cubic miles of fresh water annually abstracted.

(24.) The Nile delivers into the sea 101,000 cubic feet of water per second (Talabot) on the average of the whole year, which gives an annual contribution of fresh water from this river alone = 21·653 cubic miles. So that, even on the extravagant supposition that each of the other principal rivers (the Danube, Dnieper, Don, Rhone, Dniester, Ebro, and Po) contribute as much as the Nile, we should still have only 173 cubic miles of river supply, leaving 335 to be furnished from the Atlantic.

(25.) In point of fact, the current which sets in at the Straits (estimated by Admiral Smyth[3] as 4 miles in breadth, with an average velocity of 2½ miles per hour) would carry in, supposing it to extend 30 fathoms only in depth, 2986 cubic miles per annum, of which it is therefore past a doubt that at least 2000 must flow out again in the form of an under-current (no regular lateral return currents being observed to exist). This enormous interchange of water is sufficient perfectly to account for the observed fact that the Mediterranean is not sensibly salter than the ocean, and not materially so at great depths than at the surface, though, on arranging the results

[1] Captain Beechey's results (where reduced by him) are given for 60°, and are corrected by — 0·00020 to bring them to 62°.
[2] A mean of eleven stations at points surrounding the whole of the Mediterranean, as reported by Admiral Smyth, gives 23·05 inches
[3] Mediterranean, p. 160.

recorded by the last-named eminent hygrographer in groups according to depth, a very perceptible increase is apparent. Thus we find (setting apart the last result as anomalous, and as a case in which, by bare possibility, a submarine brine spring may have been struck upon)—

At depths from	[illegible]	By
0 to 8 fathoms	1 0271	2 observations.
34 „ 60 „	1 0285	4 „
250 „ 450 „	1 0297	3 „
670 „	1·1288 ??	1 „

(26.) The disproportion between evaporation and fresh-water supply is carried to its maximum in the Red Sea, where rain scarcely ever falls, into which no rivers run, and throughout whose whole extent an excessive temperature always prevails. The evaporation has been computed at 165 cubic miles per annum, so that but for an interchange of water with the Persian Gulf, similar to that which takes place between the Mediterranean and the Atlantic, only more intense, it could not fail to be speedily reduced to the condition of an almost saturated brine.

(27.) In several places in the Mediterranean, springs of fresh water, nay, even subterraneous rivers, well up to the surface from considerable depths. Many such are enumerated by Admiral Smyth; but the most remarkable is Anàvolo, in the Sinus Argolicus, between Kiveri and Astros, where a body of fresh water fifty feet in diameter rises with such force at a quarter of a mile from the shore, as to produce a visible convexity of surface, and to disturb the sea for several hundred feet round.—(Leake, *Travels in the Morea*, ii. 480). In the Gulf of Xagua, south-west of the Port of Batabano, on the south coast of Cuba, a similar instance occurs (Humboldt, *Aspects*, p. 233), and others are said to exist in the Pacific, among the Sandwich Islands.

(28.) In the Polar Seas, too, there are extensive regions where large accretions of fresh ice, from snow or glaciers melting in summer, render the surface-water comparatively fresh. But these are too obvious exceptions to the general fact to need more than a passing notice.

(29.) The following is given by M. Regnault (*Chim.* ii. 193) as a mean result of the analysis of sea water. Under the head of "loss" may be comprised the various ingredients which exist in too small quantity for distinct separation, except in operations conducted on a very large scale.

Water		96·470
Saline ingredients = 3.505.	Chloride of Sodium	2 700
	„ Magnesium	0 360
	„ Potassium	0·070
	Sulphate of Lime	0 140
	„ Magnesia	0·230
	Carbonate of Lime	0 003
	Bromide of Magnesium	0·002
Loss (including Iodides, Silica, &c.)		0 025
		100·000

(30.) *Colour and Phosphorescence of the Sea.*—The sea is only purely blue in the open ocean, or in very deep water, out of the fouling influence of rivers, the washing of coasts, or such currents as drift along mud and impurities. When clear of all such causes of discoloration, a white object, as a plate thrown overboard, is seen to become bluer and bluer as it sinks. The light illuminating the Grotto of Capri, in the Bay of Naples, which is mainly derived from reflexion at the bottom of the water, and which has traversed many yards of sea-water, is very blue. This colour is common to the sea and to lakes of pure fresh water. In the little lake of Chede (now filled up by the fall of a mountain), the blue colour of the water used to be very apparent at a few yards in depth. So also of the water in the Grotto of Vaucluse. It will hardly be contended that in these instances the colour is owing either to salt, which is insisted on by some as the cause of the colour of the ocean, or by cuprate of ammonia, which, on the strength of the discovery of copper in sea water, has recently been suggested. The intense blue colour of the Rhone, where it issues from the Lake of Geneva (far surpassing that of the bluest sea), is alone sufficient to negative both these explanations. Like the blue colour of the sky, the explanation is yet to seek, unless we are content with the very simple, but somewhat doubtful one, that in both cases it is an absorptive colour proper to either element.

(31.) In this view of the subject, wherever the sea is otherwise than fully and purely blue, we may be sure it is by reason of *solid* matter held in *suspension*. In many instances this is obviously the case. The surface water both in the Indian and Pacific Oceans is frequently coloured in patches as far as the eye can reach, of red, brown, or white, the water of which, when taken up and carefully examined, is found to be full of animalculæ of the colours in question. On the shores of the Red Sea a red matter is thrown up, which Ehrenberg has found to be of vegetable origin. Along the coast of China, and especially in the Yellow Sea, spots of that colour are said to be not unfrequent. Captain Kingman, in lat. 8° 46′ S., lon. 105° 30′ E., passed through a tract of water 23 miles in breadth and of unknown length, so full of minute (and some not very minute) phosphorescent animal organisms, as to present the aspect (at night) of a boundless plain covered with snow. Some of these animals were "serpents" of six inches in length, of transparent gelatinous consistency, and very luminous. Such tracts by daylight appear white, not by reason of light emitted from the insects, but of the sun's light reflected by their filmy and all but aqueous substance. (*Cf.* Buist, *Naut. Mag.* 1854.)

(32.) *The Phosphorescence of the Ocean* is a phenomenon which strikes all who witness it with wonder and admiration. It prevails largely through the whole extent of the tropical seas, and proceeds from a great variety of marine organisms—some soft and gelatinous, some minute crustacea, &c., of the genera Cancer and others. They mostly shine when excited by a blow, or by agitation of the water, as when a fish darts along, or oar dashes, or in the wake of a ship as the water closes on its track. In the latter case are often seen what appear to be large lamps of light rising from under the keel, and floating out to the surface, apparently of many inches in diameter. These we have never succeeded in catching, though we feel assured to have seen them enter the net (of Urling's patent lace) dragged along for them, so that the light must have emanated from a creature small enough to escape through the meshes. One of the most remarkable of these luminous creatures is a species of pyrosoma, a tough cartilaginous bag or muff-shaped body, of more than an inch in length, which, when thrown down on deck, bursts into a glow so strong as to appear like a lump of white-hot iron.

(33.) One of the most curious phases of phosphorescence which we have witnessed (and which we have not met with elsewhere described) is the appearance on the surface of calm or but little agitated water, of luminous spaces of several square feet in area, *shining fitfully, and bounded by rectilinear, or nearly rectilinear, outlines*, presenting angular forms, across which the light flashes as if propagated rapidly along the surface.

(34.) *Depth and Form of the Bottom of the Sea.*—Of the *average* depth of the ocean we have already spoken. Of particular districts in the great ocean, nothing very distinct can be stated, except in respect of the North Atlantic, or the Atlantic basin, in which soundings enough have been

obtained to enable something like a rude chart of level lines to be constructed, and of which a summary account may be stated as follows. We shall suppose level lines corresponding to depths of 1000, 2000, 3000, 4000, and 5000 fathoms to be laid down, which will therefore trace out what would be the coast lines of continents and islands, were the sea to sink in level, successively by these several quantities. The first of these lines (that of 1000 fathoms) corresponds pretty closely in its general form with the existing coast line, or rather with what that coast line would be, supposing on the American side the Caribbean Sea and the Gulf of Mexico filled in, so as to carry the continent out to the extreme verge of the Bahamas and Caribbee Islands; and supposing the irregularities of the North American coast smoothed off by carrying out the coast line clear round Nova Scotia, to include Newfoundland with the Great Bank; and supposing, on the European and African side, the Bay of Biscay and the British and Irish Channels also filled in. From the coast lines so arising, the first level line in question hardly anywhere deviates more than 120 geographical miles, (60 to the degree). Nor does it appear that the sea-line so altered would give rise to any considerable new masses of land, but only a very moderate extension of the Azores, and a very trifling one of Madeira, the Canaries, and the Cape Verde Islands.

(35.) The level line of 2000 fathoms along the east coast also conforms very nearly to the outline of the European and African continents, taking in the Canary and Cape Verde Islands, never departing more than about 250 geographical miles from the present coast, except in the case of the last-named islands, but clinging closer to it along the European than the African coast. On the western side this level line, from 10° of south latitude northwards, accompanies the coast (modified as above) for the most part considerably within the same limit of distance as on the eastern (the descent being most precipitous at the edge of the Caribbean Sea), until we reach a point about lat. 43° N., long. 43° W.,[1] where it quits the neighbourhood of the existing coasts, and suddenly turns southwards, running in a meridional direction for 16° of latitude, and forming so much of the western boundary of a great submarine table-land which fills nearly the whole bed of the northern part of the Atlantic basin, and of which, if laid dry, the peak of the Azores would be the culminating point. Were that the case, we should see a lobe of land, (following, singularly enough, the general tendency of configuration pointed out in art. 15, not very unlike Italy in form, extending southward to the tropic of Cancer, leaving a channel of sea of about 500 miles broad between it and the eastern continent, and connected at its south-western extremity with a great triangular mass like Sicily in shape, two sides of the triangle having a general conformity to the present outline of the American continents, so as to leave a channel of about 800 or 900 miles in breadth on that side, separating it from the coast of the United States.

(36.) It is this submarine continent or plateau which, happily for the communication between the old and new world, appears as if provided to receive the lines of telegraphic wire which will one day bring America into intellectual contact with Europe.[2] From Cape Race, in Newfoundland, to Cape Clear, in Ireland, it has been ascertained to form a continuous platform of nearly 400 miles in breadth, at the depth of about 2000 fathoms, which has been sounded and surveyed for that purpose Its surface is covered with broken shells of foraminated and diatomic organisms, among which the cable might find secure lodgment, and in all probability become ultimately incrusted and imbedded in their mass.

(37.) Were the Atlantic to sink another thousand fathoms (to the 3000 fathoms level line), the whole of the European and African side of its bed would be laid dry. The table-land spoken of would form an extension of the European continent. The British Islands, and the north of Europe, would become united with the Labrador coast, and nothing would remain of the ocean but a comparatively narrow channel, following at no great distance the present line of the American continent—reduced to very slender dimensions at the Caribbees, and thence opening out into a bay or great salt lake, occupying that part of the area opposite the United States, and extending between Bermuda and the southern edge of the Bank of Newfoundland. The central and deepest part of this lake would seem to be a long valley running nearly east and west from about 46° to 67° west longitude, along which a depth of from 25,000 to 30,000 feet at present exists.

(38.) By the first step in the subsidence of the ocean we have been supposing, the Baltic would be laid dry—its depth nowhere exceeding 1100 feet—as would also the German Ocean, the British and Irish Channels, and the Bay of Biscay; but the Mediterranean would remain as a great salt lake, a bar extending across the Gut of Gibraltar, at about 900 feet in depth, inside of which the water deepens so rapidly, that between Gibraltar and Ceuta, where the breadth of the channel does not exceed 12 miles, the depth is already 6000 feet; 90 miles east of Malta, we find a depth of 15,000; between Rhodes and Alexandria, 9900; and between the latter part and Candia, 10,200; so that the next step in our ideal descent of the general sea level would lay the whole bed of the Mediterranean dry. We see, then, that the Mediterranean fills an immensely deep and comparatively a precipitous chasm, which would almost seem to have been the effect of subsidence towards the south, contemporaneous with and complementary to the upheaval of the great line of mountainous tracts which run along the whole extent of south Europe.

(39.) The depth of the Arctic Ocean is probably not great. From Baron Wrangel's explorations we learn that over very extensive tracts of the northern coast of East Siberia the water shoals so gradually, that at upwards of 150 miles from land the depth is only fourteen or fifteen fathoms, and the broken character of the northern coast of America, with its labyrinth of islands, and tortuous channels, affords a similar indication. In the axis of Baffin's Bay, however, a few days' sail from Finskernaes, in Greenland, Dr Kane found 1900 fathoms.

(40.) Of the Pacific, too little is known to afford any ground for forming even the most general notion of the form of the level lines of its bottom. The islands scattered over it spring up, for the most part, from very deep water, and soundings are said to have been obtained of enormous depth, even greater than five miles. The deepest recorded by Maury was obtained by Lieutenant Brooke, (with a deep-sea sounding apparatus of peculiar and simple construction, *bringing up specimens of the bottom*), in 58° 46′ N., 168° 18′ E., being 2700 fathoms. The greater interest therefore attaches to an estimate of its average depth in the section across its whole breadth from Simolo, in Japan, to San Francisco, in California, along the parallel of 34° N. latitude, derived by Professor Bache (*Report of Superintendent of the U. S. Coast Survey*, 1855, p. 346), from observations which can certainly be depended upon of the time taken to traverse it by the great waves of December 23, 1854, caused by the terrible earthquake

[1] All our longitudes reckon from Greenwich.

[2] The thing is done! (Aug. 1858)

which ravaged Japan on that day. Several of these waves were propagated all across the Pacific, and were recorded on the self-registering tide-gauges of San Diego and San Francisco, on the Californian coast. A comparison of the observed times of arrival so recorded with the times at which the waves took place in Japan, leads to the conclusion that a wave 217 miles in breadth can be propagated across the interval in question (4527 miles) at an average rate of $6^m 1$ per minute, from which, by the theory of waves, Professor Bache concludes a mean depth of 2365 fathoms, or 14,190 feet.

(41.) In the "Coral Sea," 13 S., 162 E., a depth of 2150 fathoms, with a specimen of the bottom, was obtained by Lieutenant Brooke. The same ingenious officer reports a sounding of 7040 fathoms in the Indian Ocean (42,240 feet, or exactly eight miles!), but under circumstances authorizing considerable doubt as to the correctness of the result. It deserves remark, that off the mouth of the Hoogly river, in the Bay of Bengal, there exists a sudden and deep depression in the ocean bed called "The Bottomless Pit," an epithet, however, relative only to the ordinary "deep-sea lines" of the old merchant vessels, yet of importance as occurring just where the lighter part of the sediment of the Ganges is carried out to sea, and for which it serves as a receptacle.

(42.) Among the most interesting results of the mode of sounding adopted by Lieutenant Brooke, may be considered the evidence procured by it of the nature of the deposits in actual process of formation in the tranquil depths of the ocean, from a microscopic examination of the specimens procured. Thus, the specimens brought up in the Coral Sea are found to consist chiefly of the siliceous spiculæ of sponges, with a few other siliceous and some calcareous infusorial shells; while over the basin of the North Atlantic, over the whole extent of the telegraph plateau, and the wide area covered by the expansion of the Gulf Stream, the bottom appears to consist exclusively of the remains of delicate calcareous exuviæ of animalcules of the foraminiferous family, in a state of such perfect preservation as proves them to have suffered no abrasion, but to have been quietly deposited, on the death of the animals, from the surface-water which served them for a habitat during life. Thus we see here going on the formation of a cretaceous deposit exactly analogous to our own chalk formations, which the researches of Ehrenberg and others have also found to consist almost exclusively of the shells, and fragments of shells, of minute infusoriæ. In some places, too, volcanic ashes and pumice, in fine powder, are found—the product, doubtless, of wind-drifted ashes bestrewing the surface.

(43.) *Subdivisions of the Sea.*—The ocean separates the globe into two principal continental masses, which our insular position between them entitles us to designate as the Eastern and Western Continents. They are separated on one side by the Atlantic Ocean, which extends north and south, in all probability, from pole to pole, and which is continued across the north pole, and through the Arctic Ocean or north polar basin, from which it is hardly separated by any well-defined line of demarcation, the interval between the Greenland coast and that of Norway alone being nearly 500 miles, not to speak of the channel communications leading out of Davis' Strait—while to and probably over the south pole it presents nothing but open sea. The separation of the continents on the other side is effected by the Pacific Ocean, which, but for the narrow communication with the Arctic Sea by Behring's Strait, would come to be considered as a great bay, bounded on the eastern side by the whole coast line of North and South America, and on the western by that of Asia, considered as prolonged by a chain of great islands to the Australian continent. Narrow and shallow as this channel of communication is—not exceeding 30 miles in breadth where narrowest, and 25 fathoms in its deepest channel—it is yet important in the economy of nature, inasmuch as it allows a portion of the circulating water from a warmer region to find its way into the polar basin, aiding thereby not only to mitigate the extreme rigour of the polar cold, but to prevent, in all probability, a continual accretion of ice, which else might rise to a mountainous height. Nothing, indeed, can be more remarkable than the way in which all direct equatorial circulation is barred by the Isthmuses of Darien and Suez on the one hand, while on the other the polar communication is left free. One of the reasons adduced in support of the early, but erroneous, opinion that the figure of the earth is that of an oblong spheroid, was drawn from a crude notion of the continued accumulation of ice and snow over the polar regions, which it was argued must result in an indefinite prolongation of the earth's polar axis. The actual form of the continent, however, prevents any such consequence from taking place, and it is probable that the melting of the ice where it rests on the sea, together with the bodily drifting away of detached masses, form, in the long average, a compensation to the effect of continued precipitation from the atmosphere.[1]

(44.) Another such vast bay or gulf, but without any northern outlet (the Red Sea and Persian Gulf being barred), is the Indian Ocean, limited westwards by the African and Arabian coasts, northwards by the south coast of Asia—the peninsula of Hindostan breaking it into two deep and nearly symmetrical indentations—and eastwards by the broken masses of Sumatra, Java, and the Indian Archipelago, and by the west coast of Australia.

(45.) Each of these great bodies of water communicates without any natural barrier-line with the Southern Ocean, which probably extends across the pole beneath the great icy barrier discovered by Sir James Ross. If, therefore, we would distinguish between them, we must assume arbitrary lines of demarcation. On the north, the arctic circle, which passes within a degree of the narrowest part of Behring's Strait, forms a very appropriate limit to the "Arctic Ocean." The Antarctic Ocean has no such natural limit, but under the wider designation of the "Southern Ocean" may be taken to embrace all the area limited by great circles drawn between Cape Hoorn, the Cape of Good Hope, and Bass' Strait, so as to constitute these localities the southern termini of the Atlantic, Pacific, and Indian Oceans. This appears a simpler division than that which runs meridians up from the three capes (the two last named and Cape Pillar) to the Antarctic Circle, so as to form a purely imaginary Antarctic Ocean, and to constitute a Southern Ocean, equally imaginary as to its limits, between the Indian and Antarctic.

(46.) Each of the three principal oceans has subordinate seas, specially marked out by distinguishing features. Besides the Mediterranean and the Baltic, on the European side, the Atlantic opens out, on the American, into the great bays which bear the names of Baffin and Hudson, both heavily encumbered with ice; the former of which communicates by a labyrinth of intricate and ice-obstructed passages with the Polar Sea, and is the source from whence are continually drifting southwards those

[1] On land, the penetration of the central, or volcanic, and local heat of the globe *may* assist in limiting its increase. Dr Kane describes the Mary Minturn River, in lat. 78° 54′ N., as issuing in a roaring and tumultuous torrent, three quarters of a mile broad, from beneath a glacier Kane Lake, near Etah (78° 17′ N.), is fed by a glacier stream, never ceasing to flow summer or winter.

floating icebergs which form one of the chief dangers of Atlantic navigation. On the other hand, the deep indentation of the Gulf of Mexico and the Caribbean Sea, nearly land-locked by the peninsula of Florida and the long chain of the West India Islands, forms a basin of hot water, having a higher mean temperature than any other oceanic district.

(47.) The mass of islands which sketches out the connection between the Asiatic and Australian continents, is continued northward along the west coast of the Pacific, forming a loose and broken barrier between the main ocean and the east coast of Asia, and breaking it up into compartments more or less land-locked by them, and by the singular system of meridional peninsulas (of Kamtschatka, Corea, Cambodia, and Malaya) known as the seas of Ochotsck and Japan, the Yellow Sea, and the China Sea. The difference in character in this respect between the western coasts in the two oceans is extremely remarkable.

(48.) On the other hand, their eastern coasts are both characterized by an equally striking absence of features of this nature. With exception of the Gulf of California, there is no approach to any deep and extensive land-locked indentation along the whole line of western America, nor does any exist on that of west Africa, or along the European coast from the Gut of Gibraltar to the British Channel.

(49.) *Temperature of the Sea.*—The mean temperature of the sea surface, when undisturbed by currents transferring water from a hotter to a colder zone, or *vice versa*, is of course nearly that of the air above it; but on descending below the surface, a most remarkable law prevails. In very deep water all over the globe a uniform temperature of 39° Fahr. is found to prevail, while above the level when that temperature is first reached, the ocean may be considered as divided into three great regions or zones—an equatorial and two polar. In the former of these, warmer, in the latter colder, water is found at the surface. The lines of demarcation are of course the two isotherms of 39° mean annual temperature. The depth at which this temperature is found is about 7200 feet at the equator, and 4500 in the highest accessible latitudes. The medial line of maximum surface temperature is far from following the exact line of the equator, being deflected by the effect of currents, and in the case of the Indian Ocean by the proximity of heated land, as the following tabulated trace of its course, indicating its greatest deviations from, and intersections with, or near approach to the equator, will shew for each of the three great oceanic regions.

Atlantic.			Pacific.			Indian Ocean.		
Longitude	Latitude	Temperature.	Longitude	Latitude.	Temperature	Longitude	Latitude.	Temperature
Deg	Deg.		Deg	Deg		Deg	Deg	
9 E.	0	80	82 W.	2 N.	84·7	120 E.	8 S.	84·6
0	1 N.	...	97 W.	7 N.	...	104 E.	0	85
46 W.	3 N.	82·6	135 W.	2 N.	81·7	90 E.	9 N.	86
60 W.	10 N.	84	152 W.	0	83·1	63 E.	10 N.	86
84 W.	20 N.	83	180	7 S.	84·7	45 E.	12 N.	86
90 W.	28 N.	88[1]	140 E.	0 +	...			
			130 E.	0	...			
			125 E.	8 S.	84·7			

(50.) Universally, the temperature of the sea surface, for the reasons explained in METEOROLOGY, is far less variable than on land, and there exist vast regions (as may be seen on inspection of the above table) over which an almost absolute uniformity in this respect prevails. The determination of the mean temperature of these regions *to the extreme of precision*, is a practical problem of the highest importance.

(51.) *Currents of the Ocean.*—Every wind that sweeps the ocean drives along before it the surface-water. The impulse given is horizontal, and proportional to, or at least increasing, in some ratio of the *relative* motion of the air, a ratio probably higher than that of the simple difference of absolute motions, by reason of the universal roughness of surface consequent on the action of the wind. If the difference of motion be due to an excess of diurnal rotation on the part of the sea, it is the water which (driven against the air) gives out momentum to the latter; if that of the air be in excess, it receives it from that element. In either case, the effect is the same; the two are brought nearer to a community of direction and velocity by their mutual friction.

(52.) The trade-winds occupy two belts on the earth's surface on either side of the equator, which are limited on the equatorial side by a belt of calm air (the movement of which is upward, and in which no prevailing tendency, east or west, is perceivable). On the polar they are limited by two belts of comparative calm, with uncertain and variable winds, which for our present purpose we may consider as nearly coincident with the tropics. Over the belt of equatorial calms, the N.E. and S.E. trades, *reduced to meridional directions by the eastward frictional impulse of the earth's rotation* (Basil Hall, *Fragments of Voyages and Travels*, 2d Series, i. 162), meet, and to a certain small extent perhaps commingle, in their upward movement, which, however, can only be the case with those portions of air which actually attain the medial line, or approach very near it; for, as the region of calms extends to four or five degrees on either side of that line, the greater part by far of either indraft will rise on its own side, and must of necessity be turned over towards the pole of its own denomination, and return, as an upper current, by a tract precisely the reverse of that of its arrival.[2] On the other hand, over the region of tropical calms, a portion of the descending air of the upper current, where it first strikes the earth, is dragged back into the tropical circulation, while the rest goes forward to form the Antitrades (or S.W. and N.W. winds) of the temperate and polar zones, which, as prevalent winds, with more or less frequent interruptions, according to local circumstances, occupy both the extra-tropical regions.

(53.) In obedience to the trade-winds, a drift of the intertropical surface-water is produced, which tends to carry it in a S.W. and N.W. direction respectively towards the equator, where the meridional components of the two drifts neutralize each other, and their westerly components conspire to produce an equatorial current setting westwards, the borders of which will be stronger than the medial line, because the existing cause is there most energetic. The general current resulting from the concentration of the drift will therefore bifurcate where it meets or nears the land, the northern portion turning northward, and the southern southward.

(54.) In the Atlantic, this bifurcation takes place somewhat south of the equator, off Cape St. Roque. The equatorial current is there not very powerful; but in its progress along the north-east coast of South America, it

[1] In the Gulf of Mexico, off New Orleans; it is evident that this is an exceptional result.

[2] Such, at least, is the ordinary, and, as appears to us, the correct dynamical view of the subject, and this is one of the points on which we have the misfortune to differ from Lieutenant Maury, who conceives that the south-east and north-east trades cross as they near the equator, and pursue their course in the upper regions of the atmosphere towards the poles of *contrary* denominations The point is irrelevant to the matter actually in hand, but it will be necessary to recur to it when we come to speak of the distribution of moisture.

is reinforced by the whole amount of S. W. drift setting towards that shore from the North Atlantic, and is thereby forced into the Caribbean Sea and through the Channel of Yucatan; and having made the circuit of the Gulf of Mexico, issues through the Straits of Florida, clinging close in shore round Cape Florida, whence it issues as the Gulf Stream in a majestic current upwards of 30 miles broad, 2200 feet deep, with an average velocity of four miles an hour, and a temperature of 86° Fahr. It is to the continual scouring of this recess, by so vast a torrent of perfectly pure water from the main ocean, that the extreme and crystalline transparency and intensely blue colour of the Caribbean Sea is owing—a transparency such as to allow every object at the bottom to be clearly seen in 30 fathom water.

(55.) From its issue through the "Narrows" off Cape Florida it is darted off into the main ocean, where it takes up a course (as Lieut. Maury has well pointed out) conformable (in a general way) to the easterly impulse given by its excess of diurnal rotation, in passing from a lower to a higher latitude, and which drives it away from the American coast in an almost direct N.E. direction *towards* the opening of the Arctic Sea, between Spitzbergen and Norway. Arriving in colder water, it becomes relatively buoyant, and thins off in depth (which has been, by a strange perversion of language, called "running up hill"), spreading itself gradually in width, until its motion at length, conspiring with that of the south-west Antitrades of the extra-tropical latitudes, it is swept on, partly by what may yet remain of its original impulse, but mainly by their aid, as a drift-current (*Stark*) of moderately warm water (51°), into the North Sea. There can be little doubt that a portion of this warm stream enters the Arctic Ocean, and, sweeping round its basin, reissues in the form of a cold current between Spitzbergen and Greenland; after skirting the coast of which latter, it unites with a similar current, also running southward, through Baffin's Bay (and which probably conveys the whole of the water entering at Behring's Strait), and forms a cold stream, which descends along the Labrador coast, and that of the United States, till it becomes extinct, or re-enters the circulation at the point where the Gulf Stream quits the coast.

(56.) It is about the 42d or 43d parallel of N. latitude that this process of thinning off and superficial extension may be said to have *dispersed, and, in fact, destroyed, the Gulf Stream as such*, since at this point, or rather over this region, a large portion of its water, strongly marked by excess of temperature (79°-73°), curves round to the eastward, and is then again deflected southward, forming an eddy or return current, which follows the bend of the great northern protuberance of Africa, but at some distance from the coast, till it again rejoins the equatorial waters. In the interior of this vast circuit, about the tropic of Cancer, and forming a floating island of an elongated oval form, between the 20th and 65th degree of W. long., and the 18th and 28th of N. lat., occurs that extraordinary accumulation of rootless sea-weed, known as the gulf-weed, or Sargasso, consisting almost entirely of the *Fucus natans* and *Macrocystis pyrifera*, and affording a home to myriads of molluscs and crustacea.

(57.) The dynamics of the Gulf Stream have of late, in the work of Lieut. Maury already mentioned, been made a subject of much (we cannot but think misplaced) wonder, as if there could be any possible ground for doubting that it owes its origin *entirely* to the trade-winds. A few words on this point, therefore, will not be superfluous. *First*, then, if there were no atmosphere, there would be no Gulf Stream, or any other considerable oceanic current (as distinguished from a mere surface drift) whatever. By the action of the sun's rays, the *surface* of the ocean becomes *most* heated, and the heated water will, therefore, neither directly tend to *ascend* (which it could not do without leaving the sea) nor to *descend*, which it cannot do, being rendered buoyant, nor to move laterally, no lateral impulse being given, and which it could only do by reason of a general declivity of surface—the dilated portion occupying a higher level. Let us see what this declivity would amount to. The equatorial surface-water has a temperature of 84°. At 7200 feet depth the temperature is 39°, the level of which temperature rises (art. 49) to the surface in lat. 56°. Taking the dilatability of sea-water the same as that of fresh, a uniform increase of temperature, from 39° to 84° Fahr., would dilate a column of 7200 feet by 10 feet,[1] at which height, therefore, above the spheroid of equilibrium (or above the sea-level in lat. 56°), the equatorial surface is actually raised by this dilatation. An arc of 56° on the earth's surface measures 3360 geographical miles, so that we have a slope of one 28th of an inch per geographical mile, or one 32d of an inch per statute mile for the water so raised to run down. As the accelerating force, corresponding to such a slope (of one-tenth of a second 0·1"), is less than one two-millionth part of gravity, we may dismiss this, as a cause capable of creating only a very trifling surface drift, and not worth considering, even were it in the proper direction to form, by concentration, a current from east to west; *which it would not be, but the very reverse.*

(58.) *Secondly.*—Whatever the difference of equatorial and polar temperatures in the surface-water, or, were there no difference at all, the actually existing trade-winds must of necessity act on the surface-water in the manner described in art. 51. Their action is in the nature of a *vera causa*, which cannot be ignored or set aside. The easterly momentum communicated to *the whole mass of air constituting the trade-wind has*, on its arrival on the equator, been abstracted from the surface-water. The surface-water *has* lost that easterly momentum, which is equivalent to saying that it *has* acquired an equal westerly amount, relatively to the dry land. It is for those who deny or under-rate the power of the winds to produce currents to dispose of this momentum otherwise.

(59.) *3dly and lastly.*—Sea water, by evaporation, acquires additional saltness and density, and by dilution with rain, the reverse qualities. In this fact we have a *vera causa*, though a very feeble one, for the production of an indraft on both sides *towards the lines of maximum evaporation and minimum precipitation.* These lines (as we have seen, art. 20) are not very remote from the tropics, being somewhat nearer the equator, it is true, but not so much so as to make it worth while to distinguish them for our present purpose. The diurnal rotation, then, will modify the directions of this indraft. Water coming in to the northern tropic, for instance, from the north side, will arrive in a south-westerly direction, and from the south in a north-easterly. The indrawn waters, then, will meet from opposite sides point blank on the tropic, and destroy each other's impulse. They will simply replace the volume of evaporated water while the denser water subsides vertically. The rain, moreover, which descends on the equator, has, on its arrival at the sea level, no tendency either eastward or westward. It opposes no resistance to being swept in the latter direction by the wind, and thus carried into the general circulation as part of the equatorial current.

[1] 9·971 feet, calculating on Dr Young's formula for the dilatation of water. Lect. ii. 392.

(60.) We ought here to observe, too, that it is by no means necessary, in accounting for the Gulf Stream or other ocean current, to assume or prove the existence of what is called "a head of water." Such currents do not of necessity run from a higher to a lower level. Indeed, such a condition (as a general one) is incompatible with the notion of *circulation.* A circulation in a closed area, produced by an impulse acting horizontally on the surface-water, may perfectly well co-exist with a truly level course of each molecule. A billiard ball runs along a level table by an impulse from the cue quite as naturally as if it rolled on an inclined plane by its weight. The notion of a "head of water," as a necessary condition, is a fundamental misconception in most of the received theories of oceanic currents, though such a head may be produced if a current be resisted or deflected.

(61.) The equatorial current of the Atlantic, as we have stated, bifurcates off Cape St Roque, and a branch called the Brazil current runs southwards—inferior in volume to the Gulf Stream. The projection of the South American coast, and the absence of any deep hollow like the Gulf of Mexico, affording no focus of concentration, a small portion only of it coasts along at about 300 or 350 miles from shore up to the extremity of the Continent, while the main body performs in the South Atlantic much the same sort of evolution as the offset of the Gulf Stream in the north. The further progress of this stream is by no means well made out. It is no doubt swept round in an eddy in some respects analogous to that in the North Atlantic basin, so as to form what is called the "connecting current of the South Atlantic," which runs nearly due east about the 33d parallel of south latitude; but in what way it is returned into the equatorial circulation, or whether so at all, does not clearly appear. It has been considered as finding its way at the Cape into the Southern Ocean. More probably a portion returns to the equator, and a portion escapes into the Southern Ocean, giving the Cape of Good Hope, however, a wide berth.

(62.) The equatorial current of the Pacific preserves a steady course, from its origin on the west coast of America across the whole Pacific basin, until it nears the Asiatic coast, where (as in the Atlantic) it bifurcates—the larger portion, however, being carried southwards through the broken channels between Borneo and New Guinea, to sweep the northern and western coasts of Australia, while the smaller branch, under the name of the Japan current, skirts the outside of the island barrier of the eastern Asiatic coast, imitating in the North Pacific, as nearly as the form of its basin and the narrowness of its opening into the Arctic Sea will permit, the course of the Gulf Stream in the North Atlantic. For it sends only a small shoot north-easterly up to the straits, while the main body, curving round, takes a great sweep along the Californian coast till nearly off the entrance of the Gulf of California, where it turns to the west, and regains the equatorial circulation. For nearly half the year (December-April) it is partially prolonged along the Mexican coast by the "Mexican coast current"—an alternating drift produced by monsoons setting along that coast.

(63.) In the North Pacific, in the latitude of Owyhee, and over an area of nearly 50° of longitude to the eastward of that island, that is to say, within the area encircled by the great eddying stream above traced, occurs a somewhat anomalous counter-current, or system of currents, running eastward, which in all probability result from peculiarities in the configuration of the bottom of the ocean—perhaps to shallows or to submarine coral elevations, which entangle and deflect a portion of the equatorial current. This and some other of the North Pacific currents are as yet far from well understood.

(64.) To understand the currents of the South Pacific, we must remember, that while the northern portion of the great equatorial drift merely eddies round the closed North Pacific basin, its southern waters find an escape, and enter the general circulation of the world through the Indian Seas. The Pacific, then, would be drained of its waters were it not replenished from the southern ocean, and we find accordingly that it is so. But this condition implies a northward direction given to the water drifted by the north-west Antitrades, which, combined with the movement to the south-east those winds alone would tend to impress, overcomes the southerly element of that motion, and leaves the east outstanding. Thus originate two leading currents known as the Antarctic drift current (of cold water bearing icebergs), and the South Pacific current, both setting into the concavity of the South American west coast (the latter prolonged into what is known by the name of the Mentor drift current), together with a general drift of cold water to the southward of both these, which takes the form of a bifurcating current about 45° S. lat., nearly opposite the isle of Chiloe, and about 600 geographical miles from the coast. One portion proceeds to, and rounds Cape Hoorn, as the "Cape Hoorn current;" the other skirts the whole western coast of South America, as the "Peruvian or Humboldt's current" (attention being first drawn to it by that celebrated traveller), interposing itself between the Mentor drift and the coast, till off Payta, in latitude about 4° S., it turns westward, and joins in the south equatorial circulation.

(65.) The currents of the Indian Ocean north of the equator are complicated by the monsoons, caused (see METEOROLOGY) by the proximity of the Asiatic coast, and it is only over the region of the S. E. trades, and about the 20th parallel of south latitude, that a general and steady westward set of water takes place. This follows, *mutatis mutandis*, the same laws as in the Pacific, the ocean being open to the south. It bifurcates about the 75th degree of east longitude, one portion taking its course north of Madagascar, and then curving southward as the Mozambique current along the African east coast, the other passing Madagascar on the east side, and pursuing a direct course towards the Cape of Good Hope, where the two branches rejoin; a portion only of the stream so produced shoots southwards past the Cape as a warm current, but the greater part is suddenly deflected and driven back in an eddy or counter-current, running nearly eastward, by the cold water setting in from the south (bearing icebergs), to supply (just as in the case of the Pacific) the deficit of water, and carrying out precisely the same system of reaction as in that ocean. The drift produced by the prevalent north-west winds beyond the southern tropic, has the southerly portion of its momentum destroyed by the general equatorial indrift, and overcome by this cause, the easterly subsisting, and the result is a north-easterly stream bifurcating off Cape Leewin about 105° E. long., and sweeping the western and southern coasts of Australia, the former portion (just as in the case of the corresponding portion of the Pacific supply current) reverting west, and joining in the equatorial circulation, the other going forwards in part supply of the Pacific deficit. We have been perhaps more diffuse on the subject of the oceanic currents than the nature of this article may seem to justify; but some such detail seemed necessary to vindicate to the winds their supremacy in the production of currents, without calling in the feeble and ineffective aid of heated water, or the still more insignificant[1] in-

[1] Insignificant for such a purpose, but not for some others, when its accumulated effect in long periods of time is regarded.

fluence of insect secretion, which has been pressed into the service as a cause of buoyancy in the regions occupied by coral formations.

(66.) *Tides and Waves.*—The tides are in the nature of forced oscillations (*i.e.*, such as are maintained against continued resistance and unconformable oscillatory tendencies in the system of waters subjected to them) maintained by the sun and moon, each of which produces and maintains such an oscillation, which, in virtue of the law of superposition of small motions, co-exists with the other, and either conspires with, or contradicts it, according to the phases in which they happen to be at a given time and place. The action of either luminary consists in a difference of attractive force exerted by it on the solid nucleus of the globe, and the covering ocean, whence arise disturbing forces analogous to those by which the motions of the moon are affected by the sun's attraction. If the disturbing luminary maintained a constant position with respect to the earth, the effect would be to produce a distortion of figure in the ocean surface, surrounding the whole globe (or which would so surround it, if entirely covered with water), having the form of a slightly elongated ellipsoid, the two vertices of which, were the waters instantly to assume a form of equilibrium under the acting forces, would be the one precisely under, the other precisely opposite to, the points at which the luminary is vertical. This, however, is not the case, the forces shifting their point of action before the ellipsoid has time to form. Thus a wave is produced, which pursues the luminary round the globe.

(67.) The height of the wave thus produced by the moon is to that produced by the sun as 100 to 38. Their mean periods of revolution about the globe are also unequal, being respectively the lunar day of 24h. 54m., and the solar day of 24h. They conspire, and have a common vertex when the sun and moon are in conjunction or opposition (*i. e.*, at new and full moon); in which case the joint tide is the sum of the separate ones, and is called spring-tide. From these points the lunar lags behind the solar wave until the quadratures of the moon, when the high water of the moon coincides with the low water of the sun, and the joint tide is the difference of the separate ones, and is called neap-tide. And it is therefore by assiduous observations of the heights of the tide at the conjunctions and quadratures that, the sum and difference becoming known, the proportions of the two are ascertained (as above), the rise and fall of the spring and neap being as 138 to 62, or nearly as 7 to 3. The greatest tides occur when the luminaries are nearest, and pass most nearly vertically over the place of observation.

(68.) The depth of the sea varies so much, and the form of its basin, taken as a whole, is so interrupted by the land, that it may be doubted whether, were the action of the luminaries at once suspended, their tide waves would perform even a single revolution with any sort of regularity, and in the course of two or three, would be so broken up and confused by reflexion to and fro, as to destroy all vestige of a tide. Hence it follows, that the tides for the time being may be considered as *almost* completely commanded by the then actual position and proximities of the luminaries, the free oscillations of the sea in its bed being quite subordinate to the forced wave generating them. In consequence (as is always the case in forced oscillations), every periodicity in the action of the forcing cause is propagated into the oscillations, and records itself in the recorded height of the tide on every point of every coast, but at each point, at a greater or less interval from the culmination of the luminary, according to its local position and the more or less circuitous course taken by the tide-wave to reach it, and which special observation can alone determine. This interval is called the *establishment* of the place.

(69.) The motion of the water in the tide-wave is totally unlike that in an ordinary surface-wave, such as the wind produces. When a narrow wave of this latter kind, or a succession of such waves of equal breadths and heights, is formed in deep water, a light floating body, as a cork, revolves either in a vertical circle, or an ellipse not very different from one, having the longer axis vertical. But in the tide-wave the movement of each particle may be regarded as performed in an excessively elongated ellipse, the *shorter* axis of which is vertical. The breadth of the tide-wave from crest to crest, supposing all the earth covered, would be half the earth's circumference, or 12,500 miles, in comparison of which the depth of the sea is insignificant; and the slightest consideration suffices to shew that as all the water which goes to form the elevated portion must be brought from that depressed, this can only take place by a lateral approach of the vertical sections of the sea when the water is rising, and their recess from each other when falling—*i.e.*, over a quadrant of the globe in either case, which is only another way of expressing an alternating forward and backward horizontal current at any given place—with this especial peculiarity, viz., that these currents (the flow and ebb current) run *most rapidly* at the moments of high and low water; the instants of *most rapid rise and fall* being those of "slack water," or no current one way or other. In fact, it is obvious that the surface must be rising most rapidly when water is *setting in equally both ways to*, and sinking most rapidly when setting *out equally both ways from* the place; in neither of which cases can there be any current *at* the place.

(70.) The tide-wave differs also from a wind-wave in another very remarkable point. It affects the whole depth of the ocean equally, from the bottom to the surface, while the wind-waves, even in the most violent storms, agitate it to a very trifling depth. For the force which acts to produce the former, which is what in the lunar theory is termed the *tangential* element of the disturbing force, is exerted equally in every portion of the vertical extent of the water, while those producing the latter are strictly confined to the surface. Hence it would at first sight seem that the tidal action must be very violent at the bottom of the sea: and in shallow seas it is so, but not in deep water. A tide-wave of four feet in total height (between high and low water), which is that of the tide at the Atolls of the Indian Ocean, advancing over a sea 30,000 feet deep, implies in each particle an alternate advance and recess of 2800 feet in its total extent; but this movement, being spread over 6 hours either way, is nowhere very rapid.

(71.) In shallow seas, however, the actual movement to and fro is more rapid in the inverse ratio of the depth of water, and this is seen in many remarkable instances, as, for example, in the Race of Alderney, and the seas in the island channels of the Orkneys, and the celebrated Maelstrom off the Norwegian coast, as well as in the rapid streams which flow all round our own coasts, and are familiar to every seaman. It is this which gives the tides their drifting and abrading power on the materials of the coast.

(72.) Both the sun and moon, on a general average, are vertical over the equator, where, therefore, if the sea covered the globe, would be the region of highest tides, and round which zone they would circulate uniformly; but the equatorial sea being broken up into three great basins, and open water existing only to the southward of the three great continental masses, the phenomena of the tides are complicated in a very singular way. In each of

these basins the equatorial tide has to take a fresh start from the eastern side, with every fresh upper and lower transit of the producing luminary, and is destroyed or confused by reflexion on the western coast before the creation of a new wave, while in the open part of the Southern Ocean the tide-wave circulates unimpeded, and spreads in to the three oceans, up which it runs as a free wave from south-east to north-west, overtaking in its progress, and amalgamating with, the partial equatorial tides or forced waves proper to either ocean, and their reflected portions. In spite of all the complications so induced, however, and of those additional ones which arise from the shoaling of seas and the narrowing of channels, as a general fact two high and two low waters occur everywhere in the course of a lunar day of 24 h. 54 m., the solar and lunar tides never contradicting each other so far as to produce a double maximum in their combined wave. The day and hour of occurrence of the highest spring-tide next following the conjunction of the luminaries being observed, informs us not only of the "establishment" of the place, but also of the *age* of the tide, or that particular original tide-wave, of which any one circuitously arriving at a place, may be a branch. Thus the age of the tide in the port of London is two days, and on the coast of Spain, thirty-six hours. By determining these particulars at a series of points along all the coast lines, it becomes possible to construct a chart of *cotidal* lines, or those of contemporaneous arrival of the same tide, however subdivided, as has been done with extraordinary perseverance and success by Dr. Whewell. From his researches we learn,

(73.) 1*st*. That whereas the forced equatorial tide in a continuous sea would run round the globe in 24 h., and therefore with a mean velocity of 900 geographical miles = 1050 statute miles per hour, it requires 12 h. to run up the Atlantic from 50° S. to 50° N. lat., giving an average rate of about 500 geographical miles per hour. In the Atlantic, then, it is more in the nature of a free than of a forced wave.

(74.) 2*dly*. That its rate of advance is mainly determined by the depth of water. When it enters the Atlantic its front runs nearly from N.E. to S.W., but in its progress it becomes curved and convex northwards, till it approaches the southern tropic, where its progress is retarded again in the interval from thence to the equator, just where the appearance of islands (St Helena and Ascension) afford an indication of less depth. From the equator northwards, its progress again becomes rapid, and the increasing convexity of the lines of successive hours marks as clearly as soundings (since obtained) would do, the deepest channel. Thus the cotidal line corresponding to the eleventh hour of its progress, which at its eastern extremity rests on Cape Blanco (lat. 21° N.), and at its western on Porto Rico (19° N.) has its front advanced to the north nearly to the bank of Newfoundland (46° N.), and the point of its farthest advance precisely on that part of the sea where (as we have seen in art. 37) the great submarine cross valley of the North Atlantic is situate. Advancing further north, the cotidal lines of the successive hours close up, in correspondence with the diminishing depth of the North Sea, and round the Irish coast, indicate a velocity not exceeding 150 miles per hour, while in the channels the wave advances still slower, and they are crowded still closer.

(75.) Further and very remarkable corroborations of the same theoretically demonstrable law appear wherever the advancing front of the tide-wave stretches across the opening of any great bay or recess of the coast line. Such is the case in the hollow of the South American coast off Patagonia, between the River La Plata and Cape Horn; and again in the Indian Ocean, in the Arabian Gulf, and the Bay of Bengal, in which last, as the rate of advance of the wave diminishes, the extent and force (as a necessary consequence) of the aquatic movement increases, both the height and the ebb and flow current are exaggerated, and result in the phenomena of a *Bore*, or sudden and violent wave rushing up the Hooghly River with such impetuosity as to sweep everything before it. The same thing takes place in many other estuaries, or gradually expanding mouths of rivers, which receive and concentrate the tide; as, for instance, in the Garonne, and in our own Severn, where the spring-tides at Chepstow (which in mid-ocean, as at St Helena and Ascension, do not exceed three feet) rise to forty, and where at such times a bore nine feet in height runs up stream. The bore of the Chinese river Tsientang advances up that river at Hangchau like a wall of water, extended across the river, thirty feet in height, and advancing at the rate of twenty-five miles per hour, sweeping all before it. In the Amazon River, at the equinoxes (when the equatorial tide is at its maximum), during three consecutive days, bores of twelve or fifteen feet high rush up the river with each high water; so that, along the course of the stream, up which for 200 miles from its mouth no less than eight tide waves are simultaneously advancing, as many as five bores are sometimes at once in progress.

(76.) The effect of concentration, by the gradual approach of the shores, and the shoaling of the bottom, is nowhere so strongly exemplified as in the Bay of Fundy, where the tide not uncommonly rises fifty feet, and, as is said, on some occasions to more than double this height. The whole of the tide-wave between Halifax and Charleston is made to converge by the shore of Nova Scotia on one side, and the United States on the other, to the entrance of this bay; a ship has been known to strike and remain fixed on a sunken rock at high water there during the night, and at daybreak the crew have been astonished to find themselves looking down a precipice into water far below.

(77.) The tide which flows round the British Islands, on the west side, bends round the north of Scotland, and enters the German Ocean from the north, after traversing which, it meets the tide of twelve hours' earlier origin which has entered by St George's Channel. Hence arises a singular complication; the former tide mainly clinging to the British, and the latter to the Continental coast, and producing a revolving wave and nodes of undulation; and, in consequence, there is a point in the North Sea whose existence was pointed out *a priori* by Dr Whewell, and verified by observation, where the rise and fall of the tide is *nil*.

(78.) The tides of the Pacific are but ill understood. In some parts of it (as in the Atlantic) they are of very small magnitude, as far as rise and fall is concerned, so that at some points, as at the Sandwich Islands, they may be said to be entirely masked by the effect of the land and sea breezes, and the diurnal variation of the pressure of the air: and a single feeble tide, at fixed hours in the day and night, occurs in place of the usual double rise and fall at hours continually varying. At Singapore, also at the Keeling Islands, and at Petropaulovski, similar phenomena occur due to local peculiarities. At Tonquin also (at Batschan) there is only a single tide; but this is explained by the interference of tides which reach it at the same time in different phases, and by different channels, combined with the "diurnal inequality" of the two high waters (a very generally observed phenomenon), which annihilates one of them, but leaves a portion of the other outstanding.

(79.) Wind-waves are small at their first origin, com-

mencing with a mere ripple, or, as the sailors term it, "a cat's paw," on the water—"darkening like water in the breeze." But each wavelet, as it advances, acquires increased height by the continued pressure of the wind, according to a law which has been clearly deduced from strict dynamical principles by Mr Airy, in a very remarkable paper on Tides and Waves, forming part of the *Encyclop. Metropol.* Hence it is that the larger waves are not developed in narrow seas, or when the wind blows off the land; they require breadth of water and continued pressure *a tergo*, for their formation. The greatest waves known are those off the Cape of Good Hope, under the influence of a north-west gale (the storm-wind of that region), which drifts the swell round the Cape, after traversing obliquely the vast area of the South Atlantic. In such gales, waves are there met with of forty feet in height, so that two ships in the trough of the sea, with such a wave between them, lose sight of one another from their decks. Off Cape Hoorn, also, waves of thirty-two feet from crest to trough have been observed. In our own seas the waves rarely exceed eight or nine feet in height.

(80.) There exists a relation between the breadth of a wave, its velocity of progress, and the depth of the water on which it travels, which has been embodied by Mr Airy in the following table:—

Depth of the Water in Feet.	Breadth of the Wave in Feet.							
	1.	10.	100.	1000.	10,000.	100,000.	1,000,000.	10,000,000
	Corresponding Velocity of Wave per Second in Feet.							
1	2·262	5·320	5·667	5·671	5·671	5·671	5·671	5·671
10	2·262	7·154	16·883	17·921	17·933	17·933	17·933	17·933
100	2·262	7·154	22·264	53·390	56 672	56 710	56·710	56·710
1000	2·262	Do.	22·264	71·543	168·83	179 21	179·33	179·33
10,000	2·262	Do.	Do.	71·543	226 24	533 90	566 72	567·10
100,000	2·262	Do.	Do.	Do.	226·24	715·43	1688·3	1793·3

The conclusion of Professor Bache respecting the depth of the Pacific, noticed in art. 40, is founded on this Table. And by a similar principle of calculation, grounded on the progress of the tide-wave (regarded as a free-wave) running up the Atlantic (art. 73), viz., that a wave 6000 geographical miles in breadth from crest to crest travels its own breadth in twelve hours, we find for the *mean* depth of the whole Atlantic from 50° south lat. to 50° N. 22,157 feet, a result perfectly in accordance with what we know from numerous soundings of its northern basin, and what may reasonably be concluded from the comparatively few obtained in its southern.

(81.) As the wind, supposed to blow off shore, continues to act on a wave, it increases both in length and breadth, and the water deepening, its velocity of progress increases rapidly. The depth of water to which the agitation of a wave extends perceptibly, never bears a very large proportion to the dimensions of the wave, either in breadth or height, the motion diminishing in geometrical progression, as the depth below the surface increases in arithmetical, and at a depth equal to the breadth of the wave, the motion is diminished to one 534th part of that at the surface. In the case of a wave, then, a quarter of a mile in breadth, and forty feet in height, the displacement of the water at a depth of 1320 feet, in its passage over it would be less than an inch, and would be incapable of disturbing the smallest grain of sand.

(82.) When waves cross each other, they are simply superposed, and in place of dividing the water into parallel ridges, they break it into lozenges. In this case, the motion of each particle of the surface-water, besides that of rising and falling, is one of circulation in a horizontal plane, and a small portion of the surface changes its inclination to the horizon in what is called a vorticose manner, a perpendicular to the surface (as the mast of a ship floating on it) revolving conically, by a combination of pitching and rolling distressing to the passengers, and trying to the vessel. This crossing of waves, especially when more than two series cross one another, forms what is called "a chopping sea." Such seas occur, 1*st*, when a series of waves, rolling into an extensive bay, meet, at oblique angles, the waves reflected from its shores, as is very frequently the case in the Bay of Biscay. 2*dly*, When the wind, after blowing long and fiercely in one direction, veers suddenly to another, which happens especially in those hurricanes called cyclones, or revolving gales, which produce waves travelling at once towards all points of the compass, the combination of which, near the centre of the whirlwind, produces a sea of the most fearful description. 3*dly*, When a storm in one direction acts on a sea in which there exists already a long rolling swell setting in from a great distance in another, called a "ground swell," the consequence of a far remote storm which has never made itself sensible in any other way at the place of the ship.

(83.) By far the largest waves, however, are those which owe their origin to earthquakes. On such occasions, great tracts of the ocean-bed are often suddenly uplifted or depressed, and the result is necessarily a vast wave running out from the spot in all directions. One such wave has already been mentioned. In the earthquake which destroyed Lisbon in 1755, a portion of the coast-line suddenly sank to a depth of 600 feet, and the result was a wave of 60 feet in height, which swept over the land, ravaged the whole coast of Portugal, and was propagated seaward quite across the Atlantic to the West Indies. At Madeira it rose and fell 12 feet.

(84.) When a wave runs forward into shoal water, the friction retards the movement of the lower particles, those of the upper continuing. The circle described by the water molecules gradually passes into a more and more flattened ellipse (Weber, *Wellenlehre*), and at length the wave *breaks:* its crest curls over, and precipitates itself forward on the shore, up which it rushes, the under-water at the same time racing back, and tearing up the beach in its backward course. Hence the abrading and destructive action of the surf on a sea-beach. Certain coasts are particularly infested with a heavy surf, such as that off Madras, where the surf habitually breaks at such a distance from the beach as to render landing always difficult and dangerous, and sometimes impossible. The great waves which roll in from the Indian Ocean sometimes break there in nine fathoms water, and at a distance of four miles from land.

(85.) The force of waves, when breaking against an

obstacle, is enormous. Their effective pressure during violent storms has been estimated as high as 6000 lbs. per square foot. The waves breaking against the base of the Eddystone lighthouse, have been known to dash up above its top to 150 feet above the sea-level, and descend like a cataract on its summit. In the great Barbadoes hurricane of 1780, cannon, which had been long lying sunk, were washed far up on shore, and found high and dry on the subsidence of the storm.

(86.) *Coral Formations, Atolls, Reefs, Lagunes.*—A very large area of the tropical seas, both in the Indian and Pacific Oceans, is dotted over with islands, the upper portions at least of which are the work of those singular organisms of the genera astræa, meandrina, and caryophyllia, which secrete from the sea-water the *nidus* which they inhabit in the form of continuous rocky masses, perforated according to regular patterns, and known by the name of coral. The animals themselves live and work only within certain very moderate limits of depth, not exceeding ninety fathoms; and whether those now living are to be considered as successors or prolongations (by a process of gemmation) of those which have perished *in situ*, does not seem well made out.

(87.) The coral formations are chiefly confined to the Indian and Pacific Oceans, between the parallels of 30° north and south. The Arabian and Persian Gulfs, and the Red Sea, are full of them, and between the coasts of Madagascar and Malabar, the whole ocean may be considered as a great coral sea. Along the east coast of Australia, and stretching thence to New Guinea, they form barrier reefs of the most dangerous character, which prevent all access to the coast, except through narrow channels occurring only at rare intervals. The "Great Barrier Reef" extends from Breaksea Spit, in lat. 24° 36′ S., to Bristow Island, 9° 15′ S., a mean breadth of 30 miles, a length of 1100, and an area of 33,000 square miles. But the most curious and striking peculiarity of the coral formations is their tendency to crown every summit rising up from deep water, and to form, upon sunken rocks, circular basins or lagunes, a *fleu de l'eau*, called Atolls, surrounded on every side with water of unfathomed depth, and shelving off in the most precipitous manner. Of these, the most remarkable instances in the Indian Ocean, is the chain of islands, or rather groups of islands, running directly south across the equator from the western extremity of the peninsula of India, the Laccadive, Maldive,[1] and Chagos Isles. These consist of "a series of circular assemblages of islands, the larger groups being 40 or 50 miles in their longest diameter. On the outside of each circle, or atoll, are coral reefs extending to a distance of two or three miles, beyond which are no soundings at immense depths. But in the centre of each is a lagune from 15 to 20 fathoms deep." It has been considered, with great probability, that these atolls crown the craters of extinct and submerged volcanos; and from the excessively sudden and precipitous manner in which many of them in the Pacific spring up from deep water, the lower portions being formed of *dead* coral (for the animal lives and works only at or near the surface), an argument almost irresistible has been drawn by Mr Darwin in favour of a slow but continual subsidence of the bottom of the ocean in which they occur, the animals constantly raising the summit to the surface as the base subsides. The upper portion of their work is battered by the sea, which heaps up the broken fragments on the windward side, leaving generally an opening into the lagune to leeward, and thus forming, as it were, harbours of refuge of great security, with free access at all times. This peculiarity has been insisted on by Sir C. Lyell as an additional and very cogent argument for their gradual subsidence, as it is difficult to imagine any other cause by which the leeward opening could constantly be kept unobstructed.

(88.) In the Pacific, the most remarkable coral formations are those of the Caroline Islands, a vast assemblage of coral groups, extending over more than 20° in longitude, and 5° in latitude, the Society Isles, and the so-called Dangerous Archipelago. Indeed, every island yet examined in the wide district termed Eastern Oceania, consists either of volcanic rocks, or coral limestones.

(89.) It is one of the peculiarities of these Zoophytes, that they always build perpendicularly upwards. This, while it serves to explain the precipitous character of the external wall of their lagunes, may serve, in conjunction with the great depth from which they rise, to give some idea of the duration of the period in which the subsidence of their foundation has been in progress—such steepness being of extreme rarity on coasts where no coral exists, and where the usual action of the sea, except on the hardest granite, invariably shoals the water into a more or less gradual declivity.

(90.) *Phenomena of the Polar Seas.—Floating Ice—Icebergs.*—Beyond the 56th parallels of latitude, as we have seen, the temperature of the water is lower at the surface, and rises as the thermometer descends, till the level of 39° is reached. The sea then, even in deep water, becomes frozen at the surface in the winter months, or rather through all that portion of the year which intervenes between the beginning of September and the latter end of June—July and August being, in high latitudes, the only open months. Sea-water freezes at a lower temperature than fresh ($28\frac{1}{2}$° Fahr.), but its ice, like that of fresh-water, floats, and nearly with the same buoyancy. It may, indeed, be doubted whether salt-water ice be really anything else than fresh, with a portion of concentrated brine entangled in its pores. Snow falling and floating on water of 28°, does not of course melt, so that the Polar Seas become coated with a stratum of perfectly fresh ice over very extensive tracts. The broken masses detached from the coasts, also, around which the ice accumulates in the long winters into cliffs and glaciers of vast height, and hundreds of miles in extent, and which, when set afloat, drift along as icebergs, by the effect of currents, are necessarily fresh. In estimating the magnitude of these masses, it must always be borne in mind that the specific gravity of ice being only 0·9, only about one-tenth of its bulk projects above the surface.

(91.) There can be very little doubt that, in the winter time, the surface of the ocean at both poles is entirely frozen; but at the North Pole, it is probable, from many indications, that open water exists over a very large area of the central polar basin, during a considerable portion of the warmer months. Although the northern coasts of Europe and Asia, from Nova Zembla to the extremity of Siberia, are always lined with ice, yet, in advancing out to sea-ward in sledges, from Kotelnoi Island and the mouth of the Kolyma River, in lat. N. 76° and 72°, Lieut. Anjou and Baron Wrangel found open ocean as far as the eye could reach; and the same has been observed by Inglefield and Kane (the latter viewing it from "Cape Constitution," 540 ft. in altitude), in lat. 81° 22′ N., in Kennedy Channel, at the north end of Smith's Sound. In the land-locked and intricate channels between Greenland and the north coast of America, the obstruction very frequently continues, however, during the whole summer, and even several successive ones, as the annals of Arctic exploration only too emphatically witness.

[1] See Moresby and Powell's beautiful charts of the Maldive Atolls.

(92.) When, under the influence of the advancing season, the "field-ice" of the general surface breaks, it becomes heaped together in sheets piled on each other into what is called an "ice-pack," showing in lines the thickness of the sheets, which often extends to 30 or 40 feet. The wild confusion which a storm creates in such a "pack," is more easily imagined than described. When extensive ice-fields meet, which they often do, under the influence of opposing winds and currents, their enormous momentum crushes together the edges in contact, breaks them up, and drives them one over the other into ridges. Occasionally these floating fields come into collision with icebergs, which are making their way under the influence of the current, by which (on account of the great depth and volume of the submerged portion) they are entirely commanded, while the "floes" drift at the mercy of the winds, when an awful scene of destruction takes place, the floes, of course, giving way, tearing up, and flying to pieces in all directions.

(93.) To give an idea of the quantity of ice which is carried out of the polar regions, independent of the icebergs, and drifted into warmer temperatures, we need only instance the case of the Resolute, exploring-ship, which, having been abandoned by reason of its getting inextricably engaged in a vast field of ice in Melville's Straits, was found afterwards in Baffin's Bay, having been carried 1000 miles from its former position by the drift of an ice-field 300,000 square miles in extent, and 7 feet thick. A similar occurrence carried Captain De Haven, of the U. S. Navy, in a mass of frozen sea-water an equal distance south of his position in the mid-channel of Wellington Straits.

(94.) Little of the *floe*, or surface-ice, however, escapes unmelted from Baffin's Bay: it is speedily broken up and destroyed by the waves in open water, and it is only the great detached masses which float to any considerable distance from either polar circle into the temperate zones. In the Atlantic they are seldom met with below 40° N. lat., being destroyed by encountering the Gulf Stream. In the North Pacific, their access from the Polar Basin being barred, they do not occur. In the Southern Ocean they attain as far as 40° S., and are very often met with in rounding the Cape of Good Hope, at some distance from land.

(95.) These bergs, from the mode of their formation, being detached by fracture from glaciers projecting into the sea, and from barrier lines of ice cliff, and being afterwards subjected to the melting influence of the air, assume the most uncouth and extraordinary forms, sometimes picturesque with towering pinnacles and overhanging cliffs, and always grand and awful. They have been seen as much as 600 feet in height, but when met with at sea are seldom more than 200 or 300. They spread a sensible degree of cold in the air, accompanied with fog, for great distances round them, and form one of the chief dangers in navigating the North Atlantic.

(96.) Many of the bergs which drift out to sea, having been the extremities of glaciers while in attachment to the coast, are loaded with broken fragments of rock and other materials, which have been heaped on them by casualties of weather, and the fall of rocks during their gradual descent to the sea level. These they carry with them wherever they may drift, and ultimately deposit at the bottom of the sea on melting. Icebergs have been encountered in the North Sea, covered or interstratified with ancient soil, among which were the bones of mammoths and other extinct animals.

(97. Around the south pole a sea, open (at least so far as land is concerned) or nearly open, extends all round it, except between the meridians of 160° and 170° E. longitude, and the parallels of 70° and 80° S. latitude, which is occupied by the coast of Victoria Land, discovered in 1841 by Sir J. C. Ross. From the southernmost accessible point of this coast, in lat. 78° 15′, extends for 450 miles to the eastward an unbroken vertical cliff of ice, being 180 feet above the water, and therefore about 1000 feet in thickness—floating in water 280 fathoms in depth (1680 feet), though probably connected to the south with an extension of Victoria Land. With exception of this, and some similar masses also connected with land, the Antarctic Sea is less unbrokenly coated with field ice than might be expected, the swell from the great oceans with which it is connected breaking the fields up into floes of no great magnitude. But, on the other hand, the "packed ice," which results from the fracture and piling up of the field ice, accumulates in immense quantities. Sir J. C. Ross, in the daring voyage of the Erebus and Terror, had to force his way through 1000 miles of such obstructions.

(98.) In consequence of the intense cold of the icy surface, contrasted, as it sometimes is in summer, with the warmth of the air, the phenomena of atmospheric refraction are exaggerated in these regions in a most extraordinary manner—the forms of icebergs, rocks, &c., are seen drawn up in vertical altitude, and spread out on their apparent summits laterally, so as to present no resemblance to their real form. One of the beneficial consequences of the great amount of refraction is the earlier appearance of the sun above the horizon, and its later disappearance, by which the dreary polar winters are shortened by several days.

(99.) Another phenomenon, which is witnessed in its highest perfection in the polar seas, and, in general, in high north and south latitudes, is the Aurora. The magnificence of its displays, as recorded by those who have witnessed them in the arctic regions, is such as those who have seen it only in our latitudes can hardly conceive. It is described as an immense curtain, waving its folds like the canopy of an ample tent agitated by the wind, and fringed with a border of light of the richest colours and vivid brilliancy. The impossibility of wintering in very high southern latitudes cuts off the most advantageous opportunities of observing auroral exhibitions.

(100.) THE LAND.—*Its Coast-lines, Harbours, Sea-cliffs, Beaches, Shingle-drifts, Tidal abrasion, Estuaries, Deltas.*—We have mentioned in arts. 12, 15, the more general features of the coast-lines of the great masses of land; but it is their minor local irregularities of outline which, in the magnitude and convenience of harbours, estuaries, and river mouths, accessible at all seasons, and the protection and facility of communication with the interior these afford, constitute a feature of the last importance to the well-being and commercial intercourse of the countries they border. In this respect there is a marked and vast difference between the several regions of the land, which has exercised, and must ever continue to exercise, a most powerful influence in determining the relative degree of civilization of nations, and, what is of greater importance, the more or less cosmopolitan character of that civilization. In this respect Europe, and the eastern coasts of North America, stand pre-eminent. It is true that the great Archipelago of the east affords innumerable and excellent positions of this nature; but their very multitude and disconnection fit them rather for nests of piracy, or for dependent emporia of commerce *in transitu*, than for the seats of great, compact, and united communities.

(101.) The capacity of any region of the globe for external communication may, to a certain degree, be very fairly estimated by a comparison of the extent of its coast-line with its superficial area. Europe, for instance, with an area

Physical Geography.

of 3,400,000 square statute miles, has 20,000 statute miles of coast-line, being at the average rate of a mile of coast for every 170 square miles of surface, and of which only about 3000 miles is of difficult access. Asia, with 17,600,000 square miles of surface, has 33,000 miles of coast (or one to 533), nearly a fourth part of which is arctic, and all but inaccessible. Africa, with 11,300,000 miles of surface, has a coast of 16,500 (1 to 420), singularly destitute, in every part of its outline, of good harbourage, and with some of its great rivers barred, and others pestiferous. On the other hand, the area of North America being 7,200,000 miles, has a coast-line (1 to 260), of 28,000, of which, however, nearly a third being arctic, is useless as a seabord. South America, with an area of 6,800,000 miles, and a coast-line of 16,500 (1 to 420), presents a remarkable contrast between its eastern and western coasts, not so much in respect of indentation by good harbours, of which it has little to boast, as on account of the vast rivers which flow into the Atlantic, and afford a power of penetrating into the interior, *ab extra*, unexampled except in North America and China. Our own islands, Ireland in particular, are more richly supplied in this respect than any other territory of equal extent, with exception of Norway, the whole coast of which is one continuous chain of deep indentations, or fiords, but whose rugged and precipitous character, and difficulty of accessibility on the land-side, owing to the rude and mountainous nature of the country, go far to neutralize this great natural advantage. The least-favoured region in this respect is Australia,—a mass of 3,500,000 square miles in area, but lying compactly within a very rounded general outline, having a coast but little indented, and nearly, in a very large portion of its eastern sea-bord, rendered unapproachable, except through particular channels, by the great barrier coral reef noticed in art. 87. Nevertheless, it possesses in Sydney perhaps the most perfect and magnificent harbour in the world, and one in which all its united navies might float in security.

(102.) One of the greatest advantages a harbour can possess is that of having, at some little distance off its opening, and in the direction from which tempestuous weather chiefly comes, an island to act as a natural breakwater, according to Virgil's description :—

> "Insula portum
> Efficit objectu laterum, quibus omnis ab alto
> Frangitur, inque sinus scindit sese unda reductos."

Such is the security and ready lateral accessibility on either side afforded to Portsmouth by the Isle of Wight, and to New York by Long Island. Table Bay owes what little security it may be considered to possess, in like manner, to the proximity of Robben Island. Where such natural breakwaters are wanting, or insufficient, artificial ones have often to be constructed, at vast expense, as at Plymouth and Cherbourg.

(103.) A sea-beach is a more or less gently sloping area, on which the breakers do their work of grinding to powder, and carrying out to sea, the fallen fragments of cliffs undermined by their action during high tides and storms, or precipitated by landslips. Such a slope, rising at a small angle (smaller in proportion to the fineness of the detritus of which it consists), surmounted usually by a somewhat steeper bank of shingle (loose stone not yet battered to powder), and backed to landward by a vertical or very precipitous escarpment, marking the limit so far attained by the encroaching ocean, and hollowed into caverns by its waves, is the almost invariable character of a coast line, except when (as in Norway, and on the west coast of Scotland) its material consists of the harder crystalline rocks, in which case there is often deep water close to the cliff, or rugged rocks in every stage of progressive destruction, forming a *talus* rising above the waves. It is therefore perfectly easy to recognize by these marks, when we find them in the interior of a country beyond the present reach of the waves, the existence of what was once a sea-beach, and thence to conclude the action, since that epoch, of elevating forces. Innumerable instances are met with in every part of the world of such ancient sea-beaches elevated at various heights above the actual sea-level—for example, at Plymouth, at New Quay, near Falmouth, in many parts of Wales and Scotland (as in the celebrated parallel roads of Glenroy, clearly shewn by Captain Hall to be ancient sea-beaches); from Alten Bay to Hammerfest in Finmark (Bravais), in the Val di Noto in Sicily (Lyell), in the Morea, as described by Boblaye, and still more remarkably in South America, in the valley of Lima, near Baños del Puyo (Cruickshank), 700 feet above the present sea, and at Coquimbo (Hall). Lately a succession of raised beaches, like a vast flight of 41 terraced steps, 480 feet in total height, has been described by Dr Kane as occurring along the coast of Kennedy Channel, separating Greenland from the land to westward, commencing at 76° N. lat., and continued to "the Great Glacier," and the north of Grinnell Land, or North Victoria. This, then, is one of many cases in which the study of what is actually going on educates the eye and the intellect to discern what has passed; and it is thus that we recognize, in the escarpment of our chalk formations, the cliffs bounding that sea which has denuded of its chalky covering the whole of our Wealden country, and conclude the continued levelling action of the ocean wherever we find a hilly country, cut down by such escarpments, abutting on an extent of comparatively level ground.

(104.) The material so pulverized and washed down into deep water is transported by the tide-current to great distances. In the peculiar nature of the tidal undulation described in arts. 69, 70, we perceive the great transporting and distributing agency by which new strata are formed from the destruction of old ones. But the full effect of this power is only to be appretiated when we contemplate the rounded forms of hills, and the branching and sinuous valleys of a very large portion of the surface of the land where the action of the existing rivers, or of any conceivable amount of atmospheric precipitation, is quite inadequate to have performed the work of excavation, and where there is no evidence of sudden and violent convulsion. Witness our own chalk downs, much of our Wealden swells and slopes, and the gentle undulations which everywhere cover the surface of the lower lands in all countries—

> "Qua se subducere colles
> Incipiunt, mollique jugum demittere clivo;"

and which can be referable to no other agency than tide-washing during a period of prolonged submersion in shallow seas. A large portion of the surface of France is one continued exemplification of this agency.

(105.) Loaded with the material so abraded, the tide-currents sweep along the coast a vast quantity of matter which they deposit in eddies, and thus alter the outlines of the coasts, silt up harbours, form sand-banks, shingle-drifts, land-spits, and other appendages to coast lines (of which we have examples in the great shingle-drift of Dungeness Point and the Chesil Bank), and are active in producing one of the greatest impediments to navigation in the form of bars at the mouths of rivers, of which notable instances occur in the Rangoon River, the Meinam, the Senegal River, the Quilimane or Zambesi, and the Canton River, where there are two bars, Port Natal, and most of the harbours on the South African coast. Such bars are chiefly formed where the opening of the river

to the sea is narrow, and not spread out into an estuary, which the tide tends rather to scour than to silt up.

(106.) Besides the material worn off from the coast by the action of the sea, a vast quantity is brought down by rivers, which accumulates at their mouths, forming deltas, the forms of which are greatly modified by tides and currents. The Ganges has been computed to deliver, on an average, into the sea annually 534,600,000 tons of solid matter; the Mississippi 292,700,000; and the Irawadi 102,500,000. No wonder, then, that in the course of ages deltas should accumulate. That of the Ganges extends across a space of 160 miles, and it has nearly the form of an equilateral triangle, considered as filling the area included by the Hooghly branch, and the innumerable smaller streams which cross like a net work over its surface. The delta of the Nile, like that of the Ganges, is formed in a fork of the river, about 90 geographical miles from the sea (though doubtless the sea, at some former period, occupied the whole space between the branches), and forms on the sea-bord a segment of a circle, having a chord of about 170 geographical miles, the outline being rounded off by the action of the currents, sweeping the drift to the eastward, and bordered with a chain of salt or brackish lakes, separated from the sea by narrow sand lines. That of the Rhine, or rather the united delta of the Rhine, Meuse, and Moselle, constitutes the whole of Holland, and offers, in its northern part, the same phenomenon of a rounded outline and chain of low drift banks (Texel, Vlieland, Schelling, and Ameland), enclosing a shallow expanse of water (the Zuyder Sea), the rivers entering the sea by innumerable outlets to the south. On the other hand, the deltas of the Mississippi and the Lena carry out the rivers to great distances, and form very projecting points; that of the Mississippi, in particular, which is singularly ramified, and in which the main channel prolongs itself, on land of its own formation, like the claw of some web-footed bird, far into the Gulf of Mexico, being increased by immense quantities of drifted trees, which meet together, and form a vast floating mass—the "Raft of Atchefalaya," which, in 1816, contained upwards of 250,000,000 cubic feet of timber, accumulated, in consequence of some local obstruction, in only 38 years, and has been increasing ever since.

(107.) THE LAND, *continued.—Law of Distribution of its Materials—Geological Relations.*—One of the first things which travel teaches us is, that the materials of which the earth consists are not scattered chaotically, and at random, over its surface. Particular sorts of earth and rock occur largely and almost exclusively over some districts, and are wanting in others, and it is the business of geological science to furnish a clue to the intricacies of their distribution, and to point out the relations which subsist between adjacent districts in respect of material composition, and the conditions which have determined the form and extent of each.

(108.) A very superficial observation of the escarpments of cliffs, and other features of a country which lay bare some considerable depth of the ground, suffices to shew that a very large portion of the earth's surface consists of successive layers or beds of different material, or of the same with marking lines of separation, or thin layers of others interposed, while other portions exhibit no such character. Hence a division into *stratified* and *unstratified.* If these layers were strictly horizontal, and of equal thickness, the slope of every hill, and the face of every cliff, would exhibit a series of horizontal belts, running level lines around their contour, and defining the extent over which each would form the surface soil; their superficial breadth being determined simply by the more or less gradual slope of the ground, and the thicknesses of the strata so intersected or "out-cropping." But this is found to be rarely the case; the strata are inclined to the horizon, and some more, some less so; and being intersected by or "out-cropping" at the surface, and that surface being an uneven one, the belts which they form on it neither follow level lines, nor are bounded by parallel outlines. It is therefore to the thickness, inclination, and *order*, if any, *of superposition of the strata*, that we have to look for a key to the extent, configuration, and order of arrangement, side by side, of mineralogical and agricultural districts.

(109.) So long as mineralogical characters only were referred to as distinctive of a "formation," it could never be positively asserted that any definite order of succession existed. The same kind of rock, a limestone for instance, might be found bordering in area, or superposed in level, on many different kinds of rock. But when the attention of geologists came to be directed to the fossil remains of animals and vegetables imbedded in them, it was found possible to assign to each formation characters so definite, drawn from these its fossil contents, as to admit of an unbroken order of succession being recognized, not in one county or district, but over the whole surface of the globe. It is this grand generalization which, worked out to its full extent by modern geologists (the hint being furnished by a countryman of our own, William Smith, with a long array of British names, many of them those of our contemporaries, standing pre-eminent in the list), has led to the full establishment of those magnificent views of the history of our globe which are embodied in our articles 9 and 10.

(110.) In traversing a country in a direction always perpendicular to the lines of demarcation of its geological districts, then, it is found, as a general fact, that we always come upon the strata in a determinate order of succession, which, taken in one direction, leads ultimately up to a district or mass of unstratified rock, through a series whose fossils differ more and more from the existing organisms; or, on the other, to one bearing evident marks of recent origin, the fossils it contains imbedded being the remains of organized beings now existing, and the material wanting in that solidity and cohesion which indicate age and pressure. The series of stratified rocks, then, *reposes on* the unstratified, and to this no exceptions are found (or extremely rare ones), except in cases where volcanic action has poured out liquid matter over or among the others, which has cooled into rocky masses.

(111.) Assuming the horizontal deposition of each stratum in its origin, inclination is in itself evidence of subsequent disturbance; and when we find, as a general rule, that the lower the stratum in the order of superposition, the greater the disturbance of this kind it has undergone, those in the immediate vicinity of the unstratified rocks being often vertical, much shattered and contorted, and even, in some few cases, actually overturned or doubled back, and that upon the broken edges of these, others have been deposited horizontally, and these again disturbed, though in a less degree; the conclusion is irresistible, that it is to the intrusion from below, and forcible upheaval, at successive intervals, with intervening periods of repose, of the unstratified masses, that the disturbance has been owing, and the whole series raised from the ocean bed, not merely to its present level, but to such a level as to admit of the upper portions of the upheaved strata being subsequently degraded and carried away, so as to leave the land as we now find it. Were it not for the evidence these facts of universal occurrence afford, and for the additional proofs afforded by the corroborative one, that in every case where a section can be observed or concluded on *both* sides of a central

mass of this kind, the strata succeed one another in the same order outward, and "dip" everywhere *from* the central line, we might hesitate to accept, so far as these rocks are concerned, the position of their upheaval. But when we come to look upon them, not, indeed, as the *prima mobilia*, but at least as the instruments, the levers and wedges with which the real *primum mobile*, the central heat, does its rough work on the crust of our globe, they lose their claim to this ideal permanence, and come to be considered as, in fact, *newer* than the rocks they penetrate and displace.

(112.) We must refer to our article on Geology, and to works especially treating of that subject, for an enumeration of the long series of strata interposed between the granitic and other unstratified rocks, and the last-deposited alluvium, as well as for an account of their characteristic fossils, in detail. There is probably no part of the world in which all, or even the major part of these strata, exist actually superposed. The series is for the most part broken by the absence of many of its members; necessarily so, indeed, since what was covered with water during one epoch, and therefore a receptacle for the deposit proper to it, became dry land during another, and therefore ceased to receive such as were then elsewhere in process of formation. But the order is never inverted. The beginning, middle, and end of each form of organic life can be traced, one form, indeed, overlapping another, but once extinct, never reappearing in the formations of a later epoch. By a singular felicity, which has influenced more than anything the progress of geology, the British Islands afford, condensed into a small compass, the nearest approach to a complete series of the strata which probably exists anywhere, and within their area (active volcanic agency excepted) there is hardly any form of geological upheaval and dislocation which is not exemplified, the Isle of Wight being especially remarkable as an instance.

(113.) Without going into detail, however, it will be advisable to give here a very brief summary of the principal *groups* into which geologists divide the strata, and their distribution. Here are—1*st*, The older Igneous formations, consisting of Granite and Granitoid rocks, such as Syenites, Porphyries, &c., in which no trace of any schistose or stratified structure is discernible. 2*d*, The Crystalline Schists or Metamorphic Rocks, such as Gneiss, Mica slate, Quartzite, Serpentine, &c., in which a tendency to cleavage, or to a fibrous structure, is for the most part perceptible—arising, as Professors Tyndall and Sorbey have rendered very probable, from pressure, prior to consolidation, giving parallel directions to particles of mica, and which cause has certainly produced the "slaty cleavage" in the true slates. These rocks contain no fossils, and, as Sir C. Lyell supposes, have been subjected to a heat so near to fusion, as to obliterate any vestiges of organic life they may have once contained. 3*d*, The Lower Palæozoic or Silurian system of Sir R. Murchison, in which the stratification is evident, and the earliest vestiges of life are found—mainly fishes, molluscs, and zoophytes. In these, too, and in the metamorphic rocks, the principal metallic deposits occur. 4*th*, The Upper Palæozoic, subdivided into the Devonian or Old Red Sandstone, the Carboniferous and Mountain Limestone, and the Permian or Magnesian Limestone, with the Lower New Red Sandstone. In this series fossils are abundant, and it derives immense importance from being the seat of the coal measures in every part of the world. 5*th*, The Mesozoic group, comprising the Lias and Oolites, the Muschelkalk and Keuper, the Jura Limestone, and the Chalk, comprehending, as their highest member (or the lowest of the next succeeding group, according to more recent authorities), the Nummulite Limestone. 6*th*, The Tertiary deposits, divided by Sir C. Lyell into Eocene, Meiocene, and Pleiocene, as indicating three stages of progress towards the now existing species of organized beings. 7*th*, The Alluvial and Boulder formation, consisting of modern detritus and erratic matter. 8*th, and lastly*, The Volcanic or Newer Igneous formations, trap, basalt, &c., which occur indifferently in every part of the series.

(114.) The proportions in which these several "formations" occupy the area of the existing land, is very different. The older igneous rocks, granite, syenite, &c., occupy but a comparatively small aliquot part of the whole surface, and in masses of little continuity, as might naturally be expected, when it is considered that it is only when actually thrust through the whole series, so as to tower above them all (as in some of the highest peaks of Mont Blanc), they would of themselves come into view, and that in all other cases they would only be laid bare by the destruction of the whole superincumbent series. In only a few districts in Europe are any extensive continuous granitic formations disclosed; such as in the north-west of Portugal and the south-west of Spain (if the whole of what is laid down as such in maps be really granite)—in the interval between the Bug and Dnieper (in Volhynia, Kiew, Podolia, and Cherson)—between Dresden and Görlitz—in the Grampian mountains in Scotland—the Lofoden Isles on the coast of Norway—in Corsica and Sardinia, &c. The southern chain of the Ural Mountains is also granitic; and across France, the district running south-west from St Malo and Ushant towards Avignon, the granite occurs in frequent masses, their line of direction, when continued, passing through Corsica and Sardinia. Indeed, there is hardly any extensive region of the globe in which, here and there, a granitic mass does not break forth. Along the east coast of Brazil there is a continuous granitic band from Rio to the mouth of the San Francisco River.

(115.) It is otherwise with the Metamorphic group, comprising the gneiss, mica slate, &c. These cover large and continuous districts, as, for instance, in Europe, nearly the whole extent of Sweden, Lapland, and Finland, except a narrow belt on the Baltic coast; almost the whole coast of Norway; nearly all the northern half of Scotland, from Perth northwards; nearly all the higher Alpine district of Switzerland and Tyrol, from Grenoble to Gratz; all the crest line of the Ural chain of mountains; probably the whole of Greenland, Labrador, and all the land north of Hudson's Bay; all the southern portion of Canada and the British North American possessions, up to the chain of lakes; and the Arctic sea-coast, as far as the Coppermine River; the whole of Russian America, as well as the eastern corner of Asia, as far as the river Kolyma. Proceeding southwards, we find nearly the whole of Tartary, a great part of China, the Malayan and much of the Cambodian peninsula; the southern part of the peninsulas of India and Arabia; nearly all that is known of Southern Africa, up to the Deserts, with exception of the Cape Colony; and in South America nearly all Brazil, Guiana, and a considerable portion of Venezuela, on the eastern side, and the chain of the Andes on the western, occupied with this most widely distributed and important formation, which, in effect, includes within its range almost all the highest mountains and most elevated country in the globe. Nearly two-thirds of the interior of Australia, also, would appear, so far as our information goes, to be occupied by it—so that at least one third of the total surface of the land consists of this formation.

(116.) The next formation in point of extent, as it is in order, is what has been termed the Transition Series, com-

prehending the whole of the Silurian, and the lower portion of the fourth or Upper Palæozoic group, as far as the carboniferous limestone. Its greatest development is in the northern portions of the continents, extending over the major part of European Russia up to the Ural, over the basins of the upper Irtisch and Yenesei, north of the Baikal Lake, together with the district occupied by the Stanovoi, Ourakantsha, and Altai Mountains, in which the Kolyma and Indigirka rivers take their rise. The comparatively small portion of Norway which is not occupied by metamorphic rocks is filled with these strata. In our own islands they have considerable development, as well as in Portugal. In North America, they divide, with the metamorphic rocks, the whole of that immense territory east of the Rocky Mountains, with exception of a comparatively small district west of the Missouri, while in South America they skirt the whole line of the Andes on the east side, spreading over Bolivia, and forming a belt bordering La Plata and Patagonia on the west, along their whole extent. In Australia, likewise, they occupy two such belts, parallel to one another, running along the whole east coast from the northern to the southern extremity.

(117.) The Secondary Formation, comprising the series from the Permian beds upwards, and including the chalk, viz. the Upper Sandstone, Lias, Oolite, Greensands Chalk, and Nummulite limestone, is very much more limited in its range. It is represented in England by the chalk-beds and other deposits in the south-east of the island, cut off by a line running from the mouth of the Tees to Exeter; on the eastern side by a broad belt of no great continuity, being often overlaid by the tertiary beds, but in which it is impossible not to trace a certain unity, continuing the east Anglican formation, in a direction from N.W. to S.E., over the whole of the south of Europe and the north of Africa, down to Egypt on the one hand, and over much of Asia Minor, through Arabia and Persia, into the Indian peninsula. Thence the belt (with larger interruptions) takes a northern direction, reappearing in Thibet, and again in China, in the districts of Setchuan and Hoo Quang. Again tending northwards, it reappears along the whole eastern coast of the Sea of Japan, and the western of that of Ochotzk, forming the sea-bord of the Kamschatkan peninsula. In the western continent it is much more sparingly represented, the states of Kansas and Nebraska being the only portion of North America occupied by it, while in South America it has as yet hardly been traced at all, with exception of a small district on the Orinoco River, at the northern extremity of that continent.

(118.) One of the most remarkable features of this vast formation (of its cretaceous members, that is to say), is the astonishing fact disclosed by microscopic examination, of its consisting almost entirely of the exuviæ of minute animalcules. In the Chalk, properly so called, they exist in such abundance, and of such minuteness, that millions have been reckoned to the cubic inch; and in the Nummulite limestone, so called from the shells of that name it imbeds, which forms nearly the whole of the south European and African portions of the formation (attaining, in some parts of its distribution, a thickness of many thousand feet) it consists entirely of minute foraminiferous shells, whole or in fragments; and it may be added, that the green and ferruginous sands which present themselves interposed between and underlying these deposits, have also been discovered by Ehrenberg to consist of *casts* of such shells, the shells themselves having disappeared. We have seen that in the North Atlantic, the process of the formation of such beds is still in progress, and from the bottom of the Gulf of Mexico, and the Gulf Stream, such casts, *together with* living specimens, have been brought up in sounding (Carpenter, *R. Inst. Proceedings*, March 12, 1858.)

(119.) We may here recall what has been stated respecting the extensive formations of calcareous submarine masses by the labours of the coral insect. Such facts would be utterly incredible but for what we know of the astonishing rapidity of multiplication of these minute forms of animal life. Dr Carpenter computes the progeny of a pair of aphides, if allowed to accumulate, at the end of one year, at a *trillion*. Granting the reproduction of marine animalcules to be *a thousand billion times less rapid* than that of aphides—granting that each of them, during its lifetime (supposed not interfered with, and food supplied), secreted only a ten-millionth part of a cubic inch of indestructible calcareous matter—we should find accumulated, in less than a quarter of a century, a globe of such material, whose diameter would exceed the distance travelled by light since the ordinarily received epoch of the creation (4004 B. C.), and the surface of the globe, supposed to continue increasing at the same rate, would then be swelling out into space a great many thousand times faster than the speed of light. There needs, then, only a residual immunity for a very small percentage of those produced to afford scope for the production of all the calcareous formations existing; and the same may be said of all those geological formations, such as the Polishing Slate of Bilin (40,000,000 to the cubic inch!), the Infusorial formations in Holland, &c., which microscopic examination has shewn to consist of infusorial and other exuviæ.

(120.) The Tertiary formations occupy a very large portion of the whole surface of the land. They are found (as the circumstances of their deposition necessitate) occupying the intervals and hollows of all the other formations, and that, too, occasionally at such considerable elevations above the actual sea-level, as suffice to shew the enormous period which must have elapsed since their deposition. Thus, in Chile we find them at 1500 feet, in the Isle of Ischia at an elevation of 2000 feet, and in the Niti Pass, in Thibet, at an elevation of no less than 17,000 feet. In England they are not largely developed, but on the continent they form a broad belt, extending all across Europe from the Baltic to the Black Sea, and including nearly the whole of Belgium, the Netherlands, Denmark, Hanover, Prussia, Poland, great part of Austria, including nearly the whole course of the lower Danube, the southern provinces of European Russia down to the Black Sea; thence entering Asia across the Sea of Azof, they occupy the whole of the Caucasian district between that sea and the Caspian, together with the depressed basin occupied by the latter and the Sea of Aral, and nearly the whole of Western Tartary. Thence sweeping upward to the north, they cover an immense area, extending to the Gulf of Obi in length, and in breadth from the Obi to the Yenesei, that is to say, nearly the whole of Western Siberia. Southward, the Great Desert of Northern Africa would seem to belong to these formations, as well as the bulk of Arabia, Persia, and Upper India; the deserts of Gobi and Shamo are also considered as being perhaps referable to the same geological district.

(121.) In the American continent the disposal of these strata is very remarkable. In the northern continent they form a broad belt, running west of the Rocky Mountains from the Polar Sea to the head of the Gulf of California; while in the southern they follow all the sinuosities of the coast line, in a band of from 300 to 600 miles in breadth, on the eastern side of the slope of the Andes, and separated from them by the secondary belt already mentioned. The central portions of Australia, too, are probably occupied by members of this series.

(122.) Taken together, then, the Metamorphic and Tertiary strata occupy the lion's share of all the existing continents, the intermediate formations having been, for the most part, denuded from the former, while they must be assumed still to exist underlying the latter, which, from all the phenomena of their occurrence, there is little reason to doubt have been formed of the immediate detritus of adjacent land during the countless ages which have been occupied in its upheaval.

(123.) The Volcanic or newer Igneous formations are distributed over the globe in a manner wonderfully indicative of the universality of those deep-seated causes which have produced them. They break through every other formation, not excepting the granite itself, as in the case of the Auvergne volcanoes, which, over a large district, divide the surface of the country with granite, every other formation being wanting, and whose scoriæ are found enveloping masses of feldspathic granite, torn up by them in the act of their ejection.

(124.) *Volcanoes* are either extinct or active, and either subaerial or submarine. In the former case they usually consist of cones of ashes and scoriæ (lava thrown up into the air, melted, and falling as stone in various broken and contorted forms), with a funnel-shaped depression called the crater, from which (frequently from a deep break in one part or other of the rim) lava streams have issued, coating the older layers of ashes, and binding the whole together as a mass, often intersected with dykes or vertical walls of lava. When lofty, the lava frequently breaks out laterally, and when such outbreaks are accompanied with ejections of scoriæ, lateral cones are formed, of which Vesuvius, and especially Etna, exhibit striking examples. Some volcanoes habitually pour forth torrents of lava during their eruptions, as Hecla, Vesuvius, Etna; others chiefly scoriæ and volcanic dust, as those of Sumatra, Java, &c.; others mud, as often happens in the eruptions of the South American volcanoes, and one (the double crater of Mowna Roa and Kirauia in Owyhee) offers the phenomenon of two perpetual seething cauldrons of liquid and red-hot lava, occasionally overflowing, but never ejected with violence. The lavas of modern volcanoes differ much in character, but are seldom or never columnar or basaltic.

(125.) Extinct volcanoes often exhibit every appearance of active ones, except their activity. In Auvergne, and the adjacent volcanic districts of France, we find cones (as that of Ayzac) which, but for the trees growing in the crater, might have been supposed in eruption not many years ago, pouring out lavas beautifully columnar; others, as the Puys of Clermont, with the craters more or less rounded off by weather, but still quite distinct, and the lava currents flooding the surrounding country; others, again, (as that of Agde), water-washed heaps of scoriæ. Over many vast tracts of country deluges of lava (as in the Vivarais, and Cantal, in France) have flowed, taking a perfectly level surface, like a sea, and, therefore, evidently from a subaërial source; in others (as in the valley of Fassa in Tyrol), vast subterranean upwellings of augitic lava of inky blackness have upheaved whole provinces of pure white limestone, and, by some process of sublimation, while splintering them into the most picturesque pinnacles, have, at the same time, impregnated them with magnesia, converting the limestone into dolomite. Others, again, have broken out, and still occasionally break out, as at Santorino, Pantellaria, Sabrina (Azores), beneath the sea, and have either, after a brief appearance, been washed over and obliterated, or remain as permanent insular craters, of which innumerable instances occur—Teneriffe, Mowna Roa, Jan Mayen's Island, the Peak of the Azores (El Pico), the Isle of Bourbon, &c.

(126.) The quantity of material ejected by volcanoes in eruption is sometimes very enormous. In those of Tomboro, in Sumbawa, in 1815, ashes and scoriæ were thrown out sufficient to form three mountains equal to Mont Blanc, or to cover the whole of Germany two feet deep. The lava which streamed, in 1783, from the Skaptar Jokul, in Iceland, has been computed on Sir C. Lyell's data (Geol. i. 375) at 21 cubic miles, a quantity equal in volume to the whole of the water poured by the Nile into the sea in a year.

(127.) The most striking features connected with the exhibition of active volcanoes, are 1st., *Their tendency to a linear arrangement when insular*. Of this, there are many very striking examples. Thus, in the Aleutian Islands, from the extremity of the Peninsula of Aliaska to the Island of Ostrova Semisopothnie, 23 active volcanoes lie almost precisely in a right line, 900 geographical miles in length. The disposition of eleven active vents, which, with many extinct ones, form the Kurile Islands, 600 geographical miles from the extremity of Kamschatka to Yesso, is also almost an exact right line, which might be prolonged 540 geographical miles northward, by taking in those of Kamschatka, which are obviously a continuation of them. Those of the Ladrone Islands, again, form a straight line, 420 geographical miles in length; and the linear arrangement of those of Java, Sumbawa, and Floris, over a length of 1080 geographical miles, is not less exact and characteristic. 2*dly*, *Their constant association with coast-lines*, which is so marked a character, that hardly more than one or two tolerably well authenticated instances have been produced (and those in regions never visited by European travellers) of volcanoes habitually active, occurring at a distance greater than 300 miles from the sea. These are the volcanoes of Peshan and Ho-tcheou, in the Thian Shan Mountains, which the Chinese annals (cited by Humboldt) describe as having been so within the period they embrace; and one on Lake Alakul, whose activity within the memory of man has been rendered very questionable by the recent explorations of Mr Atkinson (*Oriental and Western Siberia*, p. 562). Mount Demawend, in Persia, indeed, is considerably more remote from the ocean; but it is on the borders of the Caspian Sea, in the prolongation of the great Mediterranean fissure, and at the very extremity of a broad belt of volcanic activity, now for the most part extinct, which, commencing with Iceland, extends through Britain, France, Southern Europe, and Asia Minor, skirting the Mediterranean, the Euxine, and the Sea of Azof, which, there is every reason to believe, at no very remote period, to have been connected with the Caspian.

(128.) The number of volcanoes certainly known to have been in activity within the last 160 years amounts, according to Humboldt, to 225, and the total number of volcanic vents, extinct and active, to 407; but the real number is probably much greater. M. Junghuhn enumerates 19 volcanoes in Sumatra, and 45 in Java; and according to M. Laugel (*Rev. des Deux Mondes*, xiii. 353), there are no less than 900 in the vast archipelago extending round Borneo from the Nicobar Islands to the Philippines.

(129.) Besides volcanoes ejecting scoriæ and lava, there occur, sometimes separate, sometimes associated with the former class, mountains evidently of igneous origin, but of which the material (trachyte, domite, etc.) has apparently issued from the earth in so imperfect a state of fluidity as *not to run*, but to form rounded masses, sometimes of great height. The Puy de Sarcouy, in the

chain of volcanoes at Clermont, is a very characteristic specimen; and the Puy de Dôme itself consists of this material, and does not appear ever to have been, properly speaking, *in eruption.*

(130.) By far the greater number of volcanoes, and of the active ones an immense majority, occur upon the coast-line of the Pacific, regarded as prolonged by the chain of islands and the Australian coast down to Van Diemen's Land and New Zealand, and even to the active volcanoes of Mount Erebus, and the extinct one (?) of Mount Terror, in South Victoria. Thus viewed, indeed, the Pacific may be considered as bordered by an almost continuous line of recent and extinct volcanoes, and of igneous rocks, clearly owing their origin to volcanic action. Along the whole chain of the Andes, in Central America, and in Mexico, almost all the loftiest peaks are volcanic or trachytic, and the earthquake and eruption are normal, and not exceptional events. Along the north-west coast of the American continent, the chain of newer igneous formations is almost continuous, and in Oregon attains an immense development; nor are active volcanoes of great magnitude wanting, *but only those parts of the volcanic zone which lie upon the coast-line* contain such, viz., Mounts Regnier and St Helens, at the mouth of the Columbia river. The line is continued along the coast of Russian America by the Cerra de Buontempo, or Mount Fairweather (14,732 feet), Mount St Elias (17,850 feet), and Wrangel's Volcano (N. lat. 62°), in Russian America. From almost the extreme west point of the American continent, on the Aliaskan peninsula (which is igneous), the chain is continued to Kamschatka by the Aleutian Isles, where eruptions are frequent, and a new island rose in 1814, and thence, in almost unbroken succession, by the Kurile and Japanese Islands (where outbreaks are frequent, and of excessive violence) through Formosa and the Philippines down to the Indian Archipelago, where Sumatra, Java, Sumbawa, and Floris, exhibit a perfect rookery of volcanoes, the scene of one of the most dreadful eruptions of modern times (that of Tomboro above noticed).

(131.) The east coast of Australia offers no active volcano, but it is marked along its whole extent, from north to south, with evidences of former igneous activity, occurring (in striking resemblance with what prevails on the opposite coast in South America) among the crystalline and transition rocks which constitute the general seabord. But the subterranean fires would seem here to have shifted their ground, and taken up a new line of action to seaward, at an interval of from 1000 to 1200 geographical miles from the coast, but still conforming to its curvature, prolonging the series through the Solomon Islands, New Hebrides, and Friendly Isles, to New Zealand.

(132.) It seems impossible to disconnect this obviously systematic arrangement with the general evidence we have, from other sources, of the tendency to continued elevation of the coast line of the Andes, and, indeed, of the whole continent of South America, on the one hand, and of depression over a large portion of the bed of the Pacific, on the other—alterations which would naturally result from a change in the incidence of pressure on the general substratum of liquefied matter which supports the whole. The bed of an ocean supported on a yielding substratum may be depressed without a corresponding depression of its surface, by the simple laying on of material, whether abraded from the land or chemically abstracted from the sea itself. That matter *is* in process of abrasion and transportation from the land into the ocean at every instant, and along every coast line, we know as a matter of fact. We know, too, that all existing strata, however enormous their thickness, *have* been formed at the bottom of the sea, and it is therefore no hypothesis, but a perfectly legitimate assumption, that the same process is still in progress, no matter how slowly, from this cause, at least in the vicinity of coast lines; and when we look at the vast amount of organized exuviæ which constitute so large a portion of many of the secondary and tertiary beds—the secretions of mollusca, infusoria, and zoophytes—and bearing in mind the large proportion of continental substance which has been so formed, look to the evidence afforded by deep-sea soundings (42), and by coral formations (87), that the same process is going forward in open sea, far out of the reach of coast washing and river deposit (the material being *taken up chemically* by the river and coast waters, and *chemically extracted from them,* when diffused by currents, by the processes of organic life), we shall at once perceive that any amount of pressure on the one hand, and relief on the other, which the geologist can possibly require to work out his problem, and any law of distribution of that relief and that pressure, is available without calling in the aid of unknown causes.

(133.) Rocks of igneous origin border the west coast of Greenland: and the chain of the Ural, along its eastern side, offers evidence, in the intermixture of newer igneous with granitic and metamorphic rocks, of having been, at some very ancient period, a line of volcanic activity. The only other great systems of igneous rock, referable either to subaërial or submarine volcanoes, are those which occupy the Mysore country in the peninsula of Hindostan, and a great area in the centre of Africa, of which, however, our present information is extremely scanty.

(134.) "Craters of elevation" are supposed by Von Buch to have originated in a general swelling and upheaving of the strata, by the action of subterranean fire or expansive vapour, round a central point, either without, or antecedent to, actual eruption. In some cases the central portion is supposed to have fallen in, and to have subsequently become a habitual volcanic vent, as in the case of Teneriffe and Vesuvius, where the remains of the old crater or broken dome still exist, partially surrounding and inclosing the modern cone.

(135.) *Mean elevation of the Continents, Level Lines, Lines of greatest and least Declivity, Valleys and Ridges, Lakes, Drainage Basins.*—Barometrical observations, both stationary and itinerant, assisted of late by that very useful and portable form of the barometer called the aneroid, which can be read off in a carriage or on horseback, have been now so far extended over the whole accessible surface of the globe, as to afford ground for a reasonable conclusion respecting the average elevation of the surface of the land above the sea-level, and a very accurate one as to those of mountain chains and summits. The conclusion arrived at is not a little remarkable, and quite contradictory to former impressions. The mean height of the surface of the dry land most probably does not exceed one-fifteenth of the mean depth of the bed of the ocean. The following are given by Humboldt as the approximate heights of the centres of gravity of the continents above the sea level, viz., Europe 671 feet, Asia 1132, North America 748, South America 1151; from which it follows that the mean elevations of their *surfaces* (the doubles of these) are respectively 1342, 2264, 1496, and 2302 feet. Africa, from what we know of its interior, with the additional light lately thrown on it by Dr Livingstone, is probably intermediate between Europe and Asia, and its mean height may therefore be reckoned at 1800 feet, so that a general average of the whole would give about this last-named height for the mean height above the sea-level of the surface of the whole land. A rise of the ocean level, therefore, to this extent would submerge at least

three-fourths of the existing area of the land. It is remarkable for how moderate an item the great mountain masses of the world figure in the general result. The Alps, spread equally over the surface of Europe, would raise the general level no more than 21 feet (Humboldt); and the vast mountain chains of Asia, so treated, would afford a superstratum of only 150 feet thick over that continent (Ansted), the elevated desert of Gobi, 128, and the whole plateau of Thibet, with its flanking chains, 358.

(136.) If we suppose a series of level lines marking out elevations above the sea, rising progressively by steps of 100 feet, these of course would be the coast-lines of the land left outstanding were the sea to rise by such successive degrees; and if we suppose the same continued below the sea-level we should in like manner obtain the depressed coast-lines. Thus we should cover our chart of the world with a series of re-entering curves or ovals, more or less complicated, each summit and each cavity being surrounded by a series of its own—the one series expressing a mountain, the other a basin. Where the same level line makes a loop by crossing itself (at what may be termed a jugal point [*jugum*]), we have a *col* [*collum*] or mountain-pass, *across* which lies the lowest, shortest, and steepest course by which it is possible to pass out of one basin into another, or from one branch of a basin to another branch, and *along* which the shortest, highest, and least inclined path from summit to summit.

(137.) Two descriptions of lines intersect the level-lines of a country at right angles, viz., lines of watershed (wasser-scheide,[1] separation of the waters) or ridge-lines, and valleys or river-courses. The former, in proceeding downwards from a summit, intersect the level-lines at their convexities or greatest horizontal distances from the summit, and are, consequently, the paths of gentlest declivity, or the longest lines of descent from a higher to a lower level. The latter intersect them in their concavities, or least distances, and are the lines of greatest steepness or swiftest descent, and, of course, those chosen by streams whose erosive action is perpetually deepening them. Where the bottom of a basin lies above the sea-level, or, if lower, is separated from the sea by inclosing ridge lines, it becomes filled, wholly or in part, with water, and constitutes a lake, with or without an outlet. If wholly, the water finds a vent at the lowest jugal point or lip, and the lake becomes a feeder of a river, or in some cases of several, issuing by distinct outlets, as in the instance of the Lake of Yojoa in Honduras (Squier). In this case its supply exceeds its evaporation. In the contrary case, the area occupied by the water adjusts itself so as to effect an equilibrium between the evaporation and supply. The former case is that of infinitely the most common occurrence, and lakes thus fed from a number of upland sources, to which they serve as reservoirs, issue in rivers, or, if above the limit of perpetual snow, they become "neves" in glaciers. The latter case can never happen in moist climates, since, however large the basin, and however high the lip, it must at length become filled, and overflow; but in arid regions, especially in very elevated districts, in which the habitual siccity of the upper atmosphere (see METEOROLOGY, art. 88) comes in aid of otherwise favourable local circumstances, it is not uncommon, as, for instance, in the Lake of Titicaca, on the lofty plateau of the Desaguadero in Bolivia, upwards of 12,000 feet above the sea; in the Salt Lake of Utah, on the elevated region north of Mexico; in the Lakes Tchad, 'Ngami, and Nyassi, in Africa, &c. But the most remarkable instance of such a "continental basin," or one in which all the waters run inwards, terminating in inland seas and salt lakes (for, owing to the perpetual concentration of the drainage water by evaporation, such inland collections of water are of necessity more or less salt), is to be found in the great continental basin of Central Asia, an area of nearly 3,000,000 square miles, which includes the Caspian Sea, the Sea of Aral, and a vast multitude of inland rivers of all magnitudes which feed them, and innumerable other salt lakes, such as the Lakes Van and Urumiah in Armenia, the Lakes of Balkasch, Issikul (or Touz), Alakul, and Kezilbasch, in Turkistan, the Lake Lob or Loph in Upper Tartary, &c. &c. Of these, some are situated on elevated plateaus, but the Caspian and Aral Seas are situated in an extensive depression, an area of several hundred thousand square miles in extent, actually below the sea-level, the surface of the Caspian itself being 84 feet below the Black Sea.

(138.) A still more remarkable instance of depression below the sea-level, and consequent internal drainage, resulting in a lake of almost saturated brine (which is also the case with that of Utah), is that of the Dead Sea, in Palestine, fed by the River Jordan, the level of whose surface has been satisfactorily proved to be no less than 1312 feet below the Mediterranean, from which it is separated only by a narrow belt of land, occupied by the chain of Mount Lebanon, about fifty miles in breadth. There can be little doubt that the Jordan at some former period flowed into the Gulf of Akabah, in the Red Sea, and its course being depressed into a deeper valley, or the connexion cut off, by some geological change elevating the southern part of the valley, the sea-water continued to occupy this basin, which, when the gulf in question filled the valley, extended to the Lake of Tiberias, the surface of which being 983 feet above the Dead Sea, its salt water has been all washed down into the latter by the river flowing through it. Such a barrier once in existence, the increasing specific gravity of the water would counteract the effect of subterranean percolation from the Mediterranean (Fox). The waters of the Dead Sea have a specific gravity of 1·24 (Marcet), so that were a narrow channel of communication opened at a depth of about 7670 feet below the surface of the Mediterranean, the two seas would remain *in equilibrio* by equality of hydrostatic pressure.

(139.) In the upheaval of any extensive tract of land from the sea, hollows fitted for lake basins cannot fail to be left. If the upheaval be rude and paroxysmal, resulting in the formation of mountain chains, and accompanied with fracture and dislocation of the strata, such hollows will be deep, precipitous, and narrow in proportion to their length. Such is the general character of the lakes in mountainous regions—of the Swiss lakes, for instance, those of North Italy, of Cumberland, Westmoreland, and Scotland, &c. On the other hand, where the upheaving forces have acted more gently and gradually, and have raised the country with more uniformity, producing extensive plains and low steppes, lakes will not only be more numerous, by reason of the less erosive power of running water to drain them by deepening their outlets, but will affect more rounded forms, and cover the country with shallow pools or ponds void of all picturesque beauty, as we see exemplified in Poland, and in the districts between the Gulf of Finland and the White Sea, which are almost connected by a great chain of shallow lakes, some of them (as those of Onega and Ladoga) very extensive. Occasionally, too, lake basins come to be created by what may be called accidents, as by volcanic ejections barring the courses of rivers, as in the instance of the

[1] This word is used in a wrong sense in METEOROLOGY. Art. 93.

Lake of Aidat, near Clermont in France, produced in this manner by the lava of the Puy de la Vache damming the river Sioule.

(140). Every line of watershed continued downwards terminates either in a lake or in the sea, and always (of necessity) in a promontory, or more or less projecting tongue of land, or salient point of coast line. The area, bounded on the land side by one continuous line of watershed, and to the seaward by the sea itself, constitutes the drainage basin of whatever river flows into the sea between its extreme promontories.

(141.) The river courses and watershed lines then form a double system of allineations, the one branching out from the lowest cavities or pits, for the most part concealed below the sea; the other from the mountain summits. As the river branches can never be traced up beyond a certain degree of minuteness, nor the ridge lines below the sea level, these two systems have no common points, the fibres of one being always interposed between those of the other, so that, in the absence of one system of lines on a chart, it can always be approximately traced if the other be correctly mapped; and thus the limits of basins of drainage admit of being assigned, and the area of a country divided among its several rivers, the courses of rivers being generally much better laid down than the mountain system of a country. For a list of the superficial extent of the basins of the principal rivers of the world, according to the best authorities, as at present known, and the lengths of their main streams, see Appendix.

(142.) *General Distribution of Mountains.*—When we cast our eyes on a complete and well-executed set of charts of the mountain systems of the world, such for instance as those in the Physical Atlas of Mr Keith Johnston, it is impossible not to be struck with the contrast exhibited between those of the New and Old World. In the former, besides a general direction of the great mountain chains approximating to a meridional one, we find a continuity, unbroken except in a few small intervals in the narrow isthmus connecting the two Americas, of a vast and extremely precipitous line of very elevated mountains, running from the Arctic Ocean almost to the extremity of Patagonia, including 120° of latitude, or 7200 geographical miles (8280 statute miles), skirting along the western coast of that immense continent, closely following all its flexures in the southern half; and in the northern, opening out somewhat more, it is true, in breadth, and decreasing in average height, but still preserving the same general character of a lofty mountainous western border to a vast expanse of eastern lowlands. And throughout the whole extent of this border, we perceive a most distinct and unmistakeable tendency to a system of double or triple ridges nearly or exactly parallel, not here and there for short distances, but extending for hundreds of miles in succession, and resumed again and again when interrupted. In the Old World, on the other hand, we find no single well-defined continuous chain running throughout, much less following the coast line, but a broad belt of mountainous country traversing the whole mass of land in a general direction, nearly at right angles to the meridians, and carried through the heart of the continents, from the extremity of Europe and North Africa across to the western shores of the Pacific. In the European portion of this system, linear prolongation, except in the Pyrenees, is very far from distinctly indicated. On the contrary, divarication and embranchment are there the dominant features, as they are especially so in the north-eastern region of Asia; and it requires some determination in tracing connections, to follow out a leading line through the Pyrenees, the higher Alps, the Caucasus, and the mountains of Elbrouz, through the Hindu Koh, up to the great system of Asiatic mountains which enclose the plateau of Thibet. Neither is the principle of parallel association carried out with anything like the same precision and sequence in the old as in the new continent. Along the Caucasian and Elbrouz range, and as far as the termination of the Hindu Koh, this principle is pretty clearly maintained; but from the point in Little Thibet, where this last-mentioned system forks out into the two great chains of the Himalaya and the Kuen Lun, which enclose the table-land of Thibet Proper, a greater degree of interlacement and confusion prevails, and beyond the termination of these ranges in Assam and on the Chinese frontier, the mountain system of China and south-eastern Asia spreads out like an immense fan, in some of whose ranges a high degree of parallelism is preserved among contiguous members, while in others the branching character prevails quite as conspicuously.

(143.) *Mountain Systems of America.*—In describing more particularly the several partial systems of which these great subdivisions consist, we shall begin with the more simple—that of the New World. Commencing with the very extremity of the southern continent, or what may be considered its natural prolongation, the Terra del Fuego, we find already a most rugged country, with lofty peaks, and glaciers descending from them, one of which, "Mount Sarmiento," attains the elevation of 6900 feet. On the main land, though it can hardly be said that a continuous mountain chain borders the whole of Patagonia, we find lofty single peaks, such as "Mount Stokes" (6400 feet), a country generally mountainous, and an excessively rough and broken coast, full of fiords like those of Norway, of immense depth, fed by glaciers descending from the high lands above—the perpetual snow-line here descending as low as 3000 feet above the sea-level. This, however, does not prevent a great luxuriance of vegetation below that limit, the extreme humidity of the climate favouring the growth of forest trees, which clothe the mountains from the coast upwards. What may properly be called the Cordilleras, commence in latitude 47½°, about the Gulf of Penas, and extend thence close to the coast line to Mount Llebecan (latitude 41°-45°), including volcanic peaks such as Yanteles (8030 feet), Corcobado (7510), and Minchinmadava (8000), already entitled to be regarded as lofty mountains. At this point the broken coast line and its complicated insular barrier ceases with the Isle of Chiloe, or rather the same system of formation is continued on the main land by the addition of a bordering belt between the Andes and the sea, terminated in a granitic rocky barrier skirting the Chilian coast. Here the Patagonian Andes terminate, and the Chilian commence; and from this point we find, interposed between the cordillera and the sea, a slope of land continued up to the equator, nowhere exceeding 120 geographical miles in breadth from the coast to the actual ridge. Hence, too, the chain itself gains a great accession of height. Already at Valparaiso occurs the gigantic porphyritic peak of Aconcagua, the loftiest of the whole chain (23,910 feet); but the chain continues single (with a slight appearance of lateral parallels in the Sierra de Velasco, and the Pamatina ridge, at 75 and 100 geographical miles respectively distant eastward from the main chain) till it reaches the 20th parallel of S. lat., where the Chilian Andes terminate, and the Bolivian commence. Along their whole extent the former range attain and surpass the snow-line, which rises rather suddenly from 8000 feet at Valdivia, in lat. 40° S. to 12,780 at Valparaiso (33° N.), between which, about the parallel of Concepcion (36° 40′ S.), a corresponding change of climate from extreme moisture

to excessive dryness (a consequence of the change of prevalent winds), takes place, and furnishes a satisfactory explanation of the phenomenon.

(144.) About the 20th parallel, near a point marked by the lofty volcanoes of Gualatieri (21,960 feet), and Sahama (22,350), the chain which had so far followed a precise meridional direction, deflects to the N.W., still accompanying the coast line; but it is now flanked eastward by a great parallel chain, the Cordillera Real, commencing at Potosi, the highest city in the world (being 13,350 feet above the sea), and near which, at a level of 16,150 feet, is one of the richest silver mines known. These chains include between them the Plateau of Bolivia, a great table-land upwards of 130,000 square miles in extent, and 12,700 feet above the sea level, forming the internal drainage-basin of the Desaguadero, in which is placed the lake of Titicaca, already mentioned, and which is part and parcel of a considerably more extensive "continental basin," of which more hereafter. The chain of the Cordillera Real is also extremely lofty, and full of high peaks and ridges, among which the non-volcanic mountain of Illimani attains an elevation of 21,150, and that of Sorate 21,290 feet. It pursues its parallelism with the main chain (in which alone the great volcanoes and domelike trachytic igneous mountain-masses occur, and in which are the active volcanoes of Arequipas (20,320 feet), Uvinas (16,000) Viejo (20,500), and Chipicani (19,745), up to the knot of Pasco, a great ganglion, as it were, of the system, in lat. 10° 42′ S., and excessively rich in silver mines, from which point springs a third chain, preserving, like the other two, a strict parallelism with the coast line, from which it is distant 450 geographical miles, and running N.W. for about the same distance, the three being known as the eastern, central, and western Cordilleras of Peru.

(145.) From the termination of this triple arrangement to the equator, and somewhat beyond, the Cordillera is continued in a double line, or rather in a series of pairs of parallel ridges about thirty miles asunder, separated by cross ridges, and placed exactly conterminous; in the northern part of which are situated the great volcanoes of Chimborazo (21,424 feet), Cotopaxi (18,875), Antisana (19,137), Pichincha (15,924), and Tunguragua (16,424), a group unequalled in the world. These enclose the elevated valley of Quito, about 200 miles in length, with a mean elevation of 10,000 feet. The city itself is 9543 feet above the sea, and contains, or once did contain, 70,000 inhabitants.

(146.) The equator passes across the Nevada of Coyambé, a beautiful snow-clad cone, not volcanic (at least not active), of 19,535 feet in height, and immediately north of it, the phenomenon of a triple, and nearly parallel mountain-chain is resumed—those of the eastern, central, and western Cordilleras of Peru. In the *central* Cordillera occur the great volcanoes of Puracé (17,034 feet), and Tolima (18,020).

(147.) It deserves especial remark, that the most westerly of these chains does not continue as a lofty mountain-range into the isthmus of Panama, but dies out in a succession of low, nearly parallel ridges; while the eastern, deserting its parallelism, curves round, with a circular sweep, to the eastward, and forms the littoral chain of Venezuela, terminating in the peninsula of Paria, or prolonged into the Isle of Trinidad. The Sierra Nevada of Santa Marta, near Cape St Juan, on the Caribbean Sea, 19,000 feet in altitude, may be considered as an outlying prolongation of the middle chain. Whatever the forces which have elevated this vast mountain system, and however they may stand in connection with those which, probably at a much earlier period, have raised the chains north of the isthmus, there is evidently a breach of continuity, or at least a diversion of activity at this point.

(148.) The Andes, from their very commencement in Patagonia, slope rapidly, but not precipitously, to the eastward by a series of terraces consisting of secondary strata, which run out to no very great distance from the chains themselves, and terminate in the vast expanse of low country occupied by the tertiary formations, and by the alluvia marking the lower courses of the great South American rivers. The closed area or continental basin spoken of in art. 144, extends on the east side of the loftiest chain, from lat. 14° 10′ to 30° 40′ S., or about 1600 geographical miles in length, with an average breadth of 120 geographical miles, comprising an area of nearly 200,000 square geographical miles, and contains, besides the lake of Titicaca, several other smaller lakes, which are salt. This basin may be considered as occupying two distinct levels; the surface of Titicaca being more than 12,000 feet above the sea, while the southern portion of the basin (if indeed it be really such, which seems a little doubtful) has a much lower altitude.

(149.) The *mean* elevation of the South American Andes, according to Humboldt, is 11,830 feet, and the extent of surface covered by their bases is 531,000 square geographical miles. They present the extraordinary phenomenon of great communities of men, subsisting in wealth and comfort, at an elevation at which the inhabitant of the plains finds respiration difficult. Besides Quito, the city of Cuzco, on the outer and northern edge of the Bolivian plateau, at an elevation of 11,384 feet, and once the capital of the Incas, and the seat of an early and high degree of civilization, still contains 50,000 inhabitants; and the silver mines of Pasco, at an elevation little inferior to those of Potosi, attract into their neighbourhood a numerous and active population.

(150.) The narrow isthmus which connects the two continents, under the general appellation of Central America, preserves the character of precipitous descent to the sea on its west side, and is studded along the coast of the Pacific with volcanic mountains broken into groups, and intermixed with masses of disconnected table-land. The principal of these groups are those of Costa Rica, known as the groups of Uragua and Salamanca, succeeded by a great chain of volcanoes along the west coast of Honduras, Nicaragua, and Guatimala, among which are those of Agua, 15,000 feet in height, and Cosiguina, which, though less lofty, became in 1835 the focus of a frightful eruption, the ashes of which were carried even to Jamaica.

(151.) Entering upon the North American expansion of the isthmus, we find in Mexico a singular volcanic group extending almost precisely east and west, and from sea to sea, consisting of very elevated mountains, viz.—Colima (12,000 feet), Toluca (15,542), Popocatepetl (17,717), Iztacihuatl (15,705), Orizaba (17,374), and Tuxtla. With these the active volcanic series seems to terminate, and what may be called the regular mountain system of North America to commence. Indeed this line of volcanoes seems scarcely to belong to the coast chain, but to be of later origin, cutting, as it does, across its direction almost at a right angle, and finding its prolongation in the Antilles.

(152.) To understand the mountain system of North-Western America, we must conceive two coast lines similar to that which bounds the southern continent—an eastern and a western, the latter of posterior elevation to the former, and having between them the broad tertiary area noticed in art. 121. The former of these is marked out by a system of mountain chains, running generally northward, but converging towards a central knot or ganglion, about the 40th parallel of latitude, near

the sources of the Arkansas river, and at a point at present of some political interest, as affording almost the only practicable access from the east by rugged and difficult passes to the Mormonite settlement of Utah. These branches, of which the principal are the Cordillera of Cohahuela and San Luis de Potosi on the one side, and the Sierra Madre prolonged into the Sierra de S. Juan and the Sierra Verde on the other, enclose and sustain between them the high table-land of Mexico, from 6000 to 8000 feet above the sea (Mexico itself is 7482 feet), and on the eastern side slope down to the flat country by two great terraces of 4000 and 2500 feet average respective elevation, occupying the eastern portions of Texas and Kansas, a country of exceedingly sterile and uninviting character. From this knot or ganglion, marked by high elevations, lately become known as Long's Peak and Pike's Peak, and by the broken ranges of the Bow Medicine mountains, between and across which the direct railway route to California from the east may one day come to be traced, the main chain of the Rocky or Chippewyan Mountains is continued in a N. W. direction in a straight and almost unbroken course to the mouth of the Mackenzie River in the Arctic Ocean. It is generally lofty, and contains several very high peaks, such as Fremont's peak (13,568 feet), "Mount Hooker" (15,700), and "Mount Brown" (15,990) respectively, in altitude. Above the 45th parallel, however, the chain forks out and sends out a lower branch into the Columbian territory, which runs generally parallel to the main chain as far as 60° N., and between the 50th and 60th degrees is again accompanied by another parallel chain above 300 miles in length, which divides the interval between the coast line and the former chain almost equally. The distance between the eastern range of this great barrier of mountains and the Pacific varies from 300 geographical miles at its two extremities to 800, where it recedes farthest inland in 40° N., and encloses the basin of Utah.

(153.) The western coast-range commences northward with Mount St Elias (17,850 feet) in 60° N. lat., and Mount Fairweather (Cerra di Buon Tempo) (14,782), and follows the coast-line with as much fidelity as the southern Andes, never receding from it more than 150 geographical miles; and is continued under the name of the Cascade Mountains, and the Sierra Nevada, down to and along the whole Californian peninsula. In latitude 35° N., nearly opposite Point Concepcion, it sends off a branch northwards, running between the main chain and the coast mountains, about 450 miles in length, repeating strikingly the phenomenon of parallelism of which the Andes have afforded so many instances.

(154.) Between these two barriers lies a plateau of elevated land, comprising two remarkable districts—the Oregon territory, in which a vast development of volcanic activity appears, at some remote period, to have subsisted, and the great saline plateau, or inland basin of Utah, whose elevation is from 4000 to 5000 feet, and the waters of which, having no outlet, form a series of salt lakes, one of which, lying close to the settlement so called, is of considerable extent, and almost saturated with salt.

(155.) Neither the northern coasts of America nor the interior of the continent carry those outward and visible signs of violent and paroxysmal upheaval the western mountains suggest; nor do any extensive mountain ranges exist in the northern, except in the immediate vicinity of the eastern sea-bord, along the coasts of the United States. Here we find the St Lawrence delivered into the Atlantic along a wide valley skirted on the north by the Watshisch Mountains, a range of no great elevation, extending from the north-east extremity of Labrador to the Mistassin Lake, and terracing down by two subordinate parallel ranges to the valley, and on the south by the Nôtre Dame, the Green, the White, and the Adironbeck Mountains—a series of low interrupted parallel ranges of hills, among which are some which rise to the dignity of mountains, as Mount Washington (6428 feet), and Mount Katahdin (5360 feet) in Maine, which stands out apart from the general range. These hills are separated from the more important system of the Appalachian and Alleghany Mountains by the Valley of the Hudson River, which cuts across them, and which, doubtless, at some earlier period, extended up to the Gulf of St Lawrence, cutting off New England, New Brunswick, and Nova Scotia from the main-land.

(156.) On the southern side of the Hudson commence the mountain ranges of the Alleghanies, or the Appalachian system, a series of several closely parallel chains, much cut across by transverse valleys, affording outlets to numerous rivers, running through the states of Pennsylvania and Virginia, and dividing the Carolinas from Kentucky, running south as far as the 33d parallel of latitude, and forming a belt of about 120 geographical miles in breadth, and nearly 800 in length. The slope of these hills to the sea-bord comprise some of the finest districts, and the most fertile and diversified country in the United States. The ranges themselves have a mean elevation of 2556 feet, and in few places exceed 3000 or 4000 in height, and appear to have no central dominant axis of elevation, but to form an excellent exemplification of Mr Hopkins' views of the action of upheaving force, extending over an area much longer than its breadth, which he has shewn to have a tendency to produce parallel longitudinal fissures, cut across by others at right angles to them.

(157.) The Alleghany mountain system belongs chiefly to the older and newer Palæozoic, the Silurian, and Devonian groups of rocks, being flanked on both sides along its whole length by bands of the carboniferous series, which on the west expand into a vast territory full of coal measures, the source of immense present and future national prosperity. Further eastward, below the carboniferous limestone, crop out belts of metamorphic and crystalline formation, preserving a parallelism with the crests of the mountain ridge on the one hand, and with the general direction of the coast on the other.

(158.) The mountain systems of the east side of South America differ from those of the northern continent, in consisting almost entirely of metamorphic and crystalline rocks; and from that of the western coast in exhibiting little of that systematic tendency to parallel arrangement (except along the coast of Brazil) which is so conspicuous a feature of the latter. They form two distinct systems, that of Parimé and that of Brazil.

(159.) The mountain system of Parimé occupies an area from a little north of the equator to about 8½° N. latitude, and from the 50th to the 60th meridian of west longitude, comprising the whole district of Guiana between the mouths of the Amazon and Orinoco, and forming the watershed between the lower portions of the basins of other great rivers. It consists of a plateau of from 1500 to 2000 feet in height, of granite and crystalline rocks, and rises to a series of mountain chains variously directed; those known as the Sierras of Imaraca, Pacaraimo, and the long southern boundary of the district (Sierra de Acaray, Triputa, or Tamucarague), running nearly east and west, while the more westerly members of the group (the Parimé and Maigualida Sierras) affect a meridional direction. The whole system rises like an island (as no doubt at some earlier epoch it was) from a vast tertiary district, which completely surrounds it, being, however, very narrow on the coast side, but developed inland over an immense tract. There are

only two mountains in the whole formation which rise to any great elevation—that of Duida (7149 feet) at the western extremity, and Roraima (7450), near the centre of the district.

(160.) The Brazilian mountain system occupies a coast line of nearly 27° of latitude, from the most easterly projection of the continent nearly to the mouth of the La Plata, and extends its ramifications 1800 geographical miles inland, separating the waters of the Amazon River from those of the La Plata. The coast line for nearly the whole extent of this system is granitic, and a mountain barrier (under the names of the Sierras of Espinhaço, Pedade, Frios, Gran Mogol, Almas, Chapada, and Muribeca), consisting principally of crystalline rock other than granitic, upheaved by the protrusion of the latter, runs from Rio Janeiro in a north-east direction, at an interval of about 200 geographical miles from the coast, separating the coast rivers from the basin of the San Francisco River, which runs parallel to them till it escapes through a break between the Sierras Muribeca and Caryris, between which latter and the Atlantic run two other chains, preserving an exact parallelism with it. The line of mountains is continued, as the Sierra Vermelha, diverging somewhat from the sea line, to the north-east coast near the mouth of the Paranahyba River. The mountains of this principal barrier line are pretty lofty, attaining in the Peaks of Itambe 5960 feet (lat. 18° 40′ S.) and Itacolumi (5750 feet) (lat. 20° 25′ S.) (which gives its name to the mineral Itacolumite) and Itabira (5250 feet). The mountains of the Corcovado and the Organos, near Rio Janeiro, are remarkable for their picturesque beauty and the rich development of vegetable forms which adorn them, and indeed the whole of this region, and clothe their ridges to the summit.

(161.) The interior of this mountain district constitutes a plateau of vast extent, whose mean elevation is about 3200 feet. It is intersected with chains running in very various directions. The Cordillera Grande runs for 400 geographical miles from north to south, precisely along the 50th meridian, and that of the Montes Pyreneos for 150 exactly east and west. The diamond mines of Brazil are situated on the slopes of the Espinhaço range, and the ruby, topaz, and emerald are also the produce of the Brazilian mountains. Gold is washed down from the mountain by almost all the Brazilian rivers, but it is chiefly in the province of Minas Geraes that the richest gold deposits and the finest precious stones are found.

(162.) *European Mountains.*—The mountains of Europe have been divided into six principal groups, or systems—the British, the Iberian or Spanish, the Alpine, the Scandinavian, and the Sarmatian. The mean height of the surface of Europe, as we have seen, is 1342 feet, so that an elevation of the sea level of 1000 feet would submerge by far the larger portion of it. In fact, such an elevation would insulate Scandinavia, and cover at least two-thirds of France, the whole of Belgium, Holland, Denmark, North Germany, Prussia, and Poland, together with the whole of Russia, up to the Ural Mountains and down to the Black Sea, with exception of that small and insignificant group of low hills which, under the name of the Valdai, constitute the "Sarmatian System," and which suffice to afford a watershed line to the basins of the Dwina and Neva, which deliver their waters into the White Sea and the Gulf of Finland, and to determine the south-west course of those of the Dnieper and Volga.

(163.) The British system is no way remarkable for height, the highest summits in its several compartments being Ben Nevis in Inverness-shire, Scotland (4368 feet), and Ben Wyvis in Ross-shire, Cross Fell in Cumberland (3383), Snowdon in Wales (3557), and Curran, or Cairn Tual in Kerry, Ireland (3410). Only along the western coast-line in England and Wales is there any considerable tract attaining 1000 feet above the sea level, and scarcely any point of the eastern or midland counties reaches that elevation. The north-western part of Scotland beyond Loch Ness is, generally speaking, above that level; and the chain of the Grampians, which stretches across the country from N.E. to S.W., has numerous ridges from 2000 to 3500 feet in height. In Ireland there are but few points which exceed 1000 feet, and those, as in England, chiefly along the west coast.

(164.) The general direction of the Scotch mountains (which consist chiefly of crystalline rocks, with here and there, in the Grampians, true granite), as well as of the deep cleft of Loch Ness, which cuts across the country from sea to sea, and the exceedingly rectilinear character of this, and of the strike of the formations of the whole of Scotland, and especially of a great belt of trappean and basaltic formation which crosses it, from the Friths of Forth and Tay across the channel to Antrim in Ireland (where it is developed in the magnificent colonnades of the Giant's Causeway), is not among its least remarkable features. The rugged nature of the country affords, both in the west of Scotland and the north-western counties of England, lakes and other scenery of exquisite beauty. The same character of a general north-eastern strike of the geological formations, which is supplanted in the northern counties of England and in Wales by a meridional direction of the leading eminences, re-appears over its southern and eastern portions, as well as in the great contraction of breadth in the island between the estuaries of the Severn and the Welland.

(165.) *The Scandinavian* mountain system has the same general north-eastern direction. It consists mainly in a series of lofty and broad plateaus, intersected by deep valleys cutting them down to the sea, where they form a coast-line of excessively rugged character (art. 103). The chain extends along the whole western coast of Norway, from end to end, upwards of a thousand miles, under the names of Hard-angar, of the Langefield, the Dovrefield, or Doffrines, and the Kiolen Mountains; the highest summits of which are the Schneehutten (7520 feet), in lat. 62° N., and the Sulitelma (6200), in lat. 67° 20′ N. The greatest part of them rise above the limit of perpetual snow. A considerable portion of this range consists of silurian rocks.

(166.) The *Iberian Mountain System* consists of a great rectilinear barrier (the Pyrenees), of the Permian, Carboniferous, and Devonian strata, with some granitic masses (especially towards the eastern part of the chain), extending from the farthest western point of the peninsula (Cape Finisterre) to Cape Creux, the farthest east. It is very lofty—no less than 7970 feet in mean elevation, and has several peaks exceeding 10,000 feet in height, viz., the Malahite or Nethou (11,168 feet), Mont Perdu (10,994), the Cylinder of Malore (10,899), the Maladetta (10,886), and the Vignemale (10,820). Spain itself is generally high land, having a central plateau of nearly 2000 feet in elevation. Besides the Pyrenees, it has several other mountain chains—the granitic chain of the Sierra de Guadarama (prolonged into Portugal by the Sierra Gredos, which rises to a height of 10,552 feet, and the mountains of Gata, to the S. d'Estrella)—the Toledo chain, which culminates at Guadaloupe, and the Sierra Nevada, which skirts the south coast, and rises, in the peak of Mulhaçen, south-east of Granada, to the height of 11,664 feet.

(167.) The mountain system of North Africa belongs, obviously, to judge from its general parallel direction and elevation, to the Spanish group of the European formation. It consists of three subdivisions, the most extensive

and loftiest of which is the most southern, and runs generally parallel to the Mediterranean coast, at a distance of from 100 to 180 geographical miles, following the curvature of the Atlantic sea-bord outside the Straits of Gibraltar, through Morocco, where it rises to the height of 13,000 feet, or above the line of perpetual snow. This chain continues eastward to the Gulf of Cabes at the confines of Tripoli and Tunis, and would seem to be a continuation of the Apennines through Sicily. The middle range, or rather succession of terraced heights and table-lands, interspersed with mountains rising from the lesser or coast range to the interior and higher, comprises the best and most habitable part of North Africa, including Algeria, while the lesser, commencing opposite Gibraltar as an offset from the great chain, and rising there to a very considerable altitude, runs first inland, then returns to the coast about Oran, and continues along it as far as Tripoli.

(168.) The Alpine is the highest, most extensive, and most complex of the mountain systems of Europe. It connects itself with the Pyrenees, through the mountain districts of France west of the Rhone,—the Cevennes, the Puy, and the Vosges Mountains, a district generally elevated above 2000 feet, but rising to peaks of 6220 feet (Puy de Sancy), 6093 (Plomb du Cantal), and 4806 in the Puy de Dome, the mountain on which the decrease of barometric pressure was first observed by Pascal in the middle of the seventeenth century. This district, which consists in large measure of granite and crystalline rocks, is full of vestiges of most intense volcanic action, and presents, in the chain of the Puys near Clermont, in the Mont D'or and in Auvergne and the Vivarais, multitudes of cones of scoriæ and ashes apparently quite fresh, together with trachytic domes (Puy de Dome, Sarcouy, &c.), basaltic colonnades and plateaus of immense extent which occur in a country of most picturesque beauty, affording the most accessible and agreeable field for the study of volcanic phenomena which Europe affords. East of the Rhone the mountains become more elevated, and through the Dauphiné and Grenoble mountains, or, as they have been called, the Cottian Alps, connect themselves with the great system of the Pennine Alps, of which there are two principal distinct chains separated by the upper Rhone. The southern and loftier, or the Sardinian Alps, in which are Mont Blanc (15,744 feet), Monte Rosa (15,174), and Mont Cervin (14,836), and the northern or Bernese chain, the highest points of which are the Finsteraarhorn (14,026), and the Jungfrau (13,716). These unite in a central knot at St Gothard, from which, spreading eastward, extends a wilderness of lofty peaks and ridges through the Grisons and Tyrol to the Glockner on the eastern extremity of that province, from which point, as from another centre or ganglion, branches ramify in various directions, the chain of the Buch Alps extending north-eastward towards Vienna, and other chains proceeding east and south-east, and accompanying the coast line of the Adriatic, under the names of the Julian, Carnic, and Dinaric Alps, a range whose mean altitude may be reckoned at above 5000 feet, and which rises in Mount Kom to 9000, from which part off innumerable ramifications, covering the whole region south of the Danube to the utmost confines of Europe.

(169.) The system of the Eastern Alps (the Slavo-Hellenic system), however, mainly diverges from the Sharah Tagh (10,000 feet) in two directions. The Pindus chain running southward, traverses Macedonia, Albania, Thessaly, and Greece, down to the extremity of the Morea, and comprises in its course the most celebrated summits in classic lore, Olympus in Thessaly (9749 feet), and Parnassus (8068). The other, or Balkan chain, runs eastward along the forty-third parallel of latitude to the Black Sea, which it encounters near the Gulf of Bourgas and the promontory of Emineh Burun, consisting, in its highest range, of the rugged and almost impassable chain of the ancient Hæmus (8874), parallel to which, lying directly east and west in the latitude of Constantinople, is the ancient Rhodope (8313). The whole is rugged in the extremest degree, and the broken outline of Greece, full of deep bays and harbours, and admirably adapted for a maritime centre, as well as the multitude of islands in the Archipelago, with the sheltered coasts of Thessaly on one side, and of Asia Minor on the other, testify to the continuation of the mountain system in the same general direction beneath the sea level.

(170.) The great southern chain of the Pennine Alps descends with precipitous rapidity on the plains of Piedmont and Lombardy, around which the Cottian range, prolonged into the chain of Maritime Alps, skirting the Gulf of Lyons, makes a vast circular sweep, and, crossing over Italy nearly to its eastern coast, embraces in its circuit the basin of the Po, and runs down the whole length of the peninsula, as the chain of the Apennines, attaining at one point, Monte Corno, near Aquila, an altitude of 10,114 feet. Nor does it terminate with the Italian peninsula, but may be considered as prolonged into Sicily, running across the north of the island from east to west, and having for outliers the active volcanoes of Vesuvius, the Lipari Isles, and Etna. The ridge of the Apennines is of secondary limestone, and flanked on both sides, and largely interspersed, with tertiary strata, and along the west coast of Italy with volcanic rocks, both recent and ancient.

(171.) Of the Alps Proper, one of the most striking characters in contrast with other great chains, is the absence of elevated plateaus. Where the principal chains meet, instead of enclosing, as in similar circumstances in America and Central Asia, lofty districts, like Bolivia, Utah, and Thibet, we find quite the reverse—deep open valleys, giving to the whole system a decided out-branching character. In their eastern ramifications this feature is modified, and among the Balkan group we find elevated districts of considerable extent, from which the higher summits rise as from a vantage ground.

(172.) The base of the higher Alps is calculated by Humboldt to cover an area of 24,300 square geographical miles. The principal chain, that of the Sardinian Alps, consists almost entirely of gneiss, mica slate, serpentine, with here and there granite, and other rocks more or less allied to true granite; that of the Bernese Alps is for the most part of secondary limestones, oolites, &c., much disturbed and altered by heat. North of the higher ranges occur a broad zone of tertiary formation, and towards France the Jura limestone is so developed as to have received its name from the mountains in which it occurs. The Alps are considered by geologists to have gained an accession of nearly 4000 feet in height since the tertiary period.

(173.) The great plains of the north-east of Europe are separated in a very decided manner from the northern slope of the Alpine region, by the chains of the Hercynian and Carpathian Mountains, which form an oval basin (that of the upper Danube and the Theiss), including Bavaria, Austria Proper, Hungary, and Transylvania, and which connect themselves with the Balkan range by the North Balkan, a narrow passage only being left open at Orsova for the Danube. Some of the Carpathian Mountains are of considerable elevation, as the Lomnitz Point of Mount Tatra (8524) in the northern, and Pojano Ruska (9912) in the southern part of their chain. The Transylvanian system is remarkable for its mineral riches.

(174.) The great northern plain of the eastern continent is unbroken almost to the extremity of Siberia by any elevation worth mentioning, except the Ural chain, which marks the division of Europe and Asia, and which runs down in an exact meridional direction from the 70th to the 48th degree of north latitude, forming a rectilinear and nearly unbroken chain of 1300 geographical miles in length. Indeed, it may be considered as extending nearly 400 miles farther, to the extremity of Nova Zembla, making a considerable bend in its course at the arctic circle. It consists, along its western declivity, of the older palæozoic rocks, upraised by a line of metamorphic formation, along the whole length of which occur at intervals a series of newer igneous rocks, which would appear to have broken through at the time of upheaval, while yet forming a coast line, or chain of islands; at the southern end, for a considerable distance, granitic or other analogous rocks appear. Scarcely any mountain region is more rich in mineral productions, gold and platinum being richly produced in its central portions, and even diamonds in its southern. No part of this chain is very elevated. The Konstantinow Kamen (lat. 68° 30′) being 5000 feet, the Koniakofski Kamen (lat. 60°), 5397, and the Iremel (lat. 54° 20′) 5075 feet; nor does it exhibit any of those rugged and precipitous features which attend mountain chains in general. It would seem as if the upheaving force, whose general feebleness is manifested over the whole of this vast region, had barely been able along this line to overcome the superposed weight, and break out to day, but not to shatter rocks or throw up cones.

(175.) The transition from the great mountain masses to those of Asia, is through the elevated plateaus of Asia Minor and Armenia, and the mountain chains of the Caucasus and Elbrouz, beyond which, to the north, the level sinks at once to that of the lowlands of the great northern area. Asia Minor presents several considerable mountain chains, the principal of which are that of the Taurus, which runs along the southern coast, and rises, in Mount Argeus in Karamania, to 13,197 feet, and the Anti-Taurus, bordering the Euxine, which at one point (Argischtagh) attains 13,000. Asia Minor, moreover, offers the first striking instance in our progress eastward, of the general tendency to rise in elevated plateaus and table-lands, which distinguishes the medial zone of the great eastern continent. The mean elevation of the surface of the whole peninsula is not less than 3280 feet, with a central depression which, though not sufficient to form a basin (the country being intersected with many valleys affording an outlet), allows the collection of numerous lakes, many of which are salt, one of them at Tutzla of considerable size.

(176.) The plateau of Armenia is still more elevated (7000 feet). It occupies a belt extending across the neck of Asia Minor between the Caspian, the Caucasian range, the Euxine, and the Mediterranean. It has several very lofty eminences, among others, Ararat, an extinct volcano, 17,212 feet in height, the summit of which is always covered with snow. The Caucasian chain itself runs along the north-eastern coast of the Euxine and the southern shores of the Caspian. Its highest points are Mount Elbrouz, a volcano still showing some faint signs of activity, 18,493 feet, and Mount Kasbeck, 16,523, and the still, though torpidly, active volcano of Demawend, 14,695, not far from Teheran, the capital of the Persian empire.

(177.) We are now fairly entered upon that great succession of table-lands and elevated plateaus, which give a peculiar character to the eastern continent, and which, according to the opinions of the best geologists, existed as such anteriorly to the protrusion of the great mountain chains which run across them. The general direction of this series of elevated districts (which comprehends the whole of Arabia, Armenia, Persia, Afghanistan, Thibet, and Upper Tartary, as far as, and beyond the desert of Gobi into Mongolia), is from W.S.W. to E.N.E., while the general direction of the loftier mountain ranges, commencing with the Pyrenees and ending with the Himalayas, is from W.N.W. to E S.E., forming an angle of from 45° to 50° with the former—a very significant fact as regards the geological history of the continent, and one to which, it appears to us, sufficient attention has not been paid.

(178.) Arabia consists generally of very elevated land. Along the eastern and central parts, an elevation of 7000 or 8000 feet has been assigned to it; but this is perhaps exaggerated, no country being so difficult of access, and offering such obstacles to exact determination. Its general character is that of excessive aridity, and an all but complete absence of rivers, and, in the interior, of any running water whatever. Towards the southern coast it becomes somewhat lower, and a little less inhospitable. The Louskebir and Seger mountains, which skirt the south coast, range from 3000 to 5000 feet in height, and are rather to be regarded as the termination of the interior plateau than as chains *per se*. At the south-east corner in Yemen, they retreat a little, and leave some room for cultivation; and for the course of one of the only two streams which can be called a river, in the whole of this vast country, whose general area is not less than 720,000 square geographical miles. The east coast, from Aden to Medina, along the Red Sea, is skirted, at a distance of 100 or 150 miles, by an almost continuous range of mountains, which extend as far as Medina, from whence to the Gulf Akabah the coast-line is low, and admits of the passage of the caravans to Medinah and Mecca; but the mountainous character recommences at this point with Mount Sinai (7498), Horeb (8593), and Um Shomah (9300), granitic and slaty masses, intersected with basaltic dykes, and plunging down like huge towers and buttressed fortresses on the narrow plains or "wadies," which form the only habitable portion of the country. Arabia is crossed from the Red Sea to the Persian Gulf (from Mecca to Lahsa, celebrated for the pearl fisheries of Bahrein) by a mountain axis, along which lies one of the few lines of route by which the desert can be crossed, and from which a small river (the only other Arabia can boast) descends to the Gulf of Lahsa. The plateau of Arabia may be regarded as continued across the Red Sea (which runs up it as a deep but narrow rectilinear cleft about 150 miles in breadth, and 1300 in length, from Aden to Suez), into Africa, to form the lofty table-land of Abyssinia and Upper Ethiopia, where M. d'Abbadie has ascertained the existence of mountains 14,000 to 16,000 feet in height.

(179.) The plateau of Iran, which comprises about 350,000 square geographical miles, is also very elevated, though less so than Arabia. Its mean height may be stated at about 3000 feet, and, like Arabia, its interior is almost entirely destitute of rivers, and parched and desolate to an extreme degree. The line of the Zagros mountains, which forms the watershed of the Euphrates on its east bank, continues along the Persian Gulf into Beluchistan, and nearly to the Indus. It consists of a series of bordering ridges running parallel to, and separating the narrow sea-bord of that gulf from an immense inland or closed basin, to be more particularly described hereafter, and of whose entire extent the whole of this region forms but a very small fraction. On its northern limit, the Persian plateau runs up to the range of mountains bordering the South Caspian, which may be considered as prolonging the Caucasian range through Mazanderan and Khorasan to the lofty chain of the Hindu

Kho, or Koosh; being, however, rather a mural limit to the extension of the table-land in that direction, than an independent mountain chain. Its junction with the much more lofty and continuous chain of the Hindu Kho is at Herat, which stands as it were in the Gate of India, from whence to Kuttore, at the eastern corner of Little Thibet, the incipient chain of the Kuen Lun to the north (of which the mountains in question may be considered a prolongation), and the terminal outlying eminences of the Hindu Kho on the south, run parallel for nearly 500 miles. The entrance to India from Herat, however, lies to the south of both these ranges, through Upper Afghanistan by the pass of Cabul, immediately adjacent to the lofty peak (20,232 feet) of the Hindu Kho, the mountain which gives its name to the whole chain, and between this and the Sufieh Koh, the road lies along the Khyber Pass (of disastrous memory) to Peshawur, on the Upper Indus.

(180.) At Kuttore, about lat. 36° 40′ N., long. 72° 40′ E., the chain of the Kuen Lun, considered as prolonged westward in that of the Hindu Kho, and the Himalaya range, considered as prolonged in the arc of a vast circle north-westward into the Bolor Mountains, cross each other; and from hence up to the Lakes Rewan, or R'akas, and Manasarowar, at the eastern extremity of Thibet Proper, in which the Sutlej and the Ganges have their highest recognized sources, these two great chains interlace and ramify in a vast ganglion of mountain masses of the first magnitude. In the eastern corner of this knot we find the elevated valley of Cashmir, an almost closed basin of an oval form, surrounded on all sides by the loftiest mountains, and 5800 feet above the sea, and in the interval the chain of the Himalaya rises to the altitude of 25,669 feet in the peak of Jumnotri, and 25,749 in that of Nanda-devi, the mean altitude being from 18,000 to 20,000 feet. These peaks, as is the case with most of the loftiest summits of the Himalaya, stand out at some distance southward from the main ridge, with which they are connected by long spurs. Pursuing thence the line of this chain along the province of Nepaul, where it skirts the districts of Kemaon, Sikkim, and Bhotan up to Assam (a total length from Kuttore of not less than 1300 geographical miles), it comprises within its range a most astonishing series of lofty and snow-clad pinnacles. At least 40 peaks exceeding Chimborazo in altitude are enumerated in its course; among which we may name Dwalagiri (27,600 feet), long supposed the highest mountain in the world, which stands out from the general chain where the valley of the Gunduc River intersects it about the 83d meridian, but whose supremacy has been supplanted by two other summits at least, viz., Kinchinjunga (88° 30′ E.), which overhangs the Lacheh pass into Thibet (28,178 feet), and Gahurishanka, Chingopamari, or Deodunga (at present considered as the culminating summit of the world), in long. 86° E. (29,002 feet.)

(181.) The Himalaya and Kuen Lun ranges afford a parallel on a much vaster scale to the phenomenon exhibited by the great mountain ranges both of North and South America. From their point of intersection at Kuttore to the 93d meridian, they open out into an oval expanse, about 500 or 550 geographical miles across, which is occupied by the plateau of Thibet, the loftiest inhabited region in the world, having, in its western or lowest portion—that occupied by the district of Ladak—an average elevation of 12,000 feet, and in its eastern, or highest portion, 17,000. Fifteen thousand feet may be taken as the average height of this wonderful plateau, which serves as a base for a mountain system of its own, and which extends over 166,000 square geographical miles. On either side of it the mountains sink rapidly—to the north into the inferior but still elevated plateau of Upper Tartary; and to the south, by three gradations of inferior mountain ranges, running parallel to, and serving as terraced bases to the great central masses. The first descent is exceedingly abrupt, so much so, that in Bhotan, the change of level is upwards of 10,000 feet in ten miles, being, in fact, in many places almost a mural precipice. The substratum of the Thibetian plateau consists of secondary formations, but much of the surface is composed of quite modern detritus, in which are found the fossil remains of elephants, rhinoceroses, and other animals of the latest tertiary epoch. In the pass of Niti, too, by which the sacred lakes of Mansowarowar and Rewan are approached, the occurrence of tertiary beds, already noticed in art. 120, proves the astonishing fact that this enormous plateau has actually been raised from the sea-level to its present elevation subsequently to the deposition of the newest of the great geological groups of strata. That it has been thrust up bodily through the general mass of the continent is equally clear — the detritus lying in horizontal beds, and the remnant of the formation thus marvellously preserved existing here alone, where the lofty ridges surrounding it on all sides, and the extreme dryness of its new climate (a consequence of its great elevation), have preserved it intact from the causes of denudation that have acted on all the surrounding masses, and swept away from the south side of the Himalaya all but the older strata. With this exception, and with that of a considerable mass of volcanic formation in the neighbourhood of the sacred lakes, the highest portions of the Himalayas consist of granite, gneiss, and metamorphic rocks, and their southern flanks of fossiliferous limestones, and other members of the older and newer Palæozoic series—among which the Siwalik Hills are remarkable as having furnished specimens of that extraordinary fossil, the Sivatherium, or four-horned camel, discovered by Captain Cautley.

(182.) The chain of the Himalayas terminates rather abruptly about the 94th meridian east, where it is cut through by the Brahmaputra River and its tributaries, unless we prefer to consider it as continued somewhat further eastward by the parallel chains of the Assam and Khasyah mountains, on the opposite side of the valley of the last-named river, at about 120 miles to the south; after which a system of mountain-lines, following nearly a meridional direction, stretches into Arracan and the Malayan and Cambodian peninsulas, directing their rivers in nearly parallel courses southwards. The chain itself, for the last 330 geographical miles of its extent (from Darjeeling eastward), follows very nearly indeed the 28th parallel of latitude. It is by no means correct, however, to consider, as is usually done, the whole chain as, "generally speaking, parallel to the equator:" its whole previous course of 960 miles from the knot of Bolor, making an angle of 30° with that direction, from N.W. to S.E.

(183.) The line of the Assam and Khasya mountains, if prolonged across the valley of the Ganges, would find its continuation in the Rhamghur, Khymore, and Vindhya mountains, a range which separates Hindostan proper from the plateau of Malwa and Upper India; and it deserves remark that, so prolonged, the line runs a precise parallel to the Thian-shan, and nearly so to the eastern line of the Himalaya and the Tengri-nor range in Thibet. These mountains form the northern watershed of the valley of the Nerbudda, as the Satpore range does the southern, up to the Gulf of Cambay. The peninsula of Hindostan itself is a great triangular table-land, or congeries of such, with intermediate low levels, bounded or sustained by these mountain-ranges on the northern side, and by the Eastern and Western Ghauts on the others. Of these, the western forms an almost continuous wall,

upwards of 600 miles long, rising, towards its southern extremity, to an elevation of 4700 feet. They support, as by a series of steep and mural buttresses, the plateaus of the Deccan, 1500 or 2000 feet high, and the still loftier table-land of Mysore (4000-5000 feet), the granite nucleus of which has been deluged with an enormous flood of basaltic lava. In this district are situate the diamond mines of Golconda, where this precious mineral is found in iron-stone, and disintegrated clayey and marly strata. Towards the southern termination of the peninsula, the mountains become loftier. The Nilgheri hills (enjoying the most uniform and perfect climate on earth) rise to 8760 feet above the sea, and form a group in which, in a space of 40 miles long by 15 broad, 17 peaks, between 5800 and 8800 feet high, are enumerated. The Eastern Ghauts are lower and less continuous, and the general level of the peninsula slopes downwards towards the eastern coast.

(184.) The Kuen-lun system of mountains is but imperfectly known, being very difficult of access from either side. It would appear to be prolonged far into China by the Pe-ling and Tapa-ling ranges; and, so prolonged, would present the imposing fact of a mountain-range extending over 64° of longitude from the Caspian nearly to the Pacific (3350 geographical miles), and nowhere deviating more than 2° in latitude from the parallel of 35½°. But in addition to this, it sends out a great branch to the N.E., which, under the names of Yn Shan and Kingan Oulah, prolongs the system into and over Mantchouria, up to the Sea of Japan and the mouth of the Amur.

(185.) The Asiatic chain next in extent and importance, is that of the Tengri or Thian Shan (Celestial Mountains), between which and the Kuen-Lun chain intervene the immense, high, and desolate plateau of Upper Tartary, and the sandy and rainless deserts of Gobi and Shamo, divided from each other by a deep depression, occupying together 380,000 geographical square miles in area, at a mean elevation, the former of 3000, the latter of 4300 feet of altitude. This chain is in many respects extremely remarkable; and although less elevated, is quite as leading a feature in a geological and geographical point of view as the Himalayas. In direction it is almost exactly rectilinear, and 1150 geographical miles in length, from the 72d east meridian, where it intersects the Bolor range, running north and south, to the 97th, and between the parallels of 41° and 43° N. lat. It may be considered, indeed, as continued west of the Bolor by the lower chains of Asferagh and Ak-tagh to the 66th meridian. And this can hardly be considered as a mere ideal extension, when taken in connection with geological relations, for it points directly towards the southern extremity of the Caspian, and but for the intervening flat and desert region of Kharesm, might be looked upon as a branch of the volcanic chain of Elbrouz. And, in fact, the most marking feature it offers is the frequency in it of volcanic vents, mostly extinct, but two of which, Pe-shan and Ho-tscheou (art. 127), may perhaps be still occasionally active. These mark it out to have been one of the ancient coast-lines of elevation (an indication, on the great scale, quite as convincing as the traces of ancient sea-beaches on a small one) of a former tropical continent, to which the great plains of North Asia and North Europe form the same kind of appendage as the flat eastern portions of America do to the western coast-chain—a formation, that is to say, out of the detritus of the elevated region washed outwards into what was then a great and shallow northern ocean, and which, up to the present era, is in continual process of extension —along the coasts of Arctic Asia by the action of river deposit, and along those of north-western Europe by the more active agency of upheaving forces, the effects of which are traceable, from century to century, by the bodily uprise of the coast-line of Scandinavia, and which, in the lapse of some twenty or thirty thousand years (a period, geologically speaking, trifling), will, if continued, obliterate the Baltic.

(186.) The Altai mountain system covers an area of about 35° of longitude and 8° of latitude, between the 46th and 54th parallels. They separate the Dzungharian and Mongolian plateaus (of no great elevation) from the low country of North-East Siberia. They consist of a series of ranges (the Ala-Tagh, Tangnou, Kianghan, and Tschokindo mountains, which last, with the mountain knot of Kentei Khan, attain an elevation of 7000 or 8000 feet, and inclose the Lake Baikal, and the sources of the Great Russian rivers, the Lena, the Yenesi, and the Obi. In the Tangnou are many eminences which rise above the limit of perpetual snow, and some near the head of the Oubsa river, above 11,000 feet. These mountains are extremely rich in mineral productions; and, to judge from the beautifully-executed drawings of Mr Atkinson (*Western and Oriental Siberia*), it would seem scarcely possible for any region to surpass the whole of this mountain district in picturesque beauty. Around the Baikal Lake granitic masses abound, interspersed with newer igneous formations, and Mr Atkinson reports an extinct crater near the Lake Karanur in the Tangnou, with a cone of ashes 800 feet in height (lat. 53° N., long. 97° E.) From the Baikal the mountain system is continued northward and eastward, through the Daurian mountains, in a series of branches under various names, as the Yablonoi, Udskoi, Aldan, and Stanovoi mountain ranges (or Krebets), up to the furthest extremity of the Sea of Ochotsk, and terminating in the volcanic system of Kamschatka, where there are several active vents, an eruption of one of which (that of Klieutschewsk, lat. 56° 33′, long. 160° 20′), 15,955 feet in height, in September 1829, Erman was fortunate enough to witness. (*Reise um die Erde*, iii. chap. 19.)

(187.) *African Mountains.*—Of the mountain systems of Africa our knowledge is very imperfect. The Atlas system and that of Abyssinia have already been noticed. The southern termination of the continent is formed of tabular sandstone masses, from 3806 feet (height of the Table Mountain) to 6000 or 7000, reposing on slate and granite, dykes of which latter run up into the superposed rock. The granitic formation, which, in many places, is thus capped with sandstone, is very extensively developed in South Africa. In the Kamies Berg it rises to 5100 feet in height, and the whole plateau of the Bushman flat, with a general elevation of from 2000 to 3600 feet, is granitic. The sandstone (which incloses rolled pebbles of pure quartz) is disposed in perfectly horizontal strata, proving the elevation of the land to have been performed with little of paroxysmal disturbance. From the rounded forms of the lower eminences, and the wide, sloping taluses, contrasted with the mural cliffs above in the loftier ones, from a definite level uniform over large tracts of country, we may consider this elevation to have been performed in two steps, with a long interval of tidal washing in a shallow sea between them. The Quotlambi or Snowy Mountains, a range rising to the altitude of 10,000 feet, run along the east coast northwards toward the Zambesi river, explored by Dr Livingstone, being prolonged in that direction under the names of the Fura Mountains, while the chains of the Beth and Lupata, 8000 or 10,000 feet in altitude, follow the coast of Zanzibar, and a loftier and more central chain (the Sierra Maxengo) runs north from the 16th parallel of south latitude, supposed to rise to 17,000 feet in its highest part. This divides into two branches, which enclose between them (as it is

supposed, from the reports of natives to M. Ehrardt, rather than any actual exploration) a great interior lake, Nyassi or Uniamesi, equal to the Caspian in size, of fresh water, beyond which they reunite and form a system of equatorial mountains covered with perpetual snow, two of which, Kilimanjaro (lat. 3° 20′ S., long. 37° 15′ E.) and Kenia or Kignea, very nearly on the equator, in long. 38° E., have been visited by M. Rebmann and Dr Krapff. A large part of South Africa, however, appears, from the account of Dr Livingstone, to be occupied by a considerably elevated table-land, and towards this region the mountains of the coasts would seem to dip inwards both ways. From the equator, in the direction of Abyssinia, would seem to extend lofty table-lands of 7000 or 8000 feet in elevation. Along the west coast, from the Cape of Good Hope northwards to Cape Negro, occur no lofty mountain ranges. Inland, behind Benguela, Congo, and Loango, the land rises in a terrace, backed by the Sierra Cumpleda, a range 12,000 or 15,000 feet in height, and at the Bight of Biafra the Cameroon mountain attains 13,000, to the north of which the Kong mountains, and the coast range of Sierra Leone, are probably to be considered an extension of the equatorial mountain system, dying out northward towards the Great Sahara Desert.

(188.) *Australian Mountains.*—Of this great continental mass, so little of the interior has been explored that we hardly know anything of its general mountain system. So far as we do know, the highest land lies along the east coast, forming a range from Torres Strait, continued out southward to Van Diemen's Land, nowhere receding more than 150 miles from the sea. Though not lofty (Mount Koschiusko, the highest point, does not exceed 6500 feet), the material of which it consists (which is chiefly granite and porphyritic mixed with volcanic rock) gives them a singularly rugged and inaccessible character, especially coastwise, while towards the interior the slope is gradual. The heights of several points in this range, determined by Count Strzelecki, will be found in the Appendix to this article.

(189.) Of Rivers.—All rivers owe their origin, of course, to atmospheric precipitation, and their magnitudes are in a compound proportion of the area of their basins of drainage, and the average annual amount of precipitation. But the greater or less deviation from uniformity in the volume of water delivered in different seasons, which is a feature of the greatest importance in the physical character of a river, depends much on the mode in which the water reaches its channels, which may be in either of three ways. 1. From immediate surface-drainage, *i. e.*, from rain actually falling, and drained off without penetrating the soil. 2. From springs, *i. e.*, rain-water which has penetrated the ground by infiltration, and collected in subterranean channels, which at length open out at the surface, or in some cases in the beds of lakes and rivers; and 3. From the melting of snow on the summits of mountains during the summer. Intermediate between the supply from springs and from surface drainage, must be classed that portion of the rain which oozes out at low levels from a saturated soil, in innumerable rills, not distinctly traceable to any perennial spring delivering a visible volume of water. The soil, when porous, acts as a reservoir, and its gradual drainage tends to equalize the monthly delivery of rivers, and feed them in the dry season. In climates, then, where there is no broad division of the year into a rainy and a dry season, where the soil is porous and habitually moist, and where the highest levels of the watershed are below the line of perpetual snow, or where such snow-fields are not largely developed, the rivers are subject to no periodical irregularities, but only to those which result from unusual, long continued rains and droughts. Such are most rivers in the temperate zones. Where floods occur in such rivers, they depend quite as much on the nature of the soil drained as on the weather. The floods of the Rhone, occasionally so very destructive, arise mainly from the sudden delivery of heavy rains on the rocky soil and steep valleys of the Côte d'Or and Jura mountains, which form the basin of the Saone. Those which, in 1829, desolated Morayshire, in Scotland, originated in no sudden and violent rains, but in a long-continued drizzling and misty state of the atmosphere, bringing great tracts of heathery and mossy ground to the state of a saturated sponge—a state of things which sometimes results in the breaking loose of peat mosses, as that of the Solway Moss in 1772.

(190.) On the other hand, when the rains are periodical, and the year divided into a dry and a wet season, which is the case with intertropical regions generally (Meteorology, art. 112), the rivers rise and fall periodically also; the commencement of the rise in the lower part of the river-course being posterior to that of the upland rains, owing to the time required for the water to descend, and the more so the longer the course of the stream. Thus, the inundation of the Nile, which may be taken as a normal case of river periodicity, and whose continuance for successive ages as the source of all the prosperity of the most anciently civilized region in the world, has been an unvarying theme of wonder and eulogy, begins to be felt in Abyssinia and Sennaar in April, while the rise is not perceptible at Cairo till near the summer solstice. In the last 1200 miles of its course, the Nile receives no affluents, and the increasing evaporation consequent on the progressive rise of annual temperature no doubt has some share in producing the retardation.

(191.) When the watershed line of a river basin is sufficiently lofty to receive and retain abundant snow, this acts as a reservoir, and detains the precipitated moisture during all the cold season. As the summer advances, the snow melts; and if the limit of *perpetual* snow be attained, the supply so husbanded continues during all the warm season. This may or may not be strictly coincident with that from the periodical rains, though since, generally speaking, in intertropical regions these are at their maximum when the sun is most nearly vertical, the two causes for the most part conspire. Thus, the floods of the Indus depend chiefly on the melting of the snows of the Himalaya from April to September (but little rain falling on its lower basin), and are at their maximum in July. Those of the Ganges and Brahmaputra afford an example of a want of exact coincidence in this respect, all the lower country adjacent to them being flooded by very heavy rains before the water from the melting of the snows (which in the Brahmaputra has a wide circuit to make before reaching the plains) has time to arrive.

(192.) When the level of perpetual snow in the watershed is not attained, its complete fusion sets a limit to that supply; and where little rain falls in summer, we have mountain torrents which cease, or afford but a scanty supply during the hottest months, as is the case with many streams in Greece, Italy, and especially Spain, with the Orange River in South Africa, &c.

(193.) Extensive lakes in the upper part of a river's course greatly tend to equalize its flow by acting as reservoirs. Thus the St Lawrence, which, with a drainage basin of 297,600 square geographical miles, has 94,000 of them occupied by lakes, maintains an almost perfectly equable flow in all seasons. On the contrary, where no lakes exist, owing to a want of surface inequality, and especially where the declivity of the ground over large regions is very slight, inundations take place on every considerable increase of the volume of water to be disposed of, owing

Physical Geography. to the want of proper channels to carry it off. Thus the Silvas, or flat wooded plains of the basin of the Amazons River (an area of more than half a million of square miles), are for the most part so level and so little inclined, that the tract of country, 1740 geographical miles in breadth, from the eastern declivity of the Andes to Grand Para, has only a slope of 25″, and under the parallel of 5°, from Cape St Roque westward to Jaen de Bracamoros, 2640 geographical miles, across the greatest breadth of South America, a fall of 16″ only, or 1 foot in 13,000 (Humboldt, *Asie Cent.* i. 90). In consequence, in March, when the river is fullest, a very large proportion of this vast area is one great standing pool, all the small drainage channels having become obliterated in the dry season.

(194) But besides the detention of snow on the watershed lines of a river basin, the general elevation of those lines, and of the district they inclose, is very influential in determining the annual average of precipitation itself, that is to say, the degree in which the rain-bearing winds, in passing over the river basin, become drained of their moisture. Such precipitation (METEOROLOGY, art. 110) is mainly determined by the vapour-laden air rising to a higher level in its progress, dilating, and losing temperature by so doing, a process which takes place of necessity whenever the atmosphere of any district is swept bodily *up the country* during the moist winds. The height of the watershed then, and its situation as regards the prevailing moist winds, are points of primary importance in determining the volume of water discharged by a river. This consideration, we may observe, is alone sufficient to render an account of the great meteorological fact (if such it really be), that the northern hemisphere receives more rain than the southern, without having recourse to the hypothesis of the trade-winds crossing at the equator, which it has been adduced as a proof.—(Maury, *Phys. Geog. of the Sea*, § 174.)

(195.) *Courses and Slopes of Rivers.*—The courses of rivers are of necessity regulated entirely by the direction of the lines of lowest level (art. 137), and are determined therefore by the same causes which have regulated the upheaval of mountain chains, and the dislocation of their strata. Hence it follows that the courses of rivers very frequently follow the escarpments of cliffs abutting on flat or gently-sloping country; such cliffs, when not ancient sea cliffs, being usually indications of lines of fracture in the act of upheaval, or the outcropping edges of inclined strata dipping from the escarpment inward; and thus it often happens that sudden turns in a river course correspond to changes in the geological features of the country. When a river, too, which has run for some distance between parallel mountain chains, escapes by a cross valley laterally, such valley is very commonly identifiable, by the inclination of the strata on either side of it, as a valley of cross fracture, accompanied with its own peculiar dislocations. And in some cases earthquakes have been known to open channels by which the courses of rivers have been diverted. The falls of the Zambesi, as described by Dr Livingstone (see art. 232), can hardly have originated in any other way.

(196.) The velocity of the water in a river is greatest in mid-stream, at some little distance below the surface; the bottom and sides being retarded by the friction of its bed and banks, and the intermediate water by friction on that which moves with less velocity than itself. The retardation is greater the more the river bed winds, the more it is obstructed by shoals or by irregularities in its bottom, especially where shallow; and thus it happens that in the case of an inundation, such as that of the Amazon, the slope there indicated, which, if uniform, and along a regularly-worn channel, would be quite sufficient to carry off the water across the country, fails to do so. The slopes of rivers are for the most part very gentle. Thus, Mr Rennie found the fall of the Thames from Chertsey to Teddington Lock to be $17\frac{1}{2}$ inches per mile, corresponding to a slope of 57″ (one inch per mile corresponds to 3·26″). The Nile, between Assouan and Cairo, has an average slope of $6\frac{1}{2}$ inches per mile (21″). La Condamine assigns to the Amazons an average slope of $6\frac{1}{3}$ inches per mile (20″·65). The Ganges, according to Rennie, slopes 4 inches, or 13″·04. The Rhone is the most rapid river in Europe (perhaps, for so long a course, in the world). From the Lake of Geneva to Lyons its slope is 4′ 24″, from Lyons to its mouth, 1′ 46″. The average velocity of the Nile is about $2\frac{3}{4}$ miles per hour, of the Ganges from 3 to 5. The velocity of rivers, however, depends much more on their depth, and on the body of water conveyed, than on their slope (except when much exceeding these limits), as the velocity generated by the mere fall of water is almost wholly destroyed at every instant by friction.

(197.) *Springs—Caves—Thermal and Gaseous Springs—Petroleum and Naphtha Wells—Gaseous Orifices.*—The welling forth of streams from perennial springs is of the most ordinary occurrence, but it is seldom more than a rivulet which rises in this manner. There are, however, some instances of considerable streams so originating. When this is the case, they issue from caverns, and these occur usually either in ice or in limestone. In the former case they are evidently only the drainage of melted snow, which pours out at the foot of a glacier by the contribution of subglacial streams converging to the lowest point. Such is the source of the Arve from the Glacier des Bois, at Chamouni, and such that of the Ganges, which emerges as a stream, already 40 yards in breadth, from a huge cavern in a perpendicular wall of ice near the temple of Gangutri (lat. 30° 59′ N., long. 78° 59′ E.) Limestone formations are very apt to be hollowed into caverns by the solvent power of carbonic, and perhaps also of other acids derived from vegetable decomposition, held in solution in the percolating water. Such caverns often run to great distances under ground, and frequently contain running streams, even considerable rivers, as is the case in the caverns of the Peak and Castleton in Derbyshire, and in that of the Nicojack Cave in Georgia, U. S., on the Tennessee river, where a waterfall occurs at a distance of three miles under ground (*Ed. Ph. Jour.*, i. 426). When such streams emerge to day, we have the phenomenon in question, as in the cavern of the Guacheros, in the valley of Caripe, in Cumana, described by Humboldt; in the celebrated fountain of Vaucluse, which issues as a considerable stream from a cave at the foot of a perpendicular limestone cliff; and in a great number of caves in Carniola and Illyria, where "almost every lake or river has a subterraneous source, and often a subterraneous exit. The Laibach river rises twice from the limestone rock, and is twice again swallowed up by the earth before it makes its final appearance"—(Davy). The rivers Sarapa and Blanco, which flow from the lake of Yojoa in Honduras, both enter subterranean channels, through which having passed, in the one case a mile, in the other a mile and a half under ground, they reappear.

(198.) When water, carried down to a great depth into the earth, is forced up again by hydrostatic pressure through other channels, and rises as a spring, it brings up the temperature of the greatest depth to which it has penetrated, and that sometimes a very high one, even out of the neighbourhood of any volcanic formation. The warm springs at Bath have a temperature from 93° to 117° Fahr., those of Bareges and Bagneres 120° and 123°. In the county of Bath, in Virginia, a "warm spring" (96°

Fahr.) issues in sufficient volume to turn a mill, and a "hot spring" (108°) rises at a few miles distance. Three springs at Yom Mack, near Macao, have temperatures of 132°, 150°, and 186° Fahr. respectively. On the Arkansas river are springs of 180° and 190°; at Broussa, in Asia Minor, the water rises scalding hot; at La Trinchera, near Valencia, 194°·5, in a stream 2 feet deep and 18 feet broad; at Jumnotri, in the Himalaya, nearly boiling; at Urijino, in Japan, fully boiling; and in the Geyser fountains at Reikiavik, in Iceland, it is spouted, intermittently, in a torrent to the height of 150...200 feet, actually boiling. In this case there can be no doubt of its having traversed a bed of lava not yet cold. A simple and perfect imitation of the phenomenon is produced by heating the stem of a tobacco-pipe red hot, and holding it horizontal, the bowl being filled with cold water. If we consider that the temperature of the earth increases at an average rate of about 1° Fahr. for every 90 feet of depth, these facts will not appear at all surprising. The permanence of their temperature is a proof of their obtaining it at great depths. At Mont Dor the very bath exists which was constructed in the time of Cæsar. At Yakutsk, where the soil is frozen to a depth of 630 feet, Mr Atkinson informs us that hot springs exist, and afford in their neighbourhood opportunities of culture.

(199.) Many springs rise impregnated with carbonic acid,—those of Carlsbad to the amount of 12 cubic inches to the pint, and that of Bilin 34 inches. The warm spring of Wildbad, in Wirtemberg, contains in a pint of water 12 cubic inches of carbonic acid, 7·9 of azote, and 8 of oxygen (Daubeny, *Report*, &c., B. A. 1836). Sulphuretted hydrogen also is no uncommon ingredient, as in the sources of Baden, Harrowgate, and St Amand. Saline ingredients often enter to a large extent, and springs of brine occur in many localities, as at Droitwich in Worcestershire, at Halle in Saxony, and at Luneburg. Other salts of soda also occur in abundance; thus the springs of Carlsbad alone have been computed (from analysis) to give out annually more than 13,000,000 lbs. of carbonate, and 20,000,000 lbs. of sulphate of that alkali (Gilbert). Borax is found in the lakes of Thibet, and free boracic acid in the Lagune of Tuscany. Lime and magnesia enter as muriate and sulphate. Silica occurs in the boiling springs of the Geysers.

(200.) Springs of petroleum and naphtha occur in Zante, in Modena and Parma, in Sicily, and many other localities. In the Burmese territory, on the Irawadi, there are upwards of 500 wells yielding annually 400,000 hogsheads of petroleum. In Trinidad there is a lake of mineral pitch three miles in circumference, partly liquid, partly solid, and fluid bitumen rises through the sea near that island.

(201.) Carburetted hydrogen gas is discharged from the earth is many regions where coal abounds. At Fredonia, in New York, U.S., it is conveyed in pipes for lighting and domestic use. In the province of Tsechuan, in China, it is also so used. At Thsee-lieou-tsing, a single source of gas heats 300 kettles. At Pietra Mala, near Florence, carburetted hydrogen rises through limestone, and may be set on fire. At Bacou, on the Caspian, flames (doubtless owing to gas on fire) are often observed to run over the hills. Something of the same kind is said to occur in the country between Namur and Liege.

(202.) Springs occasionally intermit and flow again in regularly recurring periods. That of Paderborn, in Westphalia, discharges water twice in the 24 hours—the discharge being accompanied with a loud rumbling noise. The Cave of Kilcorney, county Clare, in Ireland, generally dry, discharges a great flood of water quite suddenly two or three times in the year (*Phil. Trans.*, 1741). The lake of Zirknitz, near Trieste, is half the year a hay field, and the other half full of water discharged from a limestone cavern.

(203.) *Perpetual Snow.*—The summits of many mountains are covered with perpetual snow. The cause is found in the decrease of temperature in ascending from the sea-level (METEOROLOGY, art. 22). The rate of decrease being pretty nearly alike everywhere, the snow-line is sooner attained in high than in low latitudes. In EUROPE, in Iceland, and at the North Cape (lat. 71° 10′), the snow-level is about 2000 feet above the sea. In Norway, between 59° and 65° N., from 4000 to 5000. On the Alps (47°) and Pyrenees (43°), from 8000 to 9000. In the NEW WORLD, along the Andes, commencing with the Straits of Magellan, we find it in 54° S. so low as 3700 feet, with glaciers descending to the sea-level; but it rises rapidly on proceeding northward, attaining 8300 in 40° S., 12,780 in 33° S., and 13,800 in 27° S. Along the Chilian Cordillera, from 14½° to 18° S., the snow-level is 15,900 feet on the eastern, and 18,500 on the western side—the cause of the difference being the greater hygrometric dryness of the leeward side of the ridge; and in the great equatorial range of volcanoes (Cotopaxi, &c.), its mean altitude may be stated at 15,800, while in the northern prolongation of the chain in Mexico (19° N.), it is 14,760. In ASIA, the snow-levels present a contrast to these quite as striking as that between the mountain systems of the two continents, with whose general direction and manner of grouping they stand connected. Thus proceeding from high to low latitudes, we find (Humboldt, *Asie Cent.* iii. 360),

	Lat. N	Snow-level. Feet.
Aldan Mountains	60°55′	4476
Kamschatka	56 40	5233
Altai Mountains	50 —	7034
Caucasus	43 —	10,840
Ararat	39 42	14,170
Mount Argæus	38 33	10,705
Bolor Mountains	37 30	17,010
Hindu Kho	34 30	18,735
Himalaya, North side	31 —	20,930
——— South side		13,070

In AFRICA, we have nothing dependable except that in Morocco, Abyssinia, and on the equator, snowy mountains occur. But in the southern ocean, it deserves notice, that not only in such high latitudes as 75° S., that of Mounts Erebus and Terror, but in the much lower latitudes of South Shetland (62° 30′), the South Sandwich group (59°), and even South Georgia (54° 40′), the snow-line reaches the sea-level.

(204). The snows and glaciers of the Alps are reckoned to occupy 1400 square miles (Forbes, citing Ebel), upon which the melting effect of a hot summer day, taken at 3 millions of cubic feet per square mile per diem,[1] would afford 4200 millions of cubic feet of water, or about 1-40th of a cubic mile per diem for the supply of the streams running from them.

(205). The snow-fields on the tops of mountains are prolonged downwards beyond their natural and proper level, by *glaciers*, which are accumulations of snow thrust down by pressure, *a tergo*, into precipitous valleys, and pressed and hardened by alternate partial thawing and "regelation" into ice. Their phenomena are very curious; but having been made the subject of a lucid and elaborate special article in this work (See GLACIER), by one who, from personal research, and long meditation, is probably better qualified than any one else to describe and

[1] This supposes one-third of the sun's vertical power (at the sea level) to be effective for fusion during nine hours per diem.

explain them, we prefer referring the reader to that article for all that concerns their descent and progress. There is, however, one feature in their history which especially concerns our subject, viz., the abrading and transporting power of glaciers. Every glacier carries down with it blocks of stone, and smaller fragments, which it deposits, on melting in the valleys, in heaps and mounds of "moraine," distinguishable as such by the angular and little-worn character of the masses. Where such glaciers run out to the sea-coast in high latitudes, and break off, they carry with them, as icebergs, these masses (often of very great size), which they deposit on melting at the bottom of the sea. Thus is explained satisfactorily a phenomenon which at one time gave rise to an infinity of wild speculation—the occurrence of "erratic blocks" and granite boulders, in localities very far from any mountain-masses of like material: on the limestone slopes of the Jura, for instance, with the whole valley of Geneva and its lake interposed between them and their obvious original site in the peaks of Mont Blanc, or on the sandy, alluvial plains of North Germany, with the Baltic intercepting their transport, otherwise than by this sort of water-carriage from the Scandinavian mountains. Geologists seem agreed, that in such cases resort must be had either to a formerly existing glacier slope at an earlier geological epoch, or to their floating off on icebergs on the bosom of an ancient ocean, a process which we see going on under our eyes. Often, too, unequivocal signs of glacier action are exhibited in deeply-grooved and friction-worn surfaces of rocks *in situ*, the evident work of angular fragments forced along them with violent pressure; and in northern latitudes, similar indications (as in the hills north of the St Lawrence) testify to the heavy grinding of icebergs drifted along at an epoch when the whole of that region formed the bed of a shallow sea, extending probably to the pole. We come now to describe more particularly the phenomena of rivers, commencing with those of the New World, as in the case of the mountains.

(206.) *Rivers of South America.*—All the more considerable South American streams flow eastward into the Atlantic, the narrow strip of western slope from the Andes to the Pacific being too confined, and the climate for the most part too dry, to nurture anything beyond small mountain-streams. In fact, from Valdivia northward, their whole supply is from the snow, which lies in much less abundance on that side. Of the rivers that flow eastward, those of Patagonia, from the extremity of the continent to the mouth of the La Plata (lat. 35° S.), are of small magnitude, with few or no affluents, and making straight across the dry and shingly desert terraces of Patagonia for the sea, a region sterile and desolate in the extremest sense of the word. Beyond these, a total change of character in the river system, consequent on the changed character of the climate, commences, and we find vast rivers, with an immense development of affluents—the principal of which, in their order of occurrence, are, 1. The La Plata or Parana—for the former name appertains only to the wide estuary of Buenos Ayres. 2. The San Francisco, whose mouth is in 10° 40′ S. lat. 3. The Paranahyba (2° 45′ S.). 4. The Rio Para, or Tocantins (0°40′ S.). 5. The Maragnon, or Amazon, which may be considered as falling into the sea exactly on the equator; and, 6. The Orinoco (8° 40′ N.)

(207.) The Rio de la Plata collects its waters from three very different descriptions of country. From the eastern slope of the Andes, between the 19th and 25th parallel of south latitude, it receives the Pilcomayo, the Vermejo, and the Salado, streams not much explored, which traverse salt deserts, and the wild and inhospitable region of the Gran Chaco. The Salado is brackish, and, as laid down by Commander Page in his track survey, exhibits perhaps the most tortuous sinuosities which can be found in river navigation. From the north it receives the Paraguay, with its numerous affluents, which drain the central plains between the 13th and 25th degrees of S. lat., and the western slopes of the Brazilian mountain system, the Sierras of Arapares, Calhano, and Amambahi. This is a magnificent river, navigable from Corrientes (lat. 27° 28′ S., where it joins the main river) nearly to its sources in lat. 13° S. It flows through a country of most luxuriant vegetation, but in all the lower part of its course, is subject to great and destructive inundations. The eastern branch, which carries the name of the Parana till it forks into the Rio Grande and Paranahyba (not the great river of that name), drains the interior of a large basin included by the coast sierras on the east, the sierras just mentioned on the west, and the Montes Pyreneos on the north, a district including much of the richest part of the Brazilian territory. The Uruguay, which drains the basin included between the Sierra de Bitoanos and the Albardao de S. Ana, runs parallel to the Parana, and joins it at the estuary of La Plata, a shallow sea of fresh water, 180 geographical miles in depth inland from the coast, and 120 broad at its mouth. The total area drained by this magnificent river system is no less than 886,000 square miles. A fine survey of the course of the Paraguay has been recently executed (1855) by the government of the United States, under the direction of Commander Page above mentioned, in the steamer Waterwitch.

(208.) The basin of the San Francisco is contained between the coast sierras from Rio de Janeiro to Cape St Roque, and the mountains parallel to them forming the next interior range of the Brazilian system, the Sierras Tiririca, Tabatinga, Gorgueha, and S. dos Irmaos. Its course between these ranges is generally from south to north, and their direction and continuance northward would lead, by a natural course, to an embouchure on the north-west coast, beyond the Cape. But about the 10th degree of S. lat. it turns suddenly to the eastward, and, cutting through three successive parallel sierras, empties itself on the east coast, thus affording a striking illustration of the general fact noticed in art. 195, since the course actually pursued is precisely along the line of demarcation which separates the granitic formations of this coast from the tertiary and alluvial ones of Pernambuco and Maranham. The basin of the San Francisco includes the district of Minas Geraes, the great source of the mineral wealth of Brazil. It includes an area of 187,200 square geographical miles, and the river itself is 1400 miles in length to its source in the Sierra da Matta da Corda. The Paranahyba River, which drains the province of Maranham (a basin of 115,200 square miles), offers little of interest beyond the facilities it affords for internal communication, which, as is the case with all the rivers of South America, are the most complete and perfect which the world possesses, the whole of that vast continent east of the Andes being accessible from the sea into almost every corner, granting only the aid of steam navigation.

(209.) The Rio da Para is the joint estuary of two great streams, the Araguay and the Tocantins, which drain the interior of the Brazilian mountain system, following a parallel course on either side of the meridional chain of the Cordillera Grande. It enters the sea so near the mouth of the Amazon (being separated from it, however, by the so-called island of Marajos, of about 9000 square miles, behind which the narrow channel of Tagipuru runs from river to river), that it is sometimes called an affluent of that river. The Amazon itself, by far the largest river in the world, since the area of its basin ex-

ceeds 1,500,000 square geographical miles, is fed from the eastern slopes of the Andes, from the 2d degree of N. to the 19th degree of S. latitude. Its most remote feeder is the Apurimac, which descends from the extreme edge of the plateau of Bolivia, near Caillomas, 3000 miles from its mouth (following the stream), and among its affluents has many which would rank as first-rate rivers. It enters the ocean by an estuary 135 geographical miles broad and 200 long, but which wholly consists (at least superficially) of fresh water. It is navigable 2200 miles from its mouth, and by reason of the flatness of the greater part of the region it traverses, there is but little interval between its head waters and those of the Paraguay, on the one side, and none between it and the Orinoco on the other, inasmuch as one and the same tributary, the Cassequiare, belongs indifferently to both river systems, the level being so complete at one point between them as to obliterate the line of watershed, and establish a natural and permanent canal uniting the two basins (see art. 140). The principal affluent of the Amazon (considered as prolonged in its main stream under the names of the Solimaes, the Maragnon, and the Yucatale, to the Apurimac) is the Madeira, which rises among the farthest inland mountains of the Brazilian system, and whose course, from the extremity of the Cordillera Geral, where it leaves them, is by a great series of cataracts and rapids down to the plains. The length of this river, from its junction in 57° 40′ W. to its extreme source in the Rio Grande, which rises among the mountains north of Potosi, is not less than 1600 geographical miles; the vast and almost unexplored region between the two rivers, and, indeed, nearly the whole course of the Maragnon itself, from the junction upward (an area of more than half a million square miles), being occupied by dense and all but impenetrable forests (the Silvas of the Amazon), deluged by the equatorial rains, whose effects in flooding the country during the northward progress of the sun have been already described (art. 193). Besides the Madeira, the Amazon receives as tributaries the important rivers of the Negro, the Tapajos, and the Xingu, the former extending towards the sources of the Orinoco, and forming a junction with it by the Cassequiare, as already mentioned, the two latter draining the interior basin between the watersheds of the Araguay, the Paraguay, and the Madeira.

(210.) The basin of the Orinoco includes the western slopes of the mountain system of Parimé, and the eastern of the Cordilleras of New Granada. North of the equator its supply of water, area for area, is even greater than that of the Amazon. For, in the interior of Guiana, 560 miles from the coast, when full, it exceeds three miles in breadth, and the rise of the waters at this part of its course, in the periodical floods, is from 30 to 36 feet. These floods take place in that half of the year when the sun is north of the equator (the course of the river lying on that side of the line), and the quantity of rain which falls on the area must be enormous, probably not less 200 or 300 inches annually. (Mrs Somerville, indeed, states it at 1000 inches, we know not on what authority, but if this be correct, it can only be that the rain which falls during one period of the day, in the wet season, is in great part evaporated in the other, and, in fact, that the same water falls over and over again.) Where the Orinoco leaves the Parimé mountains at Atures, its course is broken by falls and rapids there and at Maypures, which, though not deep enough to merit the name of cataracts (being only 30 or 40 feet), have attained celebrity in the picturesque description of Humboldt (*Aspects*, i. 219), from the vast volume of water poured down, and the singularly rugged nature of the ground. At these falls, too, there are manifest indications of the course of the river having at some former period been elevated from 160 to 190 feet above its present level.

(211.) *Rivers of North America.*—In North, as in South America, all the great development of the hydraulic system is on the east side of the Pacific mountain chain, the *North American Andes*, as it may fittingly be designated. Towards the Pacific, however, owing to the broader extent of the mountain belt, the streams are not so stinted as in the South, and we find, too, the Colorado and the Columbia, which merit the epithet of great rivers, the former (which falls into the Gulf of California) having a basin of 170,000, the latter of 194,000, square miles,—streams which, however, derive greater importance than belongs to their mere magnitude, from their representing, with the Sacramento, the drainage of the great gold-fields of the West. The loftiest waterfall in the world (unless exaggerated, is to be found in the Yohamite Valley, in Mariposa (?) County, California, where a river as large as the Thames at Richmond makes a single leap of 2100 feet perpendicular, the total height of the fall being 3100 (Gibson). On the east side of the coast ranges we have six great river systems, two of them of the first magnitude, viz. the Rio Grande del Norte and the *Mississippi*, which fall into the Gulf of Mexico; the *St Lawrence*, into the Atlantic; the Saskatchewan and Churchill, into Hudson's Bay, and the Mackenzie, into the Arctic Ocean.

(212.) The Rio del Norte derives its waters almost entirely from the mountain ranges which buttress the table-land of Mexico (the Cordillera of Cohahuela, and the Sierras Madre and de lo Mimbre), and receives little or no accession in traversing the intervening slopes to seaward. Its extreme feeders abut on the eastern borders of two considerable closed areas, or "continental basins," which collect, and suffice to evaporate, the waters of the northern portion of the Mexican plateau, leaving, as usual, lakes more or less salt.

(213.) The magnitude and importance of the Mississippi will be at once appretiated from the fact of its draining nearly a million square miles of territory, admirably adapted for human habitation, and inhabited, in fact, by the most active and rapidly-increasing population in the world. Its line of watershed is very remarkable for the difference of altitude in different parts of its extent. On the west, from the 38th to the 48th degree of N. lat., it consists of the ridges of the Rocky Mountain range, averaging eight or ten thousand feet in altitude, while on the north, the division of the American waters which flow north from those which run to the south, cuts across the central plain of the continent, between the 46th and 50th parallels, and (except where it branches from the mountains) is nowhere more than 1500 or 1600 feet in elevation, to its intersection with the western watershed of the St Lawrence basin. This entire river system consists of three great branches, the Missouri and the Mississippi (uniting at St Louis, lat. 34° 84′, long. 90° 12′), and the Ohio, which falls in somewhat lower at New Madrid (36° 32′, 89° 32′), the Missouri receiving the waters from the western mountains, the Mississippi from the central slope, and the Ohio the inland drainage from the Appalachian mountain chain. Each of these is a magnificent river, with a great system of affluents. The Missouri is navigable from the *Great Falls*, in the Rocky Mountains, to the sea, a distance of 4000 miles; the Mississippi, from those of St Anthony, 2240; while the Ohio, being connected by a system of canals with Lake Erie, and thence with Lake Ontario (so as to evade the falls of Niagara), carries out a water communication between the Gulfs of Mexico and St Lawrence. The average slope of the Mississippi, from its source, is 19·87 in. per mile, or 1 in

3189 (corresponding to a slope of 1′ 4″), or about three-fourths that of the Rhone. It is therefore no sluggish river, but in many parts of its course, a torrent, against which steamers with difficulty make head, and which rushes down laden with drift timber from the (yearly disappearing) forests of the vast alluvial region it traverses, cutting down timber-laden banks (whose section discloses the forest growth and destruction of hundreds of thousands of years—*Lyell*), and carrying all out to sea through a delta of unexampled extent (see art. 106). The Arkansas and Red River join the Mississippi below New Madrid. Their course is through the desert country on the east slope of the Chippawyan range, and they and their affluents cut through the terraces parallel to that range almost at right angles.

(214.) The St Lawrence drains a vast table-land, whose highest point is not more than 1680 feet above the sea, and of which a very large portion is occupied by lakes, whose united waters constitute more than half the fresh water on the globe, and of whose extent, depth, and height of their surfaces above the sea, Mr Johnston (*Phys. Atlas*, p. 157) has given the following synopsis:—

	Extent in Square Miles	Elevation above Sea	Mean Depth
		Feet.	Feet.
Lake Superior	32,000	630	900
Lake Michigan	22,400	600	1000
Lake Huron	20,400	600	1000
Lake Erie	9,600	565	120
Lake Ontario	6,300	234	530

The estuary of this river enters the sea very obliquely. (The water being purified by subsidence in the lakes, it forms no delta.) It is 80 geographical miles broad at its opening into the Gulf of St Lawrence, and contracts very gradually for 350 miles inland to Quebec. The communication along the chain of lakes is broken between lakes Erie and Ontario by the stupendous fall of Niagara, the largest and most magnificent, though far from the highest, in the world, the total breadth of the river (which is divided into two great cataracts by Goat Island) being 3225 feet, with a depth of descent of 162 feet in the one fall, and 149 on the other. The action of the water cuts back the cliff over which it falls at a supposed average rate of about a foot per annum, so that in 30,000 years it will probably have worked its way up to Lake Erie. The sublimity of this fall is declared by all who have seen it, to be such as no language is adequate to describe.

(215.) The basin of the Saskatchewan, 300,000 square miles in extent, includes several large lakes, the chief of which is Lake Winnepeg; as does also that of the Mackenzie (441,000), within whose dreary confines lie the Athabasca, the Slave, and the Great Bear Lakes, visited only by fur hunters, or by those heroic explorers who, in the cause of science, have furnished examples of all but superhuman exertion and endurance.

(216.) The *European Rivers* are for the most part of very small magnitude in comparison with those of America. The largest are the Danube, the Dnieper, and the Don, the two former of which fall into the Euxine, and the latter into the Sea of Azof, and thus ultimately belong to the Mediterranean system.

(217.) The arid nature of the Spanish climate, and the small amount of snow in the Pyrenees, prevent the formation of any large peninsular river, for the Douro and Ebro, though considerable streams, cannot be said to merit that title. As little can any of the French rivers which flow westward. The waters of the Alps are carried northward by the Rhine, southward by the Rhone and Po, and eastward by the Danube, which receives all those of the Carpathian basin, the Tyrolese and Illyrian Alps—a total area of 234,000 square geographical miles. It is navigable nearly 1000 miles from the Euxine Sea, the last 400 of its course lying through the flat countries of Wallachia and Bulgaria, into which it enters by a rapid called "the Iron Gate," between Orsova and Gladova, through the Balkan mountains, immediately below the Pass of Kasan, cut by Trajan along the towering cliffs which descend to the water, in his first Dacian campaign, A.D. 103, and still bearing his inscription on the face of the rock. The total course of the Danube, windings included, is reckoned at 1494 geographical miles.

(218.) The north of Germany and Poland are drained by the Elbe, the Oder, and the Vistula, of which the former flows into the Atlantic, and the two last into the Baltic. The Elbe and Oder receive most of their waters from the most northern outliers of the Alpine system of mountains, and traverse a country considerably undulated and diversified; but the Vistula, with which commences the northern hydraulic system of the great Sarmatian plain, traverses, through almost the whole extent of its basin, a nearly dead level, full of lakes and morasses. The same may be said of much of the upper course of the Dnieper, a river only remarkable as furnishing, by means of canals, a complete system of navigable communication between the Euxine and the Baltic Seas.

(219.) The most notable European waterfalls are those of the Rhine at Schaffhausen, not lofty, being only 70 feet in height, but very picturesque; those of the Velino at Terni, and the Anio at Tivoli, both artificial, but of exquisite beauty; that of Riukan Fossan, where the Maanelvan, a large river flowing out of the Mióvatn lake in Tellemarken, in Norway, springs 946 feet at a single leap; the Glommen Falls, and those of the Moxa, near Stav, in the same country. The Falls of the Clyde, in Scotland, are not wanting in grandeur or beauty. Those of Gavarnie (1400 feet) in the Pyrenees, and of the Staubbach (1004, as measured barometrically by the writer of this article) in Switzerland, are mere rills, remarkable only for their height, in which, however, both are surpassed by that of the Orco, a stream which springs 2400 feet from Monte Rosa, on the Italian side of the Alps, (*Woodbridge and Willard*), and of which some further account would be desirable.

(220.) With exception of the Ural chain, as observed in art. 174, the northern portion of the Europo-Asiatic continent, from the Valdai to Kamtschatka, is one vast unbroken plain from the Arctic Ocean to the Altai—an area of 3,600,000 geographical square miles, through which, besides the Dwina, Indigirka, and Kolyma—no inconsiderable streams—three rivers of the first magnitude (the Obi, the Yenesei, and the Lena) deliver their waters into the Arctic Ocean. To form some idea of the excessive flatness of this immense region, and of that through which the Volga flows into the Caspian, it will suffice to mention the heights above the sea-level of some of its more notable positions—viz. St Petersburg, 0; Moscow, 363 feet; Tobolsk, 115; Perm, 370; Pinsk, 434; Casan, 57; Barnaoul, 383; Jakutsk, 268. Now, Tobolsk is situated on the Irtisch, a tributary of the Obi, and Barnaoul on the Obi itself, the one at 525 geographical miles, the other at 920 geographical miles direct distances from their respective mouths, which gives an average slope of the country in the one case of 8″·11, in the other of 4″·87. The Yenesei, after leaving the mountains, has, in like manner, nearly 800 miles to traverse, in a direct line, of a similar flat region, to the head of its estuary. Both rivers, therefore, in the lower part of their courses, are sluggish and monotonous, and, owing to the high latitude, desolate to the last degree in their fea-

tures. The latter, however, in the superior part of its course from Yeneseisk upwards, has more the character of a mountain river. It derives a large portion of its waters from the lake Baikal, 1535 feet above the sea, a most romantic and beautiful mountain-basin, which is itself fed by the Selenga River, which carries into it the waters of the Tangnou, Kentei Khan and Tschokindo. The basins of these great rivers respectively occupy 924,800, and 784,500 square miles, and their total lengths 2320, and 2800 geographical miles respectively.

(221.) The Lena takes its rise among the mountains of north-east Siberia, on the northern and western slopes of the Daourian, the Yablonoi, Udskoi, and Aldan mountains, from which it issues at Yakutzk, "the coldest of inhabited places;" thence to the sea its course is between banks of ice or frozen soil, which, where undermined in the summer, expose to view the carcases (not mere skeletons, but with the skins, and even the flesh remaining) of extinct elephants, evidently adapted for inhabiting a cold climate, being covered with a thick coating of long shaggy hair—the flesh being in some instances so fresh as to have been devoured by dogs. The total length of the Lena is 2400 miles, and the area of its basin 594,000 square geographical miles.

(222.) The mountains which form the southern watershed of these rivers by no means alone separate the waters which run into the Arctic from those received by the Indian Ocean. Between these slopes is interposed that great continental basin spoken of in art. 137, which, however, owing to the peculiar aridity of its climate, has few rivers, and those for the most part terminating in salt lakes. The greatest of these are the Caspian Sea, and that of Aral—expanses of salt water, though less so than the ocean—the former of 140,000, the latter of 23,000 square geographical miles. Of these, the Caspian is fed by the Volga, one of the largest Russian rivers, which, with the Ural, drains the south-western slopes of the mountains so called, and the flat steppe country from Moscow to Casan, entering the Caspian at Astrakan, after a course of 2400 miles. The Volga is admirably adapted for navigation, and by means of canals connecting its upper waters with the lakes Ladoga and Onega, near St Petersburg, forms a complete water communication between the Caspian and the Baltic by the Neva. The Aral Sea is fed by the Amu or Gihon River, which descends from the plateau of Pamir, and the Syr, or Sihon, which, breaking through the Bolor range, drains a somewhat similar plateau, of a triangular form, between that range, the western extremity of the Thian-Shan, and an offset of that chain running in a north-west direction. Of this region scarcely anything is known, nor is our information much more complete respecting that portion of the great basin in question which extends from the Altai to the Kuen Lun, and along the axis of which, centrally placed, runs the whole length of the Thian-Shan, dividing the waters of the discontinuous salt-lake system, on its north side, from the more connected one of the lake Lop or Loph on its south.

(223.) To the south of this basin (which includes in its westward prolongation the whole of Persia, and which probably exists as such only in virtue of its aridity, since, had it a more humid climate, a great lake and river system would assuredly have been established of west-flowing waters, communicating with the Euxine by self-cut channels), commences the river system of India, which consists of three gigantic rivers, the Indus, the Ganges, and the Brahmaputra (which carry off the waters of Upper and Central India, including the plateau of Malwa), and a number of smaller streams which drain the peninsula, the chief of which are the Nerbudda, the Godavery, and the Kistna, the former flowing westward, the two latter east.

(224.) The Indus is fed by the streams of the celebrated Punjab, or Five Rivers, from the lofty region of Ladak, the western and inferior portion of the Thibetan plateau (penetrated by the Sutlej to the lake Rewan), and the southern slopes of the Himalaya, as far east as the Peak of Jumnotri. These rivers, once free of the mountain intricacies, converge to and unite at a point near the southern extremity of the Suleiman mountains, after which the Indus receives no tributaries of any importance in the rest of its course (280 geographical miles), to Hyderabad, where it forks out into a delta 115 geographical miles in length, and 105 in breadth from Kurraci to Kori,[1] whence it affords a free navigation up the country to Multan and Lahore, the current (except in the flood-season) running about a mile an hour. Its eastern branches were early connected with the Ganges by canals for purposes of commerce and irrigation. Its total length is 1960 geographical miles, and its basin extends over 312,000 square geographical miles.

(225.) The Ganges receives by far the greater portion of its waters from the Himalaya range, from Jumnotri to the Lacheh Pass near Darjiling, east of which all the waters from those mountains flow to join the Brahmaputra. Very little of the plateau beyond the first range of the snowy peaks is drained by it, the whole of their northern slopes down to the level of the plateau being divided between the Sutlej (the eastern branch of the Indus) on the west, and the Yaru or Sanpi (a feeder of the Brahmaputra) on the east. In the western part of its upper course, its branches spread out like a fan, and collect not only the waters of the south Himalaya, but those of a great basin between the Aravulli, the Vindhya, and the Kymor ranges of mountains forming the plateau of Malwa. In fact, it may be considered as resulting from the union of "nineteen or twenty large rivers, of which twelve are larger than the Rhine," (Somerville). Its delta has already been noticed, art. 106. The floods of the Ganges commence, as already stated, in April, attain their maximum about the middle of August, and continue till October. The effect of the causes which produce them may best be estimated from the ratio of the water delivered per second at the maximum and at the minimum, viz. 494,208 and 36,330 cubic feet respectively. The Ganges is remarkable for the great and rapid changes in its course in certain districts, by which it cuts away its banks in one part to add to them in others. Forty square miles (25,600 acres) are said to have been so carried away in one district, in the course of a few years.

(226.) The Ganges and Brahmaputra unite in a common delta, or rather in two deltas, distinct at their commencement, but which, in their prolongation seaward, have met and overlapped, presenting the form of an inverted M, the points turned inland. They drain a joint area of 432,000 square geographical miles; but the latter is by far the larger stream, its minimum delivery of water being 150,000 cubic feet per second (Wilcox), against 36,000 delivered by the Ganges. Its course is remarkable for the sudden turn it takes round the eastern extremity of the Himalaya range, after draining the northern slopes of those mountains, and the mountain valleys of the Thibetan plateau; a turn evidently corresponding to the sudden change in the direction of the upheaving forces acting at this point. Its floods are of immense volume; the plains of Upper Assam are an entire sheet of water, eight or ten

[1] We follow, in these Indian names, the Italian system of pronunciation as to the vowels, and as nearly as to the consonants as each case admits.

feet deep, from the middle of June to that of September; and no wonder, when we consider that at one point (Cherra-pongi, in the Khasya hills) nearly 600 inches of rain fall annually (*i. e.* in the six wet months). The upper course of the Brahmaputra is but little known, and the wanderings of its branches among the mountains east and north of Assam belong rather to speculation than to knowledge.

(227.) Before passing to the river systems of Eastern Asia, we must revert to that of its south-western area. The peninsula of Arabia is riverless as it is rainless, and it is not till we pass out of the reach of the tropical indraft of the north-east winds, that we find in the twin rivers, the Euphrates and Tigris, indications of a different set of conditions. These celebrated streams are supplied entirely from the Armenian and Kurdistan watershed, receiving positively no accession from the Syrian desert on their western side. They both run in a south-eastern, generally parallel course, to the head of the Persian Gulf, the Euphrates being the larger, and its upper waters curving round along the slope of the Armenian plateau, so as to inclose the upper basin of the Tigris. From Bir, in 37° N. lat., where it leaves the mountain country, it pursues a course skirting the eastern border of the desert, and for the last 700 or 800 miles from Kirkesia downwards, receives not the smallest tributary. Near Bagdad, it approaches the Tigris within twelve miles, including between them the plains of Mesopotamia; and here, in those old historic times when Babylon and Nineveh were cities, and empire held its seat in these now desolate regions, the rivers were connected by canals, which served the joint purposes of commerce and irrigation. Like the Ganges and Brahmaputra, they have a common delta, which is supposed by many geologists (not without historical evidence in support of the opinion) to have been in great measure produced within the last 3000 years. The local circumstances are peculiarly favourable to the growth of a delta, the long narrow Persian Gulf allowing of no lateral sweep of the tides to carry off and disperse the deposited matter; and it is extremely probable that at some remoter epoch, but still quite within the *most recent* geological period, the Gulf occupied the whole of Mesopotamia to Bir and Diarbekir, leaving only a narrow but hilly isthmus at Scanderoon to connect Arabia with Asia Minor, as that of Suez connects it with Africa. At present, the Tigris sends out branches to the Euphrates from Amara, 150 miles from the mouth, but the complete junction of the rivers takes place 100 miles lower at Korna, from which to Bassora they form a single stream, subdividing again to form the modern delta. We now return to the river systems of Eastern Asia.

(228.) Each of the long and strait valleys which run southward from the breaking up of the Himalaya mountain system, between the ranges of the Cambodian peninsula, has its river, of which the chief are the Irawadi, the Martaban or Saluen, the Menam, and the Meking or Cambodia, which water the Burmese empire, the kingdom of Siam, and the territory of Cochin-China. They are but little known to Europeans, with exception of the Irawadi, which has been ascended 450 miles from its mouth to Ava, the Burmese capital. It is a magnificent stream, delivering into the ocean no less than 350,000 cubic feet of water per second on an average of the whole year (of which 1-3000th part by weight is silt). Like all tropical rivers, it has its season of flood, during which its volume increases tenfold (from the minimum), running then with a velocity of $3\frac{1}{2}$ to 5 miles per hour. It enters the sea at Cape Negrais, through an extensive delta, which is prevented from spreading westward by the subaqueous prolongation of the chain of the mountains of Aracan, which goes to form the Andaman and Nicobar Islands, Sumatra and Java. There is reason to believe this coast to have been in a state of upheaval at least since the year 1750, and perhaps longer, though it is only from that date that positive evidence of changes of level are procurable. In the volcanic island of Reguain, not far from the coast, three distinct steps of this process have been clearly pointed out.

(229.) The Chinese empire is watered by four great river systems, emptying themselves into the Pacific: the Hong-kiang, Tche-kiang or Canton River, the least of the four, and the Yang-tse-kiang, the Hoang-ho (or Yellow River), and the Amur, all three of gigantic magnitude, the two former of which form what may be considered as a twin system, having a near approach to a common embouchure. The Yellow River derives its upper waters from the south-eastern border of the continental basin above mentioned, including the watershed of the Thibetan plateau on its northern and eastern side, as also from the Yung-ling, Pe-ling, and Tapa-ling mountains, which traverse China from west to east, and direct its waters to the sea at Nankin through a course of 2900 geographical miles, and over a basin area of 548,000 square miles. Branches of the last-named mountains separate it from the Hoang-ho until near the sea, when they communicate in the low levels by innumerable canals; their mouths, however, being separated by an interval of about 90 miles, and by a delta, the common produce of both. The Hoang-ho has a basin of 537,000 square, and a course of 2300 linear, geographical miles.

(230.) The Amur takes its rise among the Daourian, Tschokindo, and Kiang-khan mountains, and the southern slope of the Yablonoi Krebet. It is a river of very peculiar interest as regards the progress of Russian domination in the direction of China, though little known to other than Russian explorers. It has a basin of 583,000 square geographical miles in extent, and a course of 2380 geographical miles, so that it is a river system of the first order, and entering the sea at the very junction of the two great land-locked seas of Ochotsk and Japan, will assume, at some period in the world's history, a commensurate degree of political and commercial importance.

(231.) Among *African Rivers* the Nile is the only conspicuous one, and is in many respects the most remarkable river in the world,—as the seat of the earliest civilization, as a perpetual witness to the stability of those great natural arrangements by which the wants of one region are supplied by the superfluities of another, and as a geological chronometer by which some insight may be obtained into the duration of the existing order of things antecedent to history. Its ultimate sources are in all probability to be looked for in the mountains on, or adjacent to, the equator, and perhaps in the lake Ungiamesi. The main stream, the Bahr-el-Abiad or White River, has been traced as far as 3° 39′ N. lat., and may therefore very well derive its waters from snowy ranges, such as we know to exist in equatorial Africa, or from the lake above mentioned (which, be it remembered, is fresh), or from a generally boggy or lacustrine district, watered by equatorial rains; for there is reason to believe that during the sojourn of the sun north of the equator, the vapours of the Indian Ocean must of necessity be swept by the south-east trade over that precise district, and there precipitated in torrents of rain. It is joined by the Blue Nile (Bahr-el-Azrek), which rises in the Galla country, south of Abyssinia, at Khartum, and by the Atbara, which traverses Sennaar at Goos, about the 18th degree of north latitude, from which point, in its farther passage through Dongola, Nubia, and Egypt, a distance of nearly 1300 miles, following the windings of the stream, it ceases to receive any accession

of waters. Its course through Nubia is a succession of low rapids, called cataracts, at the last of which, at Assouan or Syene, it enters Upper Egypt. Hence it runs in a valley varying from 2 to 18 miles in breadth, through a succession of monuments of ancient splendour, to which the world affords no parallel, to its delta,—the mountains on either side being low ranges (decreasing in height from Assouan downwards) of granite, sandstone, and nummulite, but of which all the lower portions are buried beneath vast alluvial deposits brought down by the inundations. The Nile delivers at Assouan 24,000 cubic feet of water per second when at its lowest at the summer solstice, and 362,000 when at the highest in October (Horner, *P. T.*, 1855). Its *mean annual* delivery is calculated by M. Talabot at 101,000. At the time of the flood it is loaded with black mud of most fertilizing quality, to the amount of 1-633d of its weight, so that the total quantity of fertilizing matter spread over Egypt, or carried out to sea, is about 140 millions of tons. This immense deposit is computed, from the evidence afforded by ancient monuments, the bases of which have been silted (not sanded) up, to cause a rise of the soil of the valley of $3\frac{1}{2}$ inches per century. From borings made, at the instance of Mr Horner, under the colossal statue of Rameses at Memphis, the true Nile sediment was found to terminate at 30 feet beneath the foundation of the platform on which the colossus stands, itself 10 feet below the present surface, which gives an interval of 10,285 years from the commencement of deposition at that spot to the age of Rameses, or a date of B.C. 11,646. At the depth of 39 feet a piece of pottery was found, which (unless subsequently buried there) must have dated its construction from B.C. 11,517 (Horner, *P. T.*, 1858). The supposed drainage basin of the Nile is 520,000 square, and its supposed total course 2240 linear, geographical miles.

(232.) The next African river in importance, as regards internal communication, is the Zambesi, Cuama, or Quilimano, recently explored by Dr Livingstone, which enters the sea at Quilimane, in lat. 18° S., and, if really connected, as he appears to consider demonstrated, through the Victoria Falls, with the Liba, the Liambi, the Luambesi, and an innumerable host of other rivers which cover the interior of south Central Africa like a vast network of anastomosing streams, drains an area of not less than 120 square degrees, or 432,000 square geographical miles. The falls referred to are perhaps the most striking, after Niagara, which exist. The river, 1000 yards in breadth, is suddenly swallowed up in a narrow perpendicular cleft, 100 feet deep, in a black basaltic rock directly across its course, which is prolonged from the bank 40 or 50 miles, in which the river takes its new course compressed in a deep channel of 15 or 20 yards. The hydraulic system of the interior of South Africa, disclosed by Dr Livingstone's researches, is anomalous in the extreme, and is only compatible with the idea of a generally level plateau, deluged with periodical rains, but not, like the plain of the Amazons, dominated by a great range of high lands on one side, with a slope to the other, but as if the periodical rains fell on a very gently rising convexity, so as to leave the waters undecided by what channels to seek the main arterial drainage. It would seem very probable that the cleft of the Victoria Falls has been of comparatively recent origin, and has determined a new system of drainage by which the water of those regions has been carried off more rapidly than heretofore, since the general tenor of Dr Livingstone's narrative points to what may be termed a secular desiccation of the districts traversed by him.

(233.) The Niger, Joliba, or Quorra, rises in the Kong Mountains, and after running a considerable distance along their bases to the east-and-by-north, makes a sudden turn at Timbuctoo to the south, and penetrating the chain of mountains, reverts to the west coast, and falls into the sea in the Gulf of Guinea at the New and Old Calabar, the extreme rivers of its delta,—streams foul and fetid, redolent of marsh poison and the moral pestilence of the slave trade. The expedition under Baikie, in 1854, has shewn the possibility of penetrating through this disgusting basin into regions full of tropical life, and exhibiting humanity under an aspect a few shades less repulsive than its savage forms for the most part assume.

(234.) Of *Australian Rivers* the catalogue is small, and, so far as can be at present ascertained, confined to very moderate distances from the coast. It would seem most probable that the central regions of that singular continent will furnish another instance of a "continental basin," with a system of internal drainage and salt lakes. Most of its streams flow in deep rocky clefts, affording no irrigation, and assuming alternately the impetuosity of torrents and the stagnancy of a chain of pools with a communicating thread of water sunk in deep gulleys channelled in a table-land. These streams rush with wonderful rapidity in the rainy season. The Hawkesbury has been known to swell to 100 feet above its usual level, sweeping away everything in its course. From Count Strzelecki we learn that the average fall of the rivers running eastward in the colony of New South Wales, is 48 feet per mile, of those which run westward 9 feet, the land sloping inwards more gradually.

(235.) *Pampas, Silvas, Llanos, Prairies, Savannahs, Steppes, Tundras, &c.*—The mountains which constitute the central ridge of the old continent and the lateral of the new, tower to a vast height, while on their flanks, and after a more or less extensive interval of broken country and lower chains, they fall away into sloping sheets, terracing down by steps into the low lands, which ultimately flatten into what becomes at last an unvaried plain, extending to the borders of a far remote ocean. The easier accessibility of these regions, and in many cases their high fertility (formed as they have been by alluvial deposition from the washings of the higher ground), constitute some of them the principal theatres of human habitation; though it would seem that the higher developments of civilized life require something of the excitement and hardihood generated by the neighbourhood of at least a hilly country, and languish in the monotonous ease of an uninterrupted level, however adapted by its luxuriance for that material civilization which commerce fosters.

(236.) Each of the more extensive regions of this kind has some peculiar character due to its soil, climate, and the nature of its vegetable and animal tenants. Our limits forbid lengthened or minute description; but we will endeavour, in as few words as possible, to convey some notion of the leading features of the principal among these flat regions.

(237.) *The Pampas of Patagonia* seem destined to perpetual desolation, not only by their climate (art. 274), but also by the nature of their soil, which terraces down in almost unbroken sheets of shingle and basalt, diversified with huge boulders, the whole brought down, no doubt, by ancient glaciers, and deposited by their melting when floated off to sea, and which occupy the whole eastern slope of the continent, from its extremity to the Rio Colorado. In these regions the vegetation is stunted, the winds fierce and tempestuous, and the population almost *nil.*

(238.) This desolate region is succeeded by one hardly less so, though different in its style of desolation. In the pampas of Brazil and Buenos Ayres, vast tracts are destitute of trees, and almost of water, but lying in a warmer latitude, and having, therefore, been exempt from the

action of those causes alluded to in the last article, which have covered the alluvium with stony fragments, hardly a stone or a pebble is to be found in them for hundreds of miles. In this region, which extends southward from the estuary of the La Plata to Patagonia, and westward to the feet of the Andes, the alternation of the wet and dry season, acting on a soil composed entirely of a red argillaceous alluvium, with here and there calcareous concretions, effect no other variety than the growth and decay of gigantic thistles for some distance from the coast, replaced further inland by the long-tufted pampas grass, ranged over by innumerable herds of wild or semi-wild horses and cattle, whose skins are exported, and whose fat and dried flesh serves for fuel; and where, in the dry season, the pampero's transient wind-storms from the interior raise clouds of dust, involving the whole horizon in darkness so impenetrable, that even the lightning which accompanies them is only *heard*, not seen. Roads there are none, nor any need of them. Lassoing a wild horse, mounting and riding him till he falls from fatigue, and is exchanged for another, the traveller, with his Gaucho guide, speeds on, day after day, and week after week, as for the bare life, towards the far-distant and long-invisible hills. The exciting gallop of Captain Head across this country, will probably be familiar to many of our readers. A tract of swamp and bog, succeeded by a region of ravines and stones, with a zone of thorny bushes and dwarf trees reaching to the Andes, complete the picture of this uninviting region, which communicates northwards, along the western slopes of the Parana Valley, with the hideous wilderness of the Gran Chaco traversed by the Salado, Vermejo, and Pilcomayo rivers, where the wild Indian still ranges in inaccessible freedom. The pampas of La Plata and Patagonia together, are computed by Humboldt to occupy 135,200 square leagues, or 1,217,000 square geographical miles. If they offer little of interest on their surface, the buried, and in many cases hardly buried, gigantic remains of the Glyptodon, Mylodon, and Megatherium, with other singularly-formed monsters of an earlier Fauna, which they cover, amply compensate to the geologist for this deficiency by presenting him with the enigma of a once animated creation, which seems to have simply died out, without any of those geological cataclysms and catastrophes, or changes of climate, to which we are in the habit of attributing such events in general. It is somewhat singular, too, that among all these remains, few attributable to carnivora have been discovered, the most remarkable among them being the Machairodon Neogeum, Sabre-tusked Tiger, a truly dreadful form of fossil voracity.

(239.) The *Silvas of the Amazon River* include a tract of perhaps not less than half a million square miles of the central area of South America, where, owing to the rich quality of the alluvium brought down by that river and its tributaries, and spread over the country by its inundations, aided, in the wet season, by an immense rain-fall, and by the general heat of the climate, vegetation seems carried to the extreme of exuberance. A region more than six times the area of France, crossed by the equator, and reaching from the cordilleras of the Andes to the mountains of Parimé, is clothed with a mass of forest, so dense and impenetrable as to defy access, except by navigation, and tenanted by innumerable wild animals, among which the monkey tribe holds a very conspicuous place. The descriptions given by Humboldt of this region, present pictures of forest life and scenery in which every feature of grandeur, gloom, and savage wildness is concentered.

(240.) *The Llanos of the Orinoco* occupy a perfectly level area of nearly 160,000 square miles, so level, indeed, that elevations of a few feet, quite imperceptible to the eye as slopes, suffice to form the watershed lines between adjacent streams. After the rains (during whose continuance the whole country is inundated) a rich pasture covers it, which has procured it, from the natives, the designation of the "Sea of Grass." This speedily dries and furnishes the material of extensive conflagrations, which, repeated year after year, effectually serve to maintain the treeless character of the region. The dust-storms here also are terrific, and are admirably described by Humboldt (*Aspects*, p. 17).

(241.) About half the total area of North America, from the Alleghanies to the Rocky Mountains, including great part of Canada, Labrador, and the Indian country to the north, to the amount of nearly 3,000,000 of square miles, has been characterised by Humboldt as "an almost continuous region of savannahs and prairies." The terms, however, apply more correctly to those regions of the Great North American plain and flat river basins which are deficient in timber. These, however, differ much in climate, soil, and aspect. To the west of the Mississippi, where the ground rises in terraces towards the Rocky Mountains, the climate is arid, the soil sterile, often full of salt, and destitute, at all events, of fresh springs. The prairies of Texas, however, have a rich soil, a profusion of grass, and flowers of fine hues and delicate scent, and are adorned, not indeed with forests, but with frequent clumps of large trees, or here and there a single one of vast breadth of growth, covered with long pendent moss. To the east of the Mississippi, along the coast of the Gulf of Florida, extends a region of so-called Pine Barrens, where only trees of that family can extract nutriment from the sour sand. These are not confined to Alabama and Florida, but extend far inland, and occupy large tracts in North Carolina and Virginia. East of the Mississippi, the country, till cleared by the increasing population, was for the most part richly wooded, interspersed, however, with savannah and prairie grounds, the treeless character of which, as in the case of the Llanos, was perpetuated by frequent conflagrations, which swept across whole districts, and destroyed every living thing within their area. In the southern districts, the air, especially in the "bottoms," or low swampy regions bordering on the rivers, from the heat and quantity of decaying vegetation, is impregnated with malarious miasma, producing ultimately, at New Orleans, the most virulent type of yellow fever.

(242.) The great northern plain of the old continent occupies an area of between 4,000,000 and 5,000,000 of square miles. From Belgium, through Holland (much of which lies actually below high-water mark), and North Germany and Prussia to the Vistula, we find a cultivated though sandy soil, with large tracts of heath interspersed, and presenting over all the area bordering on the North Sea and the Baltic, the phenomenon of granitic and syenitic blocks scattered in abundance, not uniformly, but in patches here and there, and referable as their origin to the older igneous rocks of the Scandinavian mountains—a phenomenon first brought into prominent notice by Deluc (*Geol. Travels*), and since received as one of the chief supports of the "Glacier Theory."

(243.) At the Vistula may be said to commence the great Sarmatian, or East European plain, which, with exception of the Valdai Hills, extends from the Baltic to the Black and Caspian Seas, and to the Ural Mountains. It may be divided into three regions—a northern, extending along the coasts of the Gulf of Bothnia and Finland, and the White Sea, and including all the region north of the Valdai to the middle of the Ural. Its climate, soil, and swampy character admit but little cultivation, and only a scanty growth of trees—chiefly birch and fir;

while much of the ground is covered with a species of moss or peat called tundra, which reappears over all the northern area of the Asiatic continent where similar conditions prevail. The middle region of Russia is fertile and well watered, with a climate of only moderate severity, a soil of rich alluvial mould, admitting of high culture, a surface gently undulated, and extensive forests of pine, birch, and deciduous trees. This region is surrounded, to the south, by sandy, barren, and often saline *steppes*, which commence at the Dnieper river and extend along the Sea of Azof, including all the country north and east of the Caspian, and connect themselves by the desert of Kharesm, and the steppes of Kirghiz, Ishim and Baraba, with the great Siberian plain north of the Altai. Nothing can exceed the dreary monotony of these steppes, wandered over by nomadic tribes—grassy indeed, and covered with flowering shrubs, tulips, and rosaceous plants for a few months, but parched by the sun and drying winds in summer, while in winter they become howling and shelterless wastes of snow. Some of these Asiatic steppes are covered with succulent ever-green articulated soda plants; in some, on the borders of the great salt districts, the salsola assumes a rich crimson or orange colour, giving a peculiar glow to the distant plains on the borders of salt lakes, while the plains themselves glisten with flakes of exuded salt, like fresh-fallen snow.

(244.) In North Siberia winter reigns supreme. Beyond the 62d parallel corn does not ripen, and beyond this the fir forests intermix with and gradually give place to the tundra, among the swamps of which, buried or half buried, mammoth tusks, or rather those of the Elephas Primigenius (art. 221), occur so frequently as to constitute a very valuable article of search and commerce. These tusks, together with the skeletons of these and several other animals, form immense local accumulations, which become richer and more extensive the further one advances north. They are found in greatest abundance in New Siberia, and in the islands which fringe the borders of the continent between the Lena and the Indijirka, especially Lachow or Liakhoff, which is represented as almost wholly consisting of such remains. Hundreds of poods (40 lbs. Eng.) are thence extracted annually for exportation. They are frequent also in Kamschatka.

(245.) The great alluvial plain of China occupies upwards of 200,000 square miles, and is the seat of the oldest civilization of which we have any authentic account (sacred history, of course, excepted), and of actually the most numerous and condensed population anywhere to be found on the globe. It is for the most part a vast plain, crossed in all directions and irrigated by canals, devoted wholly to culture, of which rice forms the principal article of produce, while the low hills afford tea to so vast an extent, that between 60 and 70 millions of pounds are imported annually into Britain alone.

(246.) The principal southern slope of the Asiatic continent is that of Central and Lower India, or the great plain of the Ganges and Indus, of which all the lower part is alluvial and of wonderful productiveness, at least under the influence of artificial irrigation. What may be called the Plain extends almost to the foot of the Himalayas, the slope of the Ganges (art 196) being only one foot in 15,840. Benares, distant from Calcutta between 500 and 600 miles along the river, is only 270 feet above the sea. The valley of the Indus is sandy and barren, unless where artificially irrigated. On the east of the river, in its lower part, the plains expand into a sandy and desert district of many square degrees in extent, called the Thur, which is so low near the mouth of the river as to be overflowed by the tide, and incapable of cultivation. The Runn of Cutch, an extensive region, the coast line of which is laid down very differently in different maps, adjacent to the delta of the Indus, is supposed to be subject to frequent alterations of level from geological causes, one of which is on record so late as 1819, by which a considerable extent of what before was land was submerged, and a portion of the internal navigation of the country, which had been closed for centuries, was again rendered practicable, while another part adjoining was permanently elevated.

(247.) Of *Climates*.—What we term the climate of a country is the result of all the meteorological influences to which it is habitually subject, and includes not merely the mean amount or intensity of the meteorological elements, but their distribution over the several months of the year and the several hours of the day. The mode of ascertaining exactly the mean annual amount and the laws of periodical fluctuation of these elements separately considered, of calculating them numerically, and representing the final conclusions to the eye by curves laid down in charts, is abundantly explained in our article on METEOROLOGY.

(248.) The elements which go to constitute our notions of climate, are chiefly temperature and moisture. These, indeed, are by no means the sole causes which affect vegetable and animal life. There are other elements, such as the greater or less habitual violence of the wind; solar light, as a vital stimulus, apart from the heat which accompanies it, and which stands in relation to the greater or less habitual obscuration of the sky by cloud; electrical manifestations; and lastly, barometric pressure, as a measure of the *quantity* of air taken up at each inspiration of an animal, or present to a given surface of leaf in a plant, an element whose importance has been rather overlooked. All these constitute items in our estimate of a climate, and each of them, when present in a high degree, gives it a marked character. But temperature and moisture exercise so preponderating an influence, that, in a general view of climates, we may limit ourselves to their consideration, regarding the others as subordinate, and their excess or deficiency as incidental and special causes of variety. Even thus limited, the number of cases which arise by simple combination of high, low, and medium annual averages, and of great and small annual and diurnal fluctuation (each of which exists as a reality over some more or less extensive region of the earth's surface), would become embarrassing. The diurnal fluctuations, however, assume importance only in two cases,—1st, When, as in the circumpolar regions, the year is divided into two very unequally illuminated seasons, and where the diurnal fluctuation in effect merges in the annual; and 2dly, at very great elevations in or near the tropics, as in the Bolivian and Thibetan plateaus, where, owing to radiation in clear sky and rarefied air, the difference of night and day temperature becomes excessive, and where the nightly dews perform the office of rain, and supply its place.

(249.) Elevation above the sea-level exercises a peculiar influence on all the elements of climate. As we rise above that level, the temperature sinks at the rate of a degree for every 350 feet of elevation, and of course the mean temperature of the year is affected at an elevated station to that full extent. Thus it happens that in ascending a mountain from the sea-level to the limit of perpetual snow, we pass through the same series of climates, so far as temperature is concerned, which we should do by travelling from the same station to the polar regions of the globe; and in a country where very great differences of level exist, we find every variety of climate arranged in zones according to the altitude, and characterized by the vegetable productions appropriate to their

habitual temperatures. The amount of rain, too, is very greatly dependent on the level of *the soil*. It increases on mountain slopes exposed to moist winds, up to a certain level, different in different geographical districts, and then diminishes, in virtue of the general law of hygrometric siccity in the upper regions of the atmosphere. At great elevations, too, the force and direction of winds, and the amount of cloud, are often very different from what prevails below. Thus, on the Peak of Teneriffe, the summer wind is habitually S.W., and the sky almost always cloudless, while at the foot of the mountain the N.E. trade prevails, and a dense stratum of cloud covers all the surrounding ocean. Not only the amount, too, but the *quality* of solar radiation is affected. The chemical rays of the spectrum are powerfully absorbed in passing through the atmosphere, and the effect of their greater abundance aloft is shewn in the superior brilliancy of colour in the flowers of Alpine regions. Nor can the difference of density in the air itself be devoid of influence either on plants or animals. Dr Muhry, in a work of great merit recently published (*Klimatologische-Untersuchungen*, Leipzig, 1858), informs us, for instance, that among the inhabitants of very elevated regions, pulmonary phthisis is a disease unknown.

(250.) *Distribution of Temperature.*—The law of distribution of heat over the earth's surface is represented to the eye by the systems of Isothermal, Isothĕral, and Isocheimōnal lines described in METEOROLOGY, art. 149, which severally connect those points of the globe which have equal *mean annual*, *mean summer*, and *mean winter* temperatures; the important points as regards climates being, that these several sets of lines are not coincident (except locally and accidentally), so that, even as regards temperature alone, it is rare to find two places that have the same annual average, and also the same distribution of heat in the several months. How this may affect climate will be obvious, if we consider the cases of two places of the same mean or average temperature, which in the one is maintained nearly uniform throughout the year, while in the other a burning summer is compensated by a rigorous winter.

(251.) If the sea covered the whole earth, or if it were uniformly occupied by land, there would prevail in all regions a climate dependent wholly on the latitude of the place, and on the sun's declination at different seasons. What would be the exact mean temperatures, and the exact annual fluctuations corresponding to each latitude in either case, it is needless to inquire; but it is certain they would be very different in the two cases, by reason of the different relations of land and water to heat. But if we take an average of the actual mean temperatures corresponding to each degree of latitude all round the globe, we shall obtain a mean law under the actual state of things which may be called the *normal law* of mean temperature, and which is not very inaptly represented by the formula $41^\circ{\cdot}8 + 39^\circ{\cdot}7 \times \cos.$ (twice latitude); and by attaching to each parallel of latitude a number expressing the temperature computed from this, there would arise a system of normal isothermic lines. The actual system, as may be seen in our plate CLXXIII., vol. vi., deviates much from this regularity; and the manner of this deviation, which constitutes the first and greatest basis of distinction between the heat-climates of the globe, is not a little remarkable.

(252.) Mr Dove has constructed a chart, in which places which have the same excess above, or defect below, the normal mean temperature, are connected by lines which he terms Isabnormal lines—the order of the lines corresponding to the amount of deviation; and on an inspection of this chart, three very prominent features are apparent. 1*st*, That the lines which limit the regions into which the globe becomes thus divided, or the lines of normal temperature, do not, as would at first sight appear probable (and as would be the case had the earth no rotation on its axis), follow meridional directions, but are *systematically* oblique to the equator, being directed from N.W. to S.E. 2*d*, That they divide the globe into two hot and two cold regions, in the form of broad belts, whose medial lines have a generally similar direction, and which, so far from being emphatically regions of much land and of much water, run systematically *across the great masses of both*. Thus, the principal hot region includes nearly all Australia, the Indian Ocean, India, and all south-west Asia and east Africa, Europe, and the North Atlantic; and the principal cold one, the western half of South America, the south-west, equatorial, and north-east Pacific, and all east Asia, from Cochin-China northwards. The other hot region includes the S.W. Atlantic, all the eastern side of South America, and the Caribbean Sea, and (after a small interruption or suspension) springs over to the other side of the American continent, to reappear in north-west America and the North Pacific, while the other cold one takes in west Africa, the south-east and equatorial Atlantic, and all the east side of North America. 3*dly*, That these regions, so distributed, bear evident reference both to the situation of the coast-lines of the great land-masses and to the trade-winds. To make our meaning clear, we will suppose the globe divided, not by the true geographical equator, but by the tropic of Cancer (which may be considered as the medial parallel of the land, and to which, rather than to the true equator, the sources of heat-disturbance have reference). Land lying to the north of this being considered as *northern*, and to the south, *southern*, it appears that, in the *northern* masses, the regions in which the temperature is in excess occupy their western, and in the *southern* their eastern coasts, while the reverse rule holds good for those in which it is deficient. A comparison of this rule with what is above stated, in reference to the regions themselves, will verify its enunciation in these terms.

(253.) So stated, the cause is not far to seek, and it is one of a generality commensurate to that of the observed facts. Referring to our account of the oceanic currents as traced in arts. 51-65, we see—That the hot water of the equatorial currents in *all* the seas is dashed against the *eastern coasts* of *southern masses*, while the cold supplying currents from the southern ocean, sweep along the west sides of those masses; that, in its northern circulation, the hot water is carried across the great oceans north-eastward, to strike on the west sides of the *northern masses*, while cold return-currents flow down their east sides; and that, in its southern circulation, the hot water is thrown off southwards by the eastern coasts of the southern masses. The only point which remains unexplained in the view here presented, is a small breach of continuity in the hot region between the Caribbean Sea and the north-west coast of North America, where the two cold regions run together across it over Mexico. It should also be observed, 1*st*, That though the immediate influence of these causes is greatest on the coasts, their prevalence extends deep into the continents, being propagated onwards by the winds; and, 2*dly*, That the inequality now in question is independent of another law more general still in its enunciation, though of smaller influence, viz., that the whole northern hemisphere is, on a general average, $3\frac{1}{2}^\circ$ warmer than the whole southern, as containing more land to be heated by the sun when north of the equator.

(254.) Within each of these four great geographical regions the mean temperature increases or decreases (ac-

cording to the character of the region) from the borders towards the middle, and each of them has within it certain poles or foci (which may be called poles of relative warmth and cold), at which the peculiar character of the region is most conspicuous. The principal, or Europo-African Hot Region, for instance, is separated from the cold region to the west by a normal line running in an undulating curve from Baffin's Bay to the Cape of Good Hope, and from that, on the east, by one commencing opposite Nova Zembla, dividing Europe from Asia almost conterminously as far as the Caspian Sea, and then passing off south-eastward to the Philippine Islands, and across the South Pacific. Within this area the north pole of relative warmth occurs almost precisely on the Arctic circle in long. 4° east, between Iceland and the Norwegian coast (full in the sweep of the Gulf-stream drift). At this point the mean annual temperature is *fully* 20° *above* that which would be due to its latitude on the supposition of a normal climate, and in receding from this point as a focus on all sides, the excess of mean temperature decreases so as to mark out a series of ovals, the interior of each of which is *relatively* warmer than those outside. Thus, the oval of 18° excess just grazes the North Cape; that of 12° takes in the whole coast of Norway and the north of Scotland; that of 9° the whole of Britain, the French coast (including Paris), Holland, Denmark, the greater part of the Baltic, and the Gulfs of Bothnia and Finland (just excluding Petersburg), up to Archangel; and, lastly, the oval of 4° excess cuts the coast of Greenland at Cape Farewell, passes nearly through Madrid and Algiers, crosses Sicily, Calabria, Hungary, and Russia, and includes all the capitals of Europe. In the southern hemisphere there is no very prominent focus of this kind, but a point in 30° S. in the meridian of Madagascar, just where the warm currents of the Indian Ocean unite after rounding that island on their way to the Cape, offers a feeble and rudimentary one.

(255.) The east Asiatic cold region has a strongly marked focus of relative cold at Yakutsk, where the deficiency of annual temperature amounts to −15°, and round which, in all directions, this deficiency decreases, over a series of ovals, of which that of −7° includes the whole of north-east Siberia, from the mouth of the Jenesei to that of the Kolyma, and descends south through the Baikal Lake and Ochotzk into Chinese Tartary. Continued south across the Pacific, this region, as above stated, enters upon the west coast of South America. Off that coast, at 300 or 400 miles south-west of Lima, in lat. 15° S., long. 82° W., occurs another very well marked focus of the same character, but less intense, the deficit of temperature being only 9°. The oval of −7° about this focus enters on the South American coast, and includes Lima, which thus (owing to the refrigerating power of Humboldt's current, to which this focus is clearly referable) enjoys a far cooler climate than its proximity to the equator would otherwise entail on it. In the Pacific, in lat. 20° N., long. 225° E., is also the central point of a small subordinate oval of relative cold (of about −2°), a feature which we shall have occasion to notice in another part of our subject.

(256.) The next, which may be called the American Warm Region, has its northern focus in the Pacific, in lat. 56° N., long. 141° W., not far from Sitka, in Russian America. It is far less strongly developed than the Atlantic focus of a similar character, its excess of temperature being +9°, and its influence on the continent of America is very limited, but nevertheless sufficient to afford the whole coast, from Vancouver's Island northwards to the Aliaskan peninsula, a climate 7° warmer than the normal one, an advantage equivalent to that of a transfer from North Iceland to New Halifax, and which forms a most important consideration as regards the future fortunes of the new colonies of Vancouver's Island and New Caledonia. In the southern hemisphere we find no marked indication of a corresponding focus, which is perhaps owing to a deficiency of the requisite observations. Owing, however, to the large portion of this hemisphere occupied by sea, the warmer areas by no means stand in so strong a contrast to the colder, as in the other.

(257.) The last of these regions we have to notice is the American cold region. It is very strongly marked, and distinctly so even in its prolongation into the southern hemisphere. In the northern continent it has a focus of relative cold in lat. 65° N., long. 96° W., near Wager Inlet, at the north-east corner of Hudson's Bay, whose intensity (−13°) nearly equals that of the Siberian focus, and whose influence is very great over the whole north-east portion of the continent, affecting Quebec with a mean deficit of 6½° (equivalent to a transfer from the south of England to the Orkneys), and even New York by one of 4°. In the southern hemisphere there is a sufficiently well-marked focus of the same character, and which bears nearly the same relation to the south-east coast of Africa that the focus off Lima does to South America, being only rather less intense (−6°), and not extending its influence very materially on the continent. It is, however, precisely on the spot where, from the indraft of cold water from the southern ocean, we should expect to find it.

(258.) The extreme cold of north-east America is evidently referable to the delivery of the whole circulating water of the Arctic Ocean, together with all which is introduced through Behring's Straits along its coast, and through the intricacies of Baffin's and Hudson's Bays, and the channels leading into them, deep into the continent, and among its outlying appendages. That of Siberia, and east Asia in general, is not so obvious a result of oceanic causes. It arises rather from the extension across Asia of the lofty mountain-chains between the 30th and 40th parallel, which increase the rigour of winter to the countries north of them, by intercepting the south-west anti-trade, and obliging it to deposit its moisture on their summits, thus draining it of its latent heat, which would otherwise be given out to the plains beyond in rain or snow.

(259.) The deviations of the isothĕral and isocheimŏnal lines from each other, and from the annual isothermals, or the exaggerations of the annual fluctuation of temperature at any place, refer themselves quite as obviously to a prevalence in its neighbourhood of great tracts of land or of water, and are, in fact, where not accounted for by special and local causes, no other than thermic expressions of its more or less approximation to a "continental" or "insular" situation. (See METEOROLOGY, art. 40.) As instances of purely insular climates, we may take those of the Azores, where the difference of mean summer and winter temperatures is only 8°; at Bermuda, 13°; in the Friendly Isles only 2°; at St Helena, 9°. As examples of continental ones, we find at Prague a difference of 29°; at Tiflis, 44°; at Astrachan, 61°; at Orenburg, 63°; and at Yakutsk no less than 102°, the *mean* winter temperature there being −40°, and the summer +62°. In the interior of North America we find this difference carried not quite to so great an extent, but still far beyond what prevails over the whole of Europe, amounting to 44° at Philadelphia and Washington, and to 54° at Fort Snelling, in latitude 44° north, and longitude 94° west; the winter temperature being −14°, and the summer +68°; while at Florence, in the

same latitude, the corresponding temperatures are 41° and 74°.

(260.) The difference between land and sea climates in this respect falls upon the general average of the whole earth, the northern hemisphere having so great a preponderance of land. By comparing the results of registers, in positions adapted for the purpose, Mr Dove has arrived at the remarkable conclusions that the mean summer temperature (July) in the whole northern hemisphere is 70°·9, and in the southern (January) 59°·5—while the winter means for the two hemispheres (respectively January and July) are 48°·9 and 53°·6—giving to the whole earth an average surface temperature of 58°·25, with an average excess of 8° in July, a kind of general summer, due to the cause above mentioned, and which would be even more influential were it not partly counteracted by the greater proximity of the sun to the earth in January.

(261.) Mr Dove calculates the *mean* temperature of the whole terrestrial equator at 79°·8, and that of the north pole at +2°·2, and the mean summer and winter temperatures at the poles at +30°·6 and −58°·6. It hardly need be observed that the extremes of absolute temperature over the globe vary within much wider limits. Sir C. Napier records a temperature of +132° in the shade in Scinde in June. A *midnight* temperature of 108° has been observed in the Northern Circars of India (Thomson). On the other hand Dr Kane records −67° in January and February at Rensellaer Bay (78° 38′ N. lat., 71° 41′ E. long). Captain Back, at Fort Reliance, observed −70°, and Gmelin, at Kiringa, in Siberia, has recorded an observation of −120° (Thomson). *The difference of the extremes exceeds by* 72° *the whole range of Fahrenheit's scale from zero to the boiling point of water.*

(262.) The isotherm 32° F. limits the region round the pole at which (below a few feet from the surface) the soil may be expected to be found habitually frozen. The course of this isotherm, as drawn in K. Johnston's Physical Atlas, is as follows:—

[illegible]	[illegible]	[illegible]	Latitude N	Longitude	Latitude N
Degrees	Degrees	Degrees	Degrees	Degrees	Degrees.
0	71½	120	49½	240	56½
30	70	150	53	270	50½
60	60	180	58	300	53
90	51¾	210	62¾	330	64

(263.) The line descends then, in the two continents, to nearly equal latitudes (50°). The places where this takes place are at Irkutsk, on the Baikal Lake, and at the southern extremity of Hudson's Bay. The latitude is about that of Cornwall, whose mean temperature is 52°. At Yakutsk the soil is frozen to a depth of upwards of 630 feet, and would be so no doubt to a much greater depth, but that the prevalence of hot springs about that region (Atkinson) indicates a subterranean source of warmth. Throughout Russia and Siberia, if we put confidence in the conclusions of M. Kupffer, there would seem to exist some internal cause of disturbance in the temperature of *the soil*, as distinct from the mean temperature of the air above it.

(264.) The line of maximum mean temperature, or the thermic equator, by no means coincides with the true equator. Over a great part of the Pacific, indeed, and in Mid-Atlantic, it does so pretty nearly; but in those longitudes which include the great masses of land, it deviates northward, crossing South America in about 5° north latitude; and in the 180 degrees of longitude, which include all the eastern world, from the west of Africa to the east of Australia, it approximates much more nearly to a great circle, inclined at an angle of 15° to the equator, and crossing east Africa, Arabia, and the peninsula of India nearly in that latitude north.

(265.) *Distribution of Moisture.*—In considering this branch of our subject, we must distinguish between hygrometrical moisture, which exists as vapour in the atmosphere, and is ready to be deposited in dew at night, and that which falls in rain or snow. The former is always present to a considerable extent, at least within a few hundred feet of the sea-level, and in its average amount (under that condition) is regulated in great measure by the mean temperature of the place. To such an extent is this the case, that, with the exception of four places (Hobartown, Madrid, Tiflis, and Washington, the three last of which are obviously exceptional, and influenced by very special and local causes),[1] the mean pressure of aqueous vapour at all the stations (21 in number) in all latitudes, set down in the list of carefully determined ones, at the end of our article METEOROLOGY, will be found to be represented by the formula—

$$0{\cdot}067436 \text{ in.} \times (1{\cdot}032075)^{t}$$

(Where t is the mean annual temperature in degrees of Fahrenheit), within limits hardly exceeding the difference between the mean results of successive years for each. It increases rapidly therefore in approaching the equator from the poles. The *relative humidity* of the air, however, or the proportion of its vapour to that of saturation, on which depends what is commonly called the *moisture or dryness* of the air, or its evaporating power, is much less dependent on local situation; and, with certain remarkable exceptions, may be taken, on a general average, as about 0·75, or three-quarters of complete saturation at the mean temperature.

(266.) The laws which regulate the distribution of rain (including snow, hail, etc.) over the globe are more complex, and its amount, both average and occasional, subject to much greater local deviations from a normal quantity depending on latitude than either heat or hygrometric moisture. Generally speaking, the average rain-fall of the year is greatest at the equator, and diminishes rapidly, but very far from regularly, in approaching either pole. The average annual rain-fall over the whole globe has been roughly estimated at 60 inches, or 5 feet in depth—between the tropics, 96, and in the temperate zones, 35; that is to say, 37 for the northern hemisphere, and 33 for the southern. In high latitudes, where unaffected by abnormal causes, it is much less,—thus we find an average of only 13 at Uleaborg, and 17 for Petersburg.[2] When we consider, however, that regions of several millions of square miles in extent exist not far from the tropics, in which the average of rain is *nil*, while in others it amounts to 200, 300, and even 600 inches, we see that it is an element to baffle all exact calculation, and that all that can be done is to indicate the sort of local conditions favourable or unfavourable to a high average.

(267.) The favourable circumstances, besides proximity to the equator, are,—1*st*, and within certain limits, elevation above the sea-level. Thus we find for the non-mountainous districts of Europe an average of 23 inches, and for the mountainous ones 42. The influence of this condition, however, diminishes beyond a certain height,

[1] Philadelphia is normal.

[2] These particulars, as well as many of the data, and much of the general statements which follow, are taken (or concluded) from Mr Keith Johnston's excellent synopsis of this subject.—*Physical Atlas.*

which is not the same in all countries, varying from 2000 to 7000 or 8000 feet. Nor is it absolute, but depends much on exposure and on the general configuration of the soil. Thus an elevated and extensive table-land, like the interior of Spain, receives less rain than the plains around it, the current of vapour-bearing wind being tossed up into a higher region after travelling up its slopes, and in so rising, precipitating its moisture. To give the rise of level its full power, a slope increasing in steepness, and facing the moist-wind (whichever that may be), is requisite. A table-land surrounded by mountain ridges overtopping it (such as Thibet, Bolivia, and Utah), is necessarily arid.

(268.) *2dly*, Exposure on the sea-coast to warm winds blowing from the sea. These, in the temperate zones, are the anti-trades. West coasts, then, are rainy in these zones, in comparison with east. The mean annual rain on the west coast of England and Scotland is 45 inches, according to Mr Keith Johnston, while the average for the east coast is only 27·4 inches. This is among the most prominent and general influences. If the west coast be a high one, and especially if the sea adjacent to it be habitually warm, it is carried to a maximum. Thus we find along the north-west coast of America, from Sitka to Vancouver's Island, and along our own west coasts and that of Scandinavia, an annual amount of rain far beyond that which might be expected from the latitude. The average for Sitka (lat. 58°) and for Bergen (lat. 60°) are each of them 88 inches, which, for so high a latitude, is enormous. Now, both these stations are in close proximity to the northern "foci of maximum relative warmth," which is situated at sea to the westward in either case (arts. 254, 256). The west coast of Patagonia is also remarkable for deluges of rain, but being in the immediate proximity of the principal focus of maximum relative *cold* in that hemisphere, the rainfall is chiefly confined to the winter months, whereas in the northern stations it occurs indifferently at all seasons.

(269.) Between the tropics the rains are periodical, and closely accompany the progress of the vertical sun. In India, however, it is the monsoon which blows *on* the coast, and not the position of the sun, which determines the rainy season. This sets in on east coasts with the north-east monsoon (April to October), and on west with the south-west (October to February). The region of the monsoons extends over China, and there it is the north-east monsoon (that which blows over the north-west Pacific) which brings the rains.

(270.) Influences unfavourable to rain are—*1st*, Situation under the lee of high land intercepting the vaporiferous winds. Exposure on east coasts in the temperate zones, and on coasts remote from the monsoon in India, is one form of this condition. It is carried to its extreme when immense and lofty mountain-chains, rising through half the atmosphere of air, and much more than half that of vapour, intercepts the latter in its progress towards them, and effectually drains the winds of their moisture. In such cases, when the lee-country is at a comparatively much lower level, the descending wind, having parted with its vapour, and acquiring warmth by condensation, becomes arid and parching. *2dly*, Exposure to the indraft of trade-winds coming in from a *colder* region. This influence is carried to a maximum when such winds, to arrive at the place, have to traverse much land and little sea, the supply of moisture being less. Even in the open ocean, as we have seen (art. 20), little or no rain falls within the sweep of the trades. *3dly*, Absence of vegetation in warm climates, and especially of trees. This is no doubt one of the reasons of the extreme aridity of the interior of Spain. The hatred of a Spaniard towards a tree is proverbial. Many districts in France have been materially injured in respect of climate by denudation (Earl of Lovelace *on Climate, &c.*), and, on the other hand, rain has become more frequent in Egypt since the more vigorous cultivation of the palm-tree. A sandy or rocky soil is no less influential in producing aridity.

(271.) *Rainless Districts.*—Commencing within a small distance of the coast of Morocco, and including all the north of Africa (except Tunis and Algeria), Syria, the northern half of Arabia as far as the 20th degree of latitude, and almost the whole of Persia, extends a zone of an average breadth of 900 geographical miles, in which rain is altogether absent, or of very unusual occurrence. With a narrow interruption, where the chain of the Himalaya passes into that of the Hindu Kho, and which includes Afghanistan and the Upper Punjab, this zone is prolonged north-east through Thibet, Upper Tartary, and into Mongolia, expanding somewhat in breadth, under the name of the Deserts of Gobi and Shamo. (In Africa it is known as the Sahara, and extends southward, when widest, nearly to the 15th parallel.) It is thus broken into two great rainless districts, the one comprising about three millions, and the other nearly two millions [1] of square miles, which exist as such under widely different conditions, both geographical and meteorological, the separation between them being strongly indicative of this diversity.

(272.) *Deserts of Gobi and Shamo.*—The aridity of this region is of very easy explanation. It unites in perfection all the conditions of dryness. It is fully within the sweep of the north-east winds drawing in from Siberia towards the sun, when vertical over the burning plains of Hindostan, with an immense region of land to windward. It is sandy or rocky, and treeless; and it is completely cut off from receiving any rain from the anti-trades in the winter half of the year by the barrier of the Himalaya.

(273.) *Deserts of Africa, Arabia, Syria, and Persia.*—I. During the months when the sun is north of the equator, the whole of the region occupied by these deserts is within the sweep of the N. E. trades, which, it will be borne in mind, extend over continents to a far wider range from the equator than at sea; both because the medial line of heat follows the sun more closely, and therefore oscillates within wider limits of latitude; and because the heat itself on and adjoining to that medial line is greater. These winds, in arriving at Arabia, Syria, and Persia, have travelled almost entirely over land. Those which arrive in Africa, it is true, have traversed the Mediterranean; but this is a narrow sea; and we have already seen that even the ocean cannot supply vapour enough to saturate the continually-increasing thirst of these winds. II. When the sun is south of the equator these regions lie within the district of the anti-trades, and being under no intercepting influence, might be expected to receive rain. But the winds can only deliver what they have taken up and not re-deposited. Now, if we trace (as in the annexed figure) the course of any parcel of air arriving from any part of the dry region at the medial line of heat (indicated at its greatest southern limit by the dotted line) as a surface or trade-wind (following, that is, a parabolic or hyperbolic curve having its vertex on the equator), indicated by ‡ and returning as an upper current along *the same track reversed* ‡, until it shall return to the surface as an anti-trade, we shall find it to lie wholly, or almost wholly, over intertropical land, and that land hot and dry, for its moisture has been *continually*

[1] By a rough measurement, as laid down in K. Johnston's *Physical Atlas* (allowing for the projections). As usually stated, the areas are much less. Humboldt made the Desert of Gobi, with Thibet, only 549,000 square miles.

swept upwards towards the hottest line in the southward progress of that line, and continually discharged upon it in

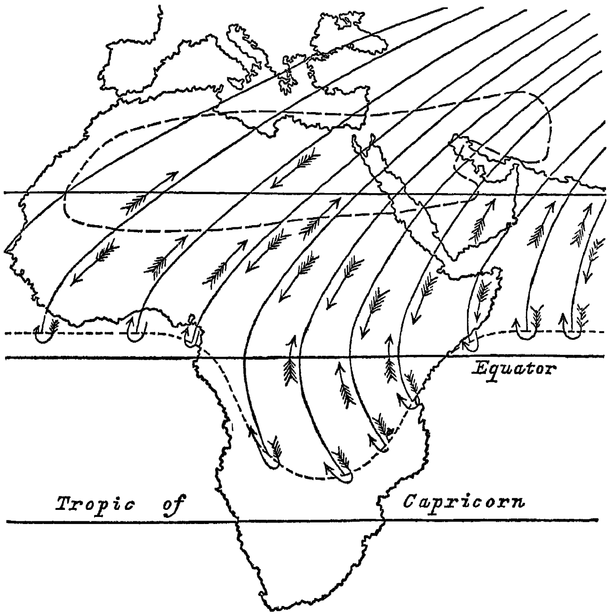


Fig. 1

torrential rains, much more copious, and therefore more exhausting, than the equatorial rains at sea, by reason of the greater elevation attained under the influence of more intense heat. The consideration of the figure will sufficiently explain any point left unsaid. The reader will observe that we decline adopting the doctrine recently propounded of a systematic crossing of the south-east and north-east trades at the medial line. In so doing we are no way disturbed by the phenomenon of infusorial dust of South American origin which occasionally falls on the north-east of Africa. Such dust might be taken up by winds tracing in inter-tropical South America precisely the same parabolic courses as these in Africa, and carried in their return northward as an upper current across the Atlantic. A good portion of "South America" too—all the sultry Llanos of the Orinoco, in which much infusorial dust, the dried residuum of the inundations, might be produced and whirled aloft, lies north of the equator.

(274.) The west coast of Peru and Bolivia, as far as the 30th parallel, is rainless, as is also very nearly so the plateau of Mexico and the west coast of Guatemala. These lie within the region of the trades, and though these sweep over sea as regards Mexico, any rains they may bring are discharged on the eastern slopes of the mountains which receive them. A similar cause, reversed in the direction of its influence, deprives the eastern side of extra-tropical South America of rain, which the Patagonian Andes almost completely intercept, as brought from the Pacific by the north-west anti-trades. California, Utah, and the countries under the lee of the Chippewyan mountains, are, in like manner, hindered of their due supply from the south-west anti-trades, which is discharged on the western slopes of the coast ranges.

(275.) South Africa, though arid, yet as it receives both the trades and the anti-trades from over wide oceans, is not condemned to that extreme of siccity which characterizes its northern region. The west coast receives a great deal of rain from winds sweeping over the warm water of the Mozambique current, drawn inland by the proximity of the heated interior of the continent, and discharging their moisture on the coast ranges of Zanzibar and Mozambique.

(276.) Snow never falls at the sea-level between the tropics. Canton, just on the northern tropic, has been occasionally astonished by a snow fall. In the southern hemisphere the limit is more remote from the equator—Sydney (lat. 36° S.) and the southern parts of the Cape Colony, as far as the 32d parallel, lie within its occasional range.[1] In the north Atlantic it hardly attains so low as 45° of latitude.

(277.) The transition from an inter- to an extra-tropical climate, as regards the fall of rain, is characterized by a very marked change in the season of the rains. In the former, as we have seen, torrential rains accompany the sun in its approach to the zenith. In the latter, on the contrary, the regions adjacent to the tropics are visited exclusively, or chiefly, by rain in the winter months. The reason is obvious. In the former case the rains are those which fall on the first elevation of the vapours into the higher region of the atmosphere, and therefore occur vertically, or nearly so, over the place where that happens. In the latter, they are the *first rains given out by the residual vapour on the descent of the upper current to the surface* as an anti-trade wind, and are, so, periodical in another sense, owing to the fluctuation of the limit between the trades and anti-trades. In open ocean, under the equator, or rather from 4° to 9° north, there is a zone in which it rains heavily, and almost daily, in the afternoon hours, the rains being accompanied with frequent and violent electric discharges, while the nights are serene and cloudless. In the higher atmosphere, between the levels of the upper and under current, occurs a calm stratum, which, over the sea, is almost always uniformly and densely clouded.

(278.) *Distribution of Thunder-Storms, Hurricanes, and Earthquakes.*—The explanation of these phenomena, as physical facts, belongs to the departments of METEOROLOGY and GEOLOGY as bodies of science. Their distribution and greater or less intensity and frequency in different regions of the earth, with reference to the local conditions and peculiarities on which these depend, however, form part of our present subject. As electricity is accumulated during the evaporation, and discharged in lightning during the rapid and copious condensation of moisture, we should expect to find thunder-storms most frequent in those regions where, owing to any general or special cause, the condensation of vapour is frequent and sudden, and least so where moisture is most copiously and continually abstracted from the surface by evaporation, with but little return in rain. And such is the case, for it is observed that in those parts of the ocean over which the trade-winds sweep, thunder-storms are very unfrequent, while in the zone of the equatorial rains, from 4° to 9° north latitude, where the first and most copious discharge of the up-cast vapour takes place, and where the clouds form rapidly, and hurry to their resolution at regular hours of the day in rain, electric discharges are exceedingly frequent and violent. So also the setting in of the rainy monsoon, in the monsoon countries, is ushered in with violent thunder-storms, and so in certain localities, where, during certain seasons, and at regular hours of the day, clouds collect and rain falls copiously (as in the mountainous parts of Jamaica, and in certain valleys leading off from the Lake of Como in Italy), thunder-storms occur daily, during the hottest season.

(279.) In the Polar regions, both arctic and antarctic, thunder-storms are of very rare occurrence, a sufficiently

[1] On the continent of America it has been known to fall at Buenos Ayres (33° S.)—Ed. *Phil. Trans.* vi. 387.

copious supply and sudden condensation of vapour being wanting. M. Geisecke, who resided six years in Greenland, only heard thunder once (Mrs Somerville). Thunderstorms, too, are unknown in the rainless districts of Peru and in California (Gibson), under the lee of the coast-ranges of mountains, which, at the same time that they condense the clouds, attract and carry off the atmospheric electricity. Generally speaking, they are more frequent on mountains than on plains. About forty per annum are reckoned to occur in Greece and Italy, and about twenty-four on the coasts of the Atlantic and in Germany (Mrs Somerville). In the United States they are more frequent and fatal than in Europe.

(280.) Violent gales of wind, amounting to what may be called hurricanes, occur pretty generally everywhere except on the equatorial seas; but in the Steppes, in the interior of Asia, and in the Siberian plains, at the foot of the Altai, as well as among those and the Tangnou mountains, as described by Mr Atkinson, they appear to be singularly frequent and furious. The true hurricane, cyclone, or typhoon, however, is restricted to very special regions, and its production (as explained in METEOROLOGY) is the result of conditions requiring the ascent of locally-heated columns of air or vapour, with a free in-draft from all sides. Accordingly, they are limited at sea to those situations where (under the necessary conditions as to latitude) currents of heated water exist. Where (as in the Gulf Stream) the current is limited in breadth by a well-defined boundary, within which the water is very much warmer than the sea on either side, they follow, with what may well be called considerable precision, the general course of the current. In the Indian and China seas they appear in the neighbourhood of the warm currents, but these currents being much more diffuse and ill-defined than in the case of the Gulf Stream, the region over which they prevail is correspondingly ill-defined; and in the China Sea this is still more markedly the case, though bearing a very obvious relation to the warm-water currents skirting the east coasts of Asia.

(281.) Earthquakes, of course, habitually infest countries adjacent to active volcanoes—such as Sicily and Calabria in Europe, and the neighbourhood of the Andes in South America, where they are stated by Humboldt to be so frequent, that their occurrence, unless severe, is no more regarded than that of a shower in Europe. Java, Sumatra, Japan, and the islands of the Eastern Archipelago, are also exceedingly subject to such visitations. But, besides these, there are districts which, for geological regions less apparent, being out of the vicinity of any active volcanic vent, are infested with frequent earthquakes. They may, however, be for the most part traced for an origin to mountain chains in which either unequivocal evidence of long extinct, and therefore possibly still dormant, volcanic power, can be adduced, or which stand out as grand original axes of upheaval. Thus the whole of Upper India, and a large portion of Western India, from the Himalaya to the mouths of the Indus, is very liable to earthquakes, evidently referable to the Himalayan range as an axis of emanation, and proving clearly that the forces which originally upheaved those mountain masses, are still active, though their energy may perhaps be expended in maintaining them at their present elevation. Between 1800 and 1842, no less than 162 earthquakes have been recorded in these districts (K. Johnston). In 1843, 23 were observed, and since that time 4 or 5 annually. In the peninsula of India they seldom occur below 15° N. latitude.

(282.) Traceable to the neighbourhood of volcanoes not quite extinct, or which, within historic times, have shewn signs of activity, we find Greece, Turkey, Asia Minor, Syria, and Palestine, with the district adjacent to Elbruz and the Caspian Sea and the Caucasus. Antioch was the centre of one of the most terrible and destructive earthquakes on record in A.D. 526, and Syria was visited no longer ago than 1837 with an earthquake extending over 4000 or 5000 square miles of country.

(283.) The south-eastern districts of North America, along the ranges of the Appalachian and Alleghany Mountains, are liable to frequent earthquakes. More than a hundred have been noticed in the last two centuries (Keith Johnston), which, to judge from the direction habitually taken by their oscillatory motion (from S.E. to N.W.), would seem to owe their origin to some deep-seated centre of action beneath the line of the great Mexican volcanoes. By one of the more recent of these, the whole valley of the Lower Mississippi was violently agitated, and its levels permanently altered. Lastly, quite beyond all reference to any reasonably distant source of volcanic power, we find a district of very limited extent in the county of Perth, near Comrie, in Scotland, where a year seldom passes without a shock, though never severe enough to do any material damage. In the Cape districts of South Africa, too, still more remote from any such centre of action, slight shocks are far from unfrequent. Generally speaking, what may be called the earthquake belt of Europe is conterminous, or nearly so, with the zone of newer igneous formation and extinct volcanoes, described in art. 127.

(284.) On the other hand, vast regions, chiefly extensive alluvial plains, or the low districts which extend out to great distances from the principal mountain chains, enjoy an immunity from earthquake shocks, as, for instance, America east of the Andes, and the great plains on the north-east of Europe and the north of Asia. Where historical evidence is deficient, we have often proof, from the continued upright position of ancient monuments, both natural and artificial, of the absence of at least any great earthquake since their creation, or since their attaining their present form, and that, too, in situations where such complete exemption could hardly have been expected. Thus in Mexico, on the Mimbre River, near El Paso on the Rio Grande, we find described and figured by Bartlett (*Personal Narrative*, &c), rocks, as in the annexed cut,

Fig 2.

which could not possibly have resisted even a very inconsiderable shock. On the west coast of Greenland (much of which is of volcanic origin) the same conclusion may be drawn from the existence of a remarkable slender pillar of rock 200 feet in height, figured by Dr Kane under the name of Tennyson's Monument. An ancient column in the country bordering on the Indus, said to have been erected by Alexander the Great as the landmark of his Indian conquests, has been in like manner appealed to in favour of an exceptional degree of stability in its site in a region generally much subject to agitation.

Pompey's Pillar affords similar evidence for Egypt during the last eighteen centuries, though its prostrate obelisks testify no less distinctly to earlier concussions. The Pierre Botte, in the isle of Mauritius, offers a similar testimony. From the immense weight and singularly slender support of the block on its summit (perched on a pillar of rock 1500 feet above the sea), it must have been precipitated by a very moderate shock given to its base.

(285.) *Terrestrial Magnetism.*—This branch of terrestrial physics is treated in considerable detail in the article on MAGNETISM, in a former volume of this work, in connexion with the general subject of that science. We shall here therefore, confine ourselves to a very general coup d'œil of the subject, and to the exposition of the chief outlines of, those facts which regard the distribution of magnetism over the globe, and which are rather of a geographical than a physical nature. In so doing we will suppose the reader to have before him a chart of the world on the Mercator projection, with two polar charts of the arctic and antarctic regions.

(286.) The magnetic elements which observation furnishes are—1*st*, The horizontal direction of the needle, or its "declination" east or west from that of the astronomical meridian of the place of observation, which may be regarded as + or —; the zero corresponding to the absence of any such deviation. 2*dly*, Its dip, or the "inclination" to the horizon, when suspended by its centre of gravity, and allowed freely to take its own position. When the north end of the needle points downwards, the inclination may be regarded as +, when it rests horizontal as 0, and when pointing upwards, as —. 3*dly*, The intensity of the horizontal component of the total directive power of the earth on it; and 4*thly*, That of the vertical component of the same total power. By the relation subsisting between these forces and the geometrical elements above mentioned, any three of them being given, the other may be found, and, moreover, the "total intensity," or the absolute directive power of the earth on the needle, from whose vertical and horizontal resolution the two forces originate. The *declination*, the *inclination*, and the *total intensity*, or simply *the intensity*, are the three primary features which the magnetist regards, whose amount and character in all regions of the globe magnetic charts are constructed to exhibit to the eye, on the same principle as the exhibition of the distribution of heat by a series of isothermic lines. If all the places in which each of these primary elements holds one and the same value be connected on a chart of the world by its appropriate curve, and if a series of such curves be laid down, in which that value is varied by successive steps of 5°, or 10° + and — from 0° for the angular elements, and by successive 10ths or 20ths of the maximum intensity, or of any arbitrary and convenient unit of directive force, we obtain charts respectively of the "Isogonal," "Isoclinal," and "Isodynamic" magnetic lines as they stand related to the configuration of the land and water of the globe, and to its meridians and parallels. The several elements themselves, it should be observed, are attainable by observation, even at sea, with a precision truly marvellous, and little short of that attained by astronomical observation. General Sabine, who has bestowed infinite pains on the collation and discussion of all the recorded observations of voyagers, travellers, and those specially instituted in "Magnetic Surveys," has constructed such charts for the epoch of 1840, which form part of the Physical Atlas of Mr Keith Johnston, from which, and from the introduction to vol. iii. of the Toronto Observations, the following particulars are mainly collected:—

(287.) The globe is divided into two magnetic hemispheres, a northern and southern, in the one of which the needle dips northwards, or the inclination is +, and in the other the reverse. The line dividing these is not precisely a great circle of the globe, but does not deviate very widely from one. It is not coincident, however, with the earth's true terrestrial equator, but inclined to it at an angle of 12°, having its nodes or points of intersection with it, the *ascending* in longitude 3° ±, and the *descending* in 187° ± east of Greenwich. Its principal deviation from a great circle consists in a rather abrupt abnormal excursion from its general course southwards, where it crosses the east coast of South America and runs into the Atlantic.

(288.) Along the whole of this "line of no dip," which is sometimes called the "magnetic equator," the needle, of course, rests horizontally. Receding from it on either side, the dip increases gradually (and, on the whole, not very irregularly in low magnetic latitudes) from 0° up to 90°, which it attains at two points, and *two points only*, which are very commonly designated as the North and South Magnetic Poles. These points have been attained, the northern pretty accurately, the southern nearly, by Sir J. C. Ross in his memorable arctic and antarctic voyages of exploration. The former lies in lat. 70° N., long. 263° E.; the latter in lat. 75° S., long. 154° E. They are, therefore, not diametrically opposite to each other, nor either of them coincident with the geometrical pole of the magnetic equator; and hence arises a want of symmetry in the isoclinal curves, which, however, follow, with some approach to fidelity, a parallel course on both sides to the magnetic equator.

(289.) The globe is also divided into two ideal magnetic hemispheres, by a medial line, or equator of *minimum intensity*; and these hemispheres are, upon the whole, pretty nearly conterminous with those of north and south dip, the medial line being here also not very widely different from a great circle, 12° or 14° inclined to the true equator, and intersecting it in two points, 180° distant in longitude, viz., 32° ± and 212° ± east, for the ascending and descending nodes respectively. And it deserves remark, that in this also the chief abnormal deviation from the general course of the great circle is of the same character, and occurs nearly at the same place, as in the other equator, about the middle of the Atlantic. The intensity is, however, not exactly equal in every part of this line, though always less in it than in any part of the adjacent region north or south of it. The point of absolutely least magnetic intensity on the globe is situate in the mid-Atlantic, somewhere about the parallel of the tropic of Capricorn, its exact position being, from the nature of the case, very difficult to define. The system of isodynamic lines is more complex than that of the isoclinal, and the simplest conception which can be formed of them is, to regard them as the level lines of an ideal model surface, of which the elevations above the sea-level are proportional in every place to the intensity at that place. So defined, this surface will have a channel or valley running round the whole course of the magnetic equator, from which it will ascend on either side, so as to form two great mountain-like protuberances, each occupying one hemisphere. The least magnetic intensity anywhere observed being 0·9 parts of an arbitrary scale, on which the greatest is 2·05, if we suppose the lowest point of the equatorial depression to be 900 feet above the sea-level, the highest culminating point of the whole surface will be 2050. This point is ascertained by the observations of Ross to be situated nearly on the antarctic circle, at about 130° long. E., in Adelie Island. Besides this, the course of the level lines indicates the existence of a second culminating point or pole of maximum intensity, at a still higher southern latitude, and somewhere about the 240th degree of longitude, but which has not yet been approached near

enough to define its exact situation. In the northern hemisphere are also two similar culminating points or maxima, the one in Siberia, rising to 1750, nearly at the point where the river Lena crosses the arctic circle, about the 120th degree of longitude, and the other to 1850 in North America, about 54° N. lat. and 270° E. long. south-west of Hudson's Bay. Between these culminations runs a line of depression, following nearly the course of the meridian, passing through Behring's Straits, and bisecting the Pacific on one side of the globe, and passing out of the Arctic Sea by Spitzbergen, and down the Atlantic on the other.

(290.) Lastly, the globe is again divided (though less definitely) into two magnetic hemispheres, or rather two very unequal compartments, an eastern and a western, by the *line of no declination.* This line (which necessarily passes through both the poles) appears on a Mercator's chart (in which the poles cannot be represented), as two distinct lines, which, were it a meridian, would be at right angles to the equator, and entering it at 180° difference of longitude. Such, however, is not the case; neglecting sinuosities, it assumes the aspect of two oblique lines running from N.W. to S.E., at angles of about 70° with the equator, and dividing it into two unequal arcs of longitude at the 100th and 310th degrees east in the Indian Ocean, south-west of Sumatra, and at the mouth of the Amazon river. Of the compartments so defined, the smaller, which may be termed the western, inasmuch as in every part of it the needle deviates westward from the meridian, includes the north-eastern corners of both North and South America, the whole of the Atlantic, all Europe and Africa, nearly the whole Indian Ocean, and the west of Australia. The other includes, with one exception, all the rest of the world, but that exception is a very remarkable one. Insulated in the midst of its north-western portion, occurs an oval space of an elliptic form, its longer axis following the meridian of 133° E. and its shorter the parallel of 50° N., extending over a large portion of Eastern Siberia (including Yakutsk), half the Sea of Ochotsk, the Sea and Isles of Japan, the Yellow Sea, and the North of China, within which the declination is westerly, and in its central portions exceeds 6° W. This oval is part and parcel of a medial belt of relatively smaller easterly declination which may be traced along the whole course of the easterly compartment, and which leads directly across that small equatorial oval of relative cold spoken of in art. 255, the line of junction holding a similar inclination to the equator, and pointing, with the other features of this system, strongly to an analogy between it and the system of lines marking out the regions of relative warmth and cold there described.

(291.) In middle latitudes of the northern hemisphere, when the sun is *east of the meridian* during the *forenoon*, the needle points more eastward than on the average of the twenty-four hours; when west *also* during the afternoon, more to the westward. These movements are reversed at stations in the southern hemisphere. The fluctuation so arising is called the solar diurnal variation, and its average over the year the *mean solar* diurnal variation. There exists, then, a line which may be regarded as a magnetic equator of a third kind, in which the *mean solar diurnal variation* is *nil.* This line is supposed to be not very different from the line of *minimum intensity.* But in addition to these diurnal periodicities, there is an annual one depending on the sun's declination. When the sun is north of the equator, the diurnal variation, as above described, at stations north of the magnetic equator is exaggerated, at southern ones palliated, and *vice versâ;* and in consequence of this it happens, that at stations *on* this third magnetic equator, although the *mean* diurnal variation on an average of the whole year is *nil*, yet, during one-half of the year a diurnal variation, having a northerly character, exists, and during the other half a southerly.

(292.) Besides these regular fluctuations of magnetic action, others of a very singular character exist, to which the name of "Magnetic Storms," or "irregular disturbances" of the three elements, has been given. They are in the nature of sudden and extensive deviations of the needle from its normal position and force. They occur quite unexpectedly (subject to a condition presently to be mentioned) and simultaneously over very extensive regions, and even, in some instances, over the whole earth; so simultaneously, indeed, that differences of longitude may, in particular instances, be ascertained by their means. Their cause is unknown, but is presumed to be connected with electric discharges, restoring the equilibrium of electric tension, somehow disturbed. Utterly irregular as these magnetic shocks are as to their particular moments of occurrence, and as to their degree of intensity, they yet, taken in their totality, and on a great average, obey the law of solar diurnal periodicity, but with the singular peculiarity of having, at each station, epochal hours peculiar to that station, and not identical with the regular epochal hours.

(293.) By far the most remarkable feature in the magnetic system of the globe, as expressed by their several systems of allineation, is its state of secular change, by which all the isogonal lines are sweeping *westward* in the northern hemisphere, and *eastward* in the southern. From this it happens, as a necessary consequence, that *their forms* are in a constant state of change, and from this, too, we may learn to receive with much suspicion any general theories as to the dependence of directions of mountain chains and mineral veins, on the direction of the magnetic forces in action, seeing that if the present rate of variation should continue, or have continued uniform for a few centuries (to say nothing of great geological periods), the magnetic state of the globe must have been in former ages, and will be in future ones, quite different from the present.

(294.) It appears to be placed beyond a doubt that the moon acts *directly* as a magnet on the earth's magnetism, the latter producing periodical fluctuations of extremely small amount, and which belong rather to the department of Cosmical Physics than to that with which we are here concerned.

(295.) *Distribution of Mineral Products.*—The number of chemical elements which go to constitute the total mass of our planet, so far as at present known, amounts to about 60, and every year is adding to their number, and to that of the already innumerable compounds which they form with each other. They are distributed, however, in such extremely unequal proportions throughout nature, and there are so many of them which, so far as we at present see, play quite a subordinate part in the general economy of the world and in useful applications, that when we come to confine our regards to those of primary importance, we find the list much narrowed.

(296.) The elementary substances which occur among the materials of the accessible crust of the globe in such abundance as to constitute appretiable aliquot parts of its total amount, are—I. *Gaseous.* (1.) Oxygen.—This constitutes one-fifth of the atmosphere, eight-ninths of the sea, half the siliceous and calcareous, and more than half the aluminous rocks and soils, besides entering as a large element into almost every other mineral substance, so that it cannot be reckoned as constituting less than half the ponderable matter of the globe. (2.) Hydrogen; which forms one-ninth of the ocean, and of all that water which

enters into the essential composition of a great many minerals, and the whole hygrometric contents of the atmosphere and of the soil. It enters also largely into the composition of coal, combined with carbon. (3.) Chlorine, as an element of sea salt, and, with this exception, occurring only very sparingly. (4.) Nitrogen, constituting four-fifths of the atmosphere, and otherwise very sparingly disseminated, existing chiefly as a constituent of the nitrates of potash, soda, and lime, which occur in some abundance, disseminated through the soil in India, Persia, and the deserts of Arabia and Africa, efflorescing in caves in America. The nitrate of soda forms strata of considerable thickness in Peru and Chili, on the western slope of the Andes.

(297.) II. *Solid.* The oxides of silicon, aluminium, and calcium, with that of carbon in the state of carbonic acid in the limestones, and of iron as an ingredient of almost universal intrusion into every other substance, constitute an overwhelming majority of the solid materials of the earth. After these probably may be placed those of potassium and sodium in the state of alkalis, forming a very notable portion of the granitic masses (as felspar and albite), and entering into the composition of a great many other bodies, especially (soda at least) into rock salt and sea water. Magnesia, too, as a characteristic element of the rocks of the serpentine character, and entering very influentially into dolomite and into many limestones, is entitled to rank among the more prominent ingredients of the land, though the sea is the source from which, exclusively, it is procured for human use. Carbon occurs as a primary and principal ingredient only in the anthracite and coal formations. The other chemical elements occur only occasionally and locally in any abundance, in veins, mines, and quarries, or disseminated in crystals and nodules in rocks, or as subordinate elements of composition in some or other of the more abundant rocks, or scattered through nature by their disintegration and dispersion.

(298.) The crystalline rocks have no doubt been the origin from which (ultimately) the stratified ones have been derived. From their destruction, partly mechanical, partly chemical, have been produced, by water-washing and graduated subsidence, siliceous and argillaceous strata—the former essentially consisting of the quartz and other hard and unattackable crystalline ingredients, which the action of the waves has been able only coarsely to pulverize, and which have, therefore, been deposited near the shore; the latter, of the aluminous portion chiefly set free, in a chemically divided or flocculent state, by the decomposition of the other ingredients, such as felspar, and of the infinitesimally thin and filmy micaceous scales set loose and floated away to remoter places of quiet deposit. Thus have originated the two great families of the secondary and tertiary rocks; the siliceous and argillaceous, however, hardened and recompacted by subterranean heat and pressure. The third, or calcareous and cretaceous family, it can hardly be doubted, have arisen—1st, From the labours of the animalcule and mollusc; 2dly, From the submarine effusion of calcareous springs (Lyell); and 3dly, From the degradation of calcareous mountain masses, themselves the successors and representatives of former ones, but which have yet, in all probability, undergone the solvent action of sea-water, preparatory to their re-aggregation by the agency of organic chemistry.

(299.) We may consider the mineral products of the earth, in relation to human use, under the general heads of materials for our structures, for our tools and utensils, for objects of ornament and luxury, and for medical use, and domestic and manufacturing consumption. The first of these divisions need not detain us long. Wherever rocky masses occur capable of being quarried and shaped into blocks of sufficient coherence to resist the weather (and there are few strata which, in some part or other of their extent, do not furnish such), building materials are not wanting. For vast and massive structures intended for indefinite duration, and in which delicacy of finish is of less importance than resistance to weather or to violence, granite is admirably adapted; not, however, all equally so. Such granites as contain potash-felspar in great abundance are attacked and corroded by the carbonic acid of the air, assisted by rain and frost. The syenitic granites, or porphyries (of which, as examples, the Egyptian obelisks consist), and those granites in which felspar is replaced by albite (soda-felspar) are far less liable to such disintegration. That of the Aberdeen quarries, of which most of the great granite structures of London consist, is of this description. As a material for the greatest structures, granite presents the advantage that masses of any magnitude can be procured of perfect continuity. These are detached from their beds by primitive but very ingenious contrivances, which must have been known and practised from the earliest times. In some cases grooves are chiselled in the rocky mass, and holes cut at brief intervals along them, into which wedges of baked wood are driven. These, when moistened, swell, and by their simultaneous expansion determine a fissure along the direction of the groove. In erecting an obelisk at Seringapatam, a block 70 feet long was separated from its bed by native workmen, by cutting a deep groove, along which was maintained a line of fires. When the rock had become sufficiently heated, water was poured along, the fires extinguished, and a crack determined along the groove.

(300.) Few but the vastest and most important structures are of granite. Its hardness, and the expense of working it to a smooth surface, prevent its general use as a building material. It is chiefly among the calcareous rocks, the marbles, the oolites, the nummulite limestones, and the harder portions of the chalk formation, as also among the close-grained sandstones, which admit of being easily quarried and sawed into shape, that the architect finds his best resource. Many of the grandest monuments in ancient Rome are constructed of the Traventine, a calcareous deposit from the numerous carbonated sources which occur in abundance along the base of the Apennines, at Volterra in Tuscany, at Terni, and over great districts in the immediate neighbourhood of Rome, and which is seen in process of formation to the present day, by the concretion of mosses, and other small aquatic vegetation percolated by water saturated with super-carbonate of lime. Marbles, adapted for architectural purposes, are of pretty common occurrence, but those fitted for the sculptor's use are exceedingly rare. The finest are those which have furnished, from the quarries of Pentelicus, near Athens, the material of the Parthenon, and those of Mount Marpesus in the Isle of Paros, whence have been derived those masses on which the genius of the Greek sculptors has stamped the impress of immortality, and which, in the Arundel marbles, yet preserve the recorded chronology of that wonderful nation. The finer grain and snowy purity of the marble from the quarries of Carrara, on the Gulf of Genoa, makes it even still more prized. An excellent marble for the more costly architectural purposes, though less so for sculpture (being deficient in whiteness), is obtained in abundance from the Pic de Gerx, in the French Pyrenees.

(301.) The wide dissemination of the calcareous formations is of the last importance in an architectural point of view, from their furnishing the chief and most indispensable material of cement. Where lime is wanting, oyster and

other sea-shells near the sea-coast may offer an excellent substitute; but its absence in the interior of a continent is an evil of no small magnitude. Much of the Cape Colony is seriously inconvenienced by it. As a chemical agent, too, and as an agricultural application, it is of immense importance, though when magnesia occurs as an ingredient in limestone, it acts as a poison on vegetation; and large tracts of country in which this is the case, in the interior of France, in the north of England, in the neighbourhood of Naples, and elsewhere, are doomed to hopeless sterility from this cause.

(302.) Among the argillaceous rocks, the slaty ones claim attention, by reason of their fissile structure and great resistance to weathering, which renders them peculiarly adapted to roofing, and to a variety of other purposes. It is very remarkable that the "slaty cleavage" is never coincident with, but always highly inclined to, the planes of stratification. This Messrs Tyndall and Sorby have explained, we think, to a certain extent satisfactorily, by referring it to the effect of lateral pressure determining the parallel direction among innumerable disseminated infinitesimal films of mica; but they have not shown how such pressure originated, or why it is always lateral. Perhaps we may be pardoned for interrupting the matter immediately in hand by a few words on this point. It is well known to geologists that the slaty rocks are subject to very singular and extravagant contortions, the layers being often folded and refolded on each other like the folds of linen. This is generally ascribed to the effect of violent intrusion of other rocks by the action of upheaving forces, acting on matter softened by heat, or only partially consolidated. A less violent origin of the phenomenon seems to us not improbable. The aluminous strata have probably been deposited in a much more minute state of subdivision, and of a more slimy consistency than the siliceous. Suppose such a deposit to take place in an ocean-basin, with sides inclining generally inwards, and having irregularities in them uniformly over the whole, till the irregularities are filled in, and the bottom reduced to a, generally speaking, basin-like concavity. Up to a certain point, the friction of the bed will retain the deposited matter on the slope, and in this way strata nearly uniform and parallel will be formed. But as the thickness of the whole increases, the weight will overcome the friction, and the still soft strata will yield inwards on all sides towards the central portion of the basin, increasing the thickness there, and at the same time crumpling the strata into contortions where they slide over the irregularities, and congregate towards local centres of depression, while yet the middle thickness increases, and that of each stratum individually (if the process go on slowly and tranquilly), by a general lateral compression and vertical dilatation of the whole central mass (however crumpled): which is all that the compression theory requires to account for the existence and direction of the cleavage in question. It seems by no means impossible, indeed, that instead of requiring the motive power of the volcano and the earthquake to wrinkle and contort the strata in the manner observed, such wrinklings and contortions (or rather the slippages to which they are here attributed, when sudden), may, by displacing the incidence of pressure on the ocean bed, be themselves causes to which some, at least, of those phenomena may be owing.

(303.) The finest slate quarries in Britain, and probably in the world, are those of Penrhyn in North Wales. Between two and three thousand workmen are there constantly employed in quarrying and cleaving the slates, which are conveyed to every part of Britain and of the world, for roofing and writing slates and slabs.

(304.) Among the crystalline schists of the metamorphic series, it is no uncommon thing to find portions, especially of the mica slate, which allow large and tolerably even slabs to be detached, which in Alpine countries are used largely in buildings of the common kind. Many basalts and lavas afford excellent material, but their dark colour gives the piles constructed from them a sombre and heavy aspect. The cathedrals of Clermont and Le Puy afford examples of this.

(305.) Gypsum (sulphate of lime) enters as an ingredient in cements, casts, and stuccos, and is largely used wherever moulded forms are required and great hardness is not essential. In its natural *habitat* it is an almost universal concomitant of rock salt and salt springs, though in some (as at Cardona, in Spain) it is absent, and in others (as at Bex, near Vevay) it occurs anhydrous, and therefore useless for such purposes. Large beds of it, however, occur in the secondary and tertiary formations (seldom or never in the lower series) without the accompaniment of salt, as in the older tertiary basin of Paris (whence its ordinary name of plaster of Paris), in many parts of Switzerland, in North Italy (as at the head of the Lake of Garda), and in the sub-Apennine marls of the older Pleiocene, in Sicily, near Girgente, where it outcrops in crystals of very singular structure.

(306.) The mineral products which contribute to the construction of our tools and utensils are almost entirely either the metals, or those which go to the formation of earthenware and glass. Among the useful metals, *iron* holds the first rank. Owing to its high attraction for oxygen it is seldom found native (though instances do occur, as at Steinbach, Eibestock, at Kamsdorf in Saxony, and in Mont d'Oulle, near Grenoble, in France), unless in masses to which a meteoric origin is usually assigned, and which occur detached and insulated in various places. The principal masses are—the great Siberian one described by Pallas, containing crysolites; that of Otumpa, 70 leagues east of Santiago, "in the vast plains of the Gran Chaco, where, as in the Pampas of Buenos Ayres, *not a stone is to be seen*," which was brought to England by Sir Woodbine Parish, and now in the British Museum, and which weighs 14 cwt.; that of Elbogen, in Bohemia; and that of Hraschina, near Agram, in Croatia (which was seen to fall). Many masses are scattered over Louisiana, and others have been discovered in the Esquimaux country and on the Senegal river. The great mass of Otumpa is far from solitary, however, in that region, and the masses which there occur are described "as huge trunks with deep roots, supposed to communicate with each other." Though alloyed with nickel (a character common to all these so-called meteoric masses) this circumstance, and their abundance near Santiago, "induced" Sir W. Parish, "as well as others in S. America, to hesitate in adopting the meteoric theory," a hesitation greatly increased by the existence in some sandy plains near Toconao, ten leagues from San Pedro, in the province of Atacama, in Peru, of an extraordinary quantity; where, besides detached masses, a vein of solid iron of the same kind is asserted by the natives to exist. This suspicion of other than a meteoric origin of these masses is considerably increased by the occurrence of a similar fact in South Africa. "Eight days' journey east of Bethany missionary station, 'meteoric iron' is found in apparently inexhaustible quantities." Anderssen, to whom we owe the account of this fact, had "seen lumps of several cwts. brought thence, so pure and malleable that the natives convert it into balls for their guns, without any previous application of fire.—*Lake 'Ngami*, 2d ed. p. 325.

(307.) Iron, however, happily for man, mineralized either by sulphur or by oxygen (in which latter state of

combination only it is available for smelting), is diffused over all the world in immense abundance. In the island of Elba are whole mountains consisting of the specular oxide. The mountains of Taberg in Lapland, and Pumachanche in Chili, consist almost entirely of magnetic iron ore, and mountains of it occur in the Minas Geraes in Brazil, where in one place it forms a mountain (Itabira) of the pure oxide, 5250 feet high. It is also plentiful in Corsica, Savoy, Bohemia, Saxony, Russia, and the East Indies. In Britain the principal iron mines fortunately accompany the coal-fields, as around Birmingham, in Staffordshire, and in the great coal-basins near Pontypool, Merthyr Tydvil, and Glasgow. The same coincidence happens in Belgium, and in the coal district near the St. Etienne, in France. It is chiefly the red and argillaceous iron ores which are so associated. These, though mostly occurring in secondary and alluvial countries, are also, though more rarely, found in the so-called primary formations. On the other hand, the oxydulated and brown iron ores belong mainly, though not exclusively, to these formations.

(308.) Among the other metals, it may be observed generally that manganese, like iron, is found among the oldest rocks. Tin, molybdœna, tungsten, titanium, cerium, uranium, chrome, and bismuth, are found almost exclusively in such veins as traverse the lower crystalline rocks. Arsenic, cobalt, silver, nickel, and copper, in these and in the higher members of these series. Gold, tellurium, and antimony, in the upper crystalline metamorphic, and in the older secondary or silurian rocks. Lead, zinc, and mercury are found in greatest quantity in secondary formations. Platina, with its associated metals (the platinoid group), has, with one exception, not hitherto been found in the matrix *in situ*, but (as is also largely the case with gold) dispersed in alluvial gravels, sands, and clays.

(309.) Many of the metals are found almost exclusively in veins. These are fissures or cracks in the rocks, usually of no great breadth, which are filled—whether by injection from below, by sublimation, by infiltration from above, or by crystalline segregation determined by voltaic currents resulting from chemical reactions—with materials of quite a different nature from the rocks in which the fissures occur. The contents of a vein are usually highly crystallized, and arranged with a certain symmetrical reference to the boundary surfaces, so as to form corresponding layers on either face of several different spars (especially fluor), with the metallic deposit, whether sulphuret, oxide, or in union with acids, occupying the middle; such at least is the normal arrangement of the contents of a mineral vein, though it is often widely departed from. Wherever a mineral vein traverses stratified rock, or differently characterized beds of an unstratified one, the strata on its two faces are very frequently, indeed almost generally, found not to correspond—one or other side of the mass having shifted in level (whether by upheaval or subsidence), forming what are called *faults* in the strata. When the fissure has been accompanied with and perhaps formed by the violent injection of non-metallic liquid matter, the vein is called a dyke, whether of granite, basalt, or other igneous rock. In such a case the dislocation is a natural concomitant of the violence used in the formation of the dyke; but it would seem probable that metalliferous veins have, at least in many instances, subsequently and quietly filled up empty intervals, themselves the results of previous violent displacement, not accompanied with the injection of melted matter.

(310.) Veins, as well as dykes, are evidently of different ages, and belong to different and successive actions of the dislocating forces. In Cornwall, where the principal tin mines in Britain, and perhaps in the world, are situated, the stanniferous veins run almost universally east and west, while those which intersect and upheave them, producing or accompanying dislocations and faults in them (which this fact proves to be posterior in date), cut them at various angles, and those which run north and south are rarely metalliferous. The same tendency to an east and west direction in metalliferous veins generally has been remarked in other mining districts, and has been (perhaps rather hastily) drawn into a general law, and referred to a generally westerly course of voltaic currents, connected, as is assumed, with the generally meridional direction of the magnetic needle.

(311.) *Copper, Tin, Lead.*—Of the metals found in veins, these are the most abundant and most generally useful, either pure or in mixture. Copper occurs in granite in the slate formations, in the sandstones of the "Trias" (a connected system of three members—Keuper, Muschelkalk, and Bunter Sandstein—common in Germany), in certain porphyries, and in serpentine. The copper mines of Tunaberg in Sweden are in secondary limestone. In Cornwall, where, in the granite, a copper vein intersects a tin one, the former always disturbs the latter—a proof of later origin. Mines of copper are largely wrought in England, Germany, Sweden, and Siberia; less so in Spain, France, Ireland, Norway, and Hungary. Native copper is of common occurrence, and in North America, in the neighbourhood of Lake Superior, about its upper end, is found in blocks of several hundred tons in weight, so pure as to require to be cut with the cold chisel. Malachite, or the carbonate of copper, which is valued almost as a gem when in fine specimens, is largely procured in the Siberian mines of the Ural and Altai mountains, and in the copper mines of Burra-Burra in Australia.

(312.) Tin has been generally considered to occur native in Cornwall; but, according to Phillips (*Mineralogy*, lxx.), the specimens which have given rise to this opinion have been found on the sites of old smelting works. Mohs (*Mineralogy*) does not admit it into his Order ix. of *native* metals. Its ores (always either oxide or sulphuret) belong exclusively to primitive countries, and the localities of its occurrence are comparatively few, viz., Cornwall, Saxony, and Bohemia in Europe, Tenasserim, in the Malayan Peninsula, and Banca Island in the Straits of Malacca. Some stream works, in which the oxide is found, exist in Mexico and Chili. At Chesterfield, in North America, it has also been found.

(313.) Lead occurs very rarely in a native state. Its chief ore is the sulphuret, which is very abundant in most European countries—comparatively rare in Asia. In England, perhaps the greatest known depository of this ore, it occurs in the secondary limestones of Derby, Durham, and Northumberland, in clay slate in Cornwall and Devon. In Scotland, in the Lead Hills in Lanark and in Dumfries. In North America, in Massachusetts, it occurs in granite and other crystalline or metamorphic rocks, which is also the case in France and Spain.

(314.) *Gold, Silver, Platina.*—Gold and silver, though they derive their high estimation mainly from their application to utensils and ornaments of luxury and splendour, yet perform most eminently the offices of *useful* metals, as the materials of the most universal of all *tools*—coined money. GOLD, owing, no doubt, to its low affinities for oxygen and sulphur, is exclusively found pure, or in alloy or mixture; all the alloys of a definite character, however, are very rare. In its *habitat* it occurs disseminated in nodules or threads in many rocks, but chiefly in quartz, and in the beds of rivers and alluvial deposits, the result of the degradaion of such rocks. The long-inhabited countries have been picked clean of

their alluvial gold, but in newly-occupied ones it is still abundant; confined, however, to the palæozoic rocks in the neighbourhood of porphyritic eruptions, and to the districts adjacent to such rocks, with an *especial preference* for those mountain chains which run north and south. Such are the Mexican and Peruvian Andes, the mountain ranges of California and North-Western America (including the newly-discovered gold districts on the Fraser River and Vancouver's Island)—such are also the mountains on the east coast of Australia, to which the gold districts of Sydney, Melbourne, and Adelaide, owe their wealth. Such, too, is the Ural chain, the chief source of the Russian gold. Gold also is found in Brazil, where almost all the rivers bring it down,—in mines at Matto Grosso, and in Minas Geraes—in the Altai Mountains—in Hungary and Transylvania—in Japan, Borneo, and in the province of Yunan in China, as well as at the base of the Kong Mountain, and in very extensive regions in the interior of Africa, where gold dust is obtained by washing, and where the closer exploration of its mountain chains will no doubt lead to the discovery of rich deposits. The largest mass of native gold yet discovered is that recently found at Ballarat, weighing 2217 ounces, greatly exceeding that of Miask in the South Ural (36 kilogrammes = 1158 ounces) found at Zarevo Alexandrofski in 1842.

(315.) Silver occurs in such immense abundance in Mexico and Peru, among the Cordilleras of the Andes, that it is hardly worth while to enumerate the localities of its feebler exhibition, such as Hungary and Transylvania, the Ural and Altai mountains, Armenia, Anatolia, Thibet, China, Cochin-China, and Japan. The most productive region of the Andes in silver is about Copiapo in Chili. In Peru, from Caxamarca along the whole range of the Andes to the desert of Atacama, it is very abundant. The most ancient mines are those of the "Knot of Pasco." At Potosi and at Chota the ore lies close to the surface. In the mines of Huantajaya a mass of pure silver weighing 800 lbs. has been found. Silver is a very general concomitant of lead, and a large quantity is extracted from that metal. This used to be done by cupellation, the lead being burned off and again recovered; but is now performed by the neater and far less wasteful and costly process of crystallization, by melting the lead, allowing it to cool and crystallize, and pouring off the last portions from the crystals formed, which portions contain all the silver much concentrated.

(316.) Platina is a rare but extremely useful metal. But for utensils formed of it, chemistry could not have attained its present state of improvement, either as a practical art or as a science. It is found in very few localities—in Brazil, at Matto Grosso, in Choco, New Granada, St Domingo, and the Ural Mountains, and always in alluvium.[1] According to the remark of Humboldt, the principal deposits of gold occur on the eastern, and of platina on the western side of the Ural chain. One of the most singular characters of this region is the frequent occurrence of the fossil bones of extinct pachyderms among the metalliferous sands. The largest "*pepite*" (nugget, *i.e.* ingot) of platina hitherto discovered is one of 25 oz. 1 dr., found in the gold mines of Condoto Choco, S. A. (*Phillips*).

(317.) Platina is *invariably* found associated with several other metals forming a family apart (the platinoids), of very singular chemical habitudes—viz., palladium, rhodium, iridium, osmium, ruthenium. Of these, palladium also occurs alloyed with gold and silver in Brazil, and iridium, or rather its osmiuret, occurs in almost all gold in a state of *mixture*, *not of alloy*, and is deposited by subsidence, by reason of its *much higher specific gravity*, at the bottom of the crucible whenever gold, fresh from the mines or diggings, is melted in large quantities. It sometimes settles *in the finest dust* from the melted gold!

(318.) Zinc and Antimony are chiefly useful as alloys tending to harden other metals, a quality which, in the case of zinc in union with copper (producing brass, or bronze), is of the highest importance in many of its applications, and in earlier ages enabled it, with the admixture of tin, to supply the place of iron, then unknown or unworkable. Bismuth is also used chiefly as an alloy, which is also the case with nickel. Zinc is chiefly found in the state of sulphuret or carbonate, sometimes in veins of tin or copper, as in Cornwall, but most frequently associated with lead in the lead-mines of Derbyshire, in the Mendip Hills; in Scotland, in those of Wanloch-head; in Wales, in Flintshire. It occurs also in the mines of Freyberg, in Saxony, Bleiberg, in Carinthia, Tarnowitz, in Silesia, and Medziana Goro, in Poland. Enormous masses of pure calamine are found in some of the North American mines—in New Jersey, and other parts. It is also found in the Siberian mines. Indeed, wherever lead occurs, zinc may be expected.

(319.) Antimony, which, besides its utility in hardening alloys, is also an important medicine, occurs in veins traversing gneiss at Allemont in Dauphiné. In Cornwall, in veins traversing those of copper and tin, at Andreasberg, in the Hartz—in Saxony, Bohemia, Hungary, Transylvania, Tuscany, in Mexico, and in Connecticut in North America. The chief deposits of Bismuth occur in the veins of primitive mountains. The chief localities are in the Cornish mines, Johan-Georgenstadt and Schneeberg in Saxony, Joachimsthal in Bohemia, in Transylvania, Swabia, France, Norway, and in Connecticut, N. A.

(320.) Nickel exists in considerable abundance in China and Japan, whence it reaches us in alloy with copper as tutenag; also in veins of primitive rocks in Saxony, Bohemia, the Banat, and in France; in rocks of the metamorphic and transition series in the Hartz. It occurs also in Swabia, at Saltzburg, in Spain; in veins traversing serpentine in Silesia, and in copper-mines in Frederick County, and at Chatham in Connecticut, N. A.; in Cornwall, and in Scotland. It is an essential ingredient in the so-called meteoric iron, which it effectually preserves from rust (*verb. sap.*)

(321.) Mercury occurs in few localities, the chief of which are the mines of Idria in Carniola, and Almaden in Spain, and it is prominent among the recent great metalliferous discoveries in California, where mines of it exist so extensive as to have given a new impulse to the working of the Mexican silver-mines, where its chief consumption takes place in the process of amalgamation. In medicine its valuable properties have been long recognized, and it has now taken its place among the essential materials of modern warfare, by reason of the detonating properties of one of its salts.

(322.) At the head of metals useful in the chemical arts, and in these only, stands Manganese, whose ores are very widely disseminated both in the primary and secondary rocks, where it occurs in veins, beds, or irregular masses, in the state of black oxide, in which alone it is of any utility. It is found, too, in Cornwall, at Upton Pyne and Tavistock in Devonshire, at Bristol, near Aberdeen in Scotland, at Howth near Dublin, in Ilefeld in the Hartz, in Nassau, at Christiansand in Norway, at Platten in Bohemia, at Johann-Georgenstadt in Saxony, and in several places in Hungary, Moravia, Silesia, and France.

[1] M. Boussigny found it in a syenitic rock associated with gold at Antioquia, in uth America.

(323.) ARSENIC is of almost universal occurrence in combination with the other metals, forming arseniurets and arseniates. CHROME, first discovered in Siberia in combination with lead, is now almost wholly obtained from the chromate of iron, which occurs in copious abundance in Unst, one of the Shetland Isles. These, with cobalt (which generally accompanies nickel), almost exhaust the list of metals useful in the manufacture of utensils, and in the chemical and medicinal arts.

(324.) *Objects of Conventional Value.—Gems.*—At the head of gems stands the DIAMOND, which, from its hardness, may also be reckoned among the useful materials as a tool. As is well known to chemists, it consists of pure carbon. It is found all but exclusively in alluvial detritus, and has never but in two or three instances been found forming an integrant part of any rock. As such, it was once observed to occur in scorodite, in a cavity of brown ironstone at Antonio Pereira, in Brazil, accompanied by micaceous iron, between Villa Rica and Sabara. Humboldt, or one of his companions in travel, detected it in the Ural, *in situ*. M. Harting (*Verh. der K. Akad der Wetensch.* Amsterdam. Deel vi. 1854) describes a diamond from Bahia, including in its substance definitely-formed crystalline filaments of iron pyrites—a fact unique in its kind, and, taken in conjunction with the affinities of iron and carbon at high temperatures, likely to throw some light on the very obscure subject of the ultimate origin of this gem.

(325.) Diamonds are found only in few localities. The principal are between Golconda and Masulipatam, in the peninsula of India, in Visapore, near Panna in Bundelcund, in the vicinity of Ellore, at Mallivully in the Mustapha-nagar Circar (in a peculiar fat white clay associated with ironstone), in the peninsula of Malacca, in Borneo, where the largest diamond known (367 carats=1130 grains) was found in Brazil, in the district of Cerro do Frio, in the country north of Rio Janeiro: also on each side of the Sierra Espenhaço, and on the affluents of the San Francisco river. The chief work is at Mandanga, on the river Jigitonhonha, where diamonds are found in an alluvium of pebbles called cascalhao; at Goyaz, Matto Grosso, and St Paul's. Diamonds are also found in the Ural, and especially in the rich mining district near Beresovsk.

(326.) The SAPPHIRE, ORIENTAL RUBY, and SPINELLE, are chiefly found in Ceylon, in the beds of streams; the finest in the Capellan Mountains near Sirian in Pegu. Sapphires also occur near Billin and Merowitz in Bohemia, in the sand of rivulets near Expailly in France, at Brendola in the Vicentine, and at St Gothard, but not in such quantity or of such value as to make their search remunerative. The Spinelle is not uncommon in Brazil, where also, in the Minas Geraes and at Villa Rica, the TOPAZ abounds. The finest EMERALDS are found in New Granada, in veins traversing a formation referable to the epoch of the greensand or lower chalk. They occur also in Upper Egypt, and in the valley of Tunca in Santa Fé, in granite. The BERYL occurs in the greatest purity and abundance at Nertschinsk in compact ferruginous clay, in Persia in a vein traversing granite, and in a similar *gisement* near Limoges in France. It is also found in Peru, Brazil, Saxony, and Elba, at Cairn Gorm in Aberdeenshire, and in Wicklow, Ireland. To enumerate the *habitats* of the inferior gems would be almost equivalent to giving a catalogue of mineral districts. The GARNET, however, may be mentioned as especially belonging to, and found imbedded in, the mica slate and gneiss formations. CORUNDUM, which, though not a gem, possesses the hardness, and consists of the same materials as one (the sapphire), and is on that account of great utility (in its form of emery), is found most abundantly in India, at Singraula near Sahapur, in Ava, on the Malabar coast, in Smyrna, and the isle of Naxos, in Italy and Spain, in Saxony in beds of steatite, in a schistose rock, and in Gellivara in Lapland. The ZIRCON is most abundant in Ceylon, in the districts of Matura and Suffragam, and is found also at Kalinovskoi near Beresovsk, and elsewhere in the Ural, and in the zircon-syenite rocks on the Aggers Elv in Norway. The CINNAMON STONE is peculiar to Ceylon.

(327.) ROCK SALT is commonly disposed in thick beds, either superficially, as in Africa, or at very great depths, as in the Polish mines at Wieliczka; sometimes at great heights above the sea, as in the Cordilleras and in Savoy. The greatest deposit in England is near Northwich in Cheshire. In Spain at Cardona it forms a rugged precipice four or five hundred feet high, of such purity as to require only pounding to be fit for use. At Lahore in India a similar mass occurs. In Affghanistan a road is cut out of solid salt at the foot of cliffs of that mineral 100 feet high. The island of Ormuz, at the entrance of the Persian Gulf, is a rock of salt. It is almost always found associated with gypsum.

(328.) PORCELAIN CLAY results from the decomposition of the felspar in granitic formations. Under the name of kaolin, it is quarried in China. It occurs also in great purity at Aue in Saxony, and at Meissen, in Austria near Passan, at Limoges and near Bayonne in France. The porcelain manufactories of Worcester are supplied from St Austel in Cornwall, at the foot of the granite range. In the granite districts of Ireland it also occurs abundantly.

(329.) COAL.—Happily for mankind this most useful mineral is very abundantly distributed over the world, though limited in its occurrence to those regions where the limestones of the (thence called) carboniferous series and their associated beds crop out to the surface, or underlie other superficial beds at accessible depths. Coal is generally deposited in "coal basins," or great concave depressions of the strata, partly owing, no doubt, to the general curve of the ocean beds in which the deposit was formed, but much more to their being broken up and dislocated by lateral upheavals, so that the parts no longer correspond—a circumstance extremely favourable to their working, since the great inclination which the beds assume would otherwise carry them down beyond the reach of the miner, were it not that their broken edges are thus brought up again and made to out-crop on the surface.

(330.) The "coal measures," or strata in which the beds of coal occur, usually alternating with clay and sandstone, are almost absolutely restricted to that group of the great geological series which used to be termed the transition series—that is to say, to the formations between the metamorphic rocks and the secondary limestones, &c., and more particularly to the upper Palæozoic formations between the Devonian and Permian groups, and in these, to the interval between the old red sandstone, the mountain or coral limestone and millstone grit below, and the new red sandstone and magnesian limestone above. From this circumstance (their coral substratum), from the nature of the fossils they inclose, and from the form and distribution of the carboniferous districts, it is inferred that their depositions took place in comparatively shallow seas, receiving the vegetable spoils of densely-clothed islands abounding in plants of a tropical character, and in particular, with arborescent ferns, flags, reeds, and large trunks of succulent plants. Few animal remains, and scarcely a single shell or coral, are found in the coal measures, while the vegetable forms, sometimes most beautifully preserved (though more ordinarily completely obliterated) which they contain, sufficiently prove their whole mass to con-

sis of vegetable matter consolidated by heat (after undergoing a specific peatifying action by long submersion in water) under a pressure sufficient to retain the more volatile portions of their structure in combination with the carbon, forming bitumen and all the varieties of hydro-carbon, which, as is well known, the distillation of coal yields in abundance. Where the heat has been very violent, the coal is converted into anthracite, or "blind coal," "culm," or "Welsh coal," which is almost pure carbon; and in some instances, in the neighbourhood of trap-dykes, into true coke, evidently from the effect of heat under insufficient pressure.

(331.) The coal measures would seem to mark an epoch of great interest in the geological history of the world, from the circumstance that whereas their strata bear every mark of great disturbance and violent dislocation, those incumbent on them are for the most part horizontal or comparatively little inclined. Such, at least, is the case in the great coal series of England and the Netherlands, and such is the impression strongly left by the moderate inclination and slight disturbance of the sandstones immediately incumbent on the great coal-fields of North America.

(332.) Coal occurs in immense abundance in all those parts of England, Scotland, and Wales where the strata above specified crop out, especially—(1.) In Northumberland and Durham, in a district the central point of which is somewhere about Jarrow at the mouth of the Tyne, in which it has been calculated that between five and six thousand millions of tons of *workable* coal exist (Phillips citing Thomson); (2.) In South Yorkshire, Nottingham, and Lancashire; (3.) In Staffordshire and Warwick, in a region having Ashby de la Zouche for its centre; (4.) In what may be called the western and south-western coal districts, comprising Anglesey, Flintshire, Shropshire, South Gloucester, Somerset, Monmouth, and Glamorgan; (5.) The Scotch coal-field occupying the great central lowland of Scotland; (6.) The Irish counties of Leinster, Tipperary, Munster, Connaught, and Tyrone. The larger portion of the whole area of Ireland, indeed, is occupied by the carboniferous formations.

(333.) On the continent of Europe coal occurs in Belgium in the district about Liège; in France in the neighbourhood of Vienne on the Rhone. The south of Europe is, generally speaking, destitute of coal. It has hitherto been found but very sparingly in Russia. It has been lately discovered, though of inferior quality, at a depth of 360 feet, near Moscow. By far the greatest system of coal deposits known, however, is that of the United States of America. It is considered that the state of Pennsylvania consists, in about one-third of its area, of coal-fields belonging to the great Appalachian system of coal measures, which extend altogether over upwards of 60,000 square miles. One of the seams in this formation, near Pittsburg, is worked through a large extent of its outcrop as an open quarry. The Illinois coal-field, which covers an area as large as England, in Illinois, Indiana, and Kentucky, consists of horizontal strata, and has numerous seams of excellent coal. Michigan, New Brunswick, Nova Scotia, and Vancouver's Island, all yield coal in abundance. It occurs at the height of 14,750 feet in the Peruvian Andes.

(334.) Coal is also found in a vast number of other localities both in Asia and Australia, in Asia Minor (on the coast of the Black Sea, near Trebizond), in Borneo, Formosa, Tasmania, and New Zealand. In India coal occurs on the Damoda river; also in Silhet and Cashar.

(335.) SULPHUR often accompanies salt and gypsum. It is produced in abundance, accompanying the latter mineral and sulphate of strontia (all three superbly crystallized) in the mines of Catolica in Sicily. The greater part of the sulphur of commerce is procured from "Solfataras" or volcanic half-extinguished vents, where, from "Fumaroles" and fissures in the soil, the sulphur is sublimed. The *Solfatara*, emphatically so called, near Naples, supplies an immense quantity. There exist also great masses of sulphur, constituting almost mountains, such as the Sulphur Island of the Luchu Archipelago. Great quantities occur among the volcanoes of Iceland, of Java, and of the Andes. It is one of the most universal of volcanic products.

(336.) *Distribution of Plants.*—Climate and soil are the elements which determine the abstract possibility of existence of all terrestrial and fresh-water vegetable productions. Their actual distribution over the globe involves, however, another element, which greatly limits the area over which particular classes and families of plants are found to prevail. Thus, while some not only will grow and flourish, but are naturally found indigenous, almost indiscriminately, wherever the soil and climate are suitable, there are others which are found native only in very limited districts, or even restricted to particular spots, removed from which they perish, or refuse to produce seed. Thus, the Disa grandiflora is found exclusively on the summit of the Table Mountain at the Cape of Good Hope, and no one has succeeded in getting it to grow elsewhere. The Coco-de-Mer (Lodoicea Seychellarum) is found only in the Seychelles Islands, and though it can be grown in Mauritius, can never be brought to produce fruit there. The Hymenophyllum Tunbridgense is found hardly anywhere but on the sand rocks of Tunbridge Wells. These, however, and such as these, are rare and exceptional cases, as are also those of plants usually of very low organization, which grow only under special, and even artificial conditions, as in the decaying hoof of a horse, or on the outside of *wine*-casks. They are, however, only the extreme exaggeration of a principle which may be considered as of universal application—that of the repartition of families, genera, and species, in districts or regions more or less extensive, in which only they are indigenously found in full development, though perfectly capable of flourishing and propagating elsewhere when artificially introduced. Indeed, it is found in many instances, that plants so introduced into a new soil and climate, not only rapidly adapt themselves to it, but flourish with singular exuberance of growth, as if their old and original *habitat* had become in some degree exhausted of their peculiar *pabulum*, and they were there in process of dying out. This has been singularly exemplified of late in the instance of the Anacharis alsinastrum, an American river weed, not remarkable for any great exuberance of growth in its native streams, but which, having been accidentally introduced into some English rivers, has spread into others, and is becoming a pest by filling and obstructing their beds in a way before unheard of. The thistles of the Pampas, of gigantic growth and immense extent of distribution, are said to be of European origin.

(337.) As the mean temperatures of the surface-soil and of the air change not only with the latitude, but with the height above the sea, the same limits of temperature which restrict the *habitat* of a plant to a definite zone of latitude, or to the interval between two isothermal lines, will also be marked out on mountains or highlands of sufficient altitude, whose lower parts are situated in an isotherm admitting of its growth, by zones of elevation. In such cases, the plant will be found flourishing at the base and up the slope, and gradually becoming more and more stunted, till it disappears altogether. Thus, on a

lofty equatorial mountain, every form of vegetation, from that of the equatorial to the polar regions, may exist, if the soil and water supply be fitting; each form occupying its appropriate zone. Of those which prevail on the Andes, and over the plains and lower elevations of Equatorial America, Humboldt has given a condensed view in a chart, from which our Plate IV. is copied, and which exhibits well the principle in question; and a reference to which will spare us much verbal explanation. The powerful influence which the element of moisture, as well as heat, has in determining the extent and limit of these mountain zones, is strikingly exemplified on the Peak of Teneriffe, where, at lower altitudes, the cloud-level determines a moist atmosphere, and where, at higher levels, the extreme of desiccation is gradually attained; here we find, according to the recent report of Mr. P. Smyth, that on descending from Alta Vista, where (at an altitude of 10,700 ft.) only lichens are found, we come, at the upper limit of 9800 ft., first on the Retama (Cytisus nubigenus), which occupies the whole zone, down to 5700 feet, to the exclusion of every other plant; then quite suddenly occurs the Erica arboracea, to the exclusion of the Retama, and of all other plants, except the Adenocarpus Frankenoides, which latter extends from 5900 ft. to 4200 ft., not, however, mixing in the upper portion of this, its zone, with the Retama, but occupying cinders, while the latter holds the rocky ground. The Erica descends to 1800 feet of altitude, but in the lower portion of its zone it encounters ferns from 5400 to 2300 feet, the Androscenum Webbianum (4900 to 1400), the laurel (5000 to 3500), and the vine (3700 to 2300). Three thousand feet is the lower limit of the perennial mountain cloud, which separates the under from the upper current of wind.

(338.) The decrease of temperature with increase of altitude, proceeding at an average rate of 1° Fahr. for about 350 feet of altitude (see METEOROLOGY), it will be easy to compute at what height above the sea, on a mountain slope, situate on a given isotherm, a plant, the mean temperature of whose most appropriate *habitat* is known, may be expected to be found, if at all. It is not, however, the mean temperature of the whole year, so much as the law of its distribution over the several months, and especially the temperature attained in the summer months, which principally determines the most vigorous growth of a plant, and the limits of its *reproductive* existence. The latter limit will, of course, be defined by the impossibility of its flowering and ripening its seed. When a plant cannot flower, it must, of course, die out, even if artificially introduced. Now, it has been laid down by botanists, that a plant flowers where the sum of the mean diurnal temperatures (or rather, as maintained by M. Quetelet, on apparently better grounds, that of the squares of those mean temperatures), from the epoch of the first movement of the sap in the spring, attains a definite amount, differing for each species of plant, but invariable for the same, under all circumstances. Wherever, then, on the globe, the climate is such, whether from the lateness of the spring, or the coldness of summer, that the appropriate sum is not attained up to the cessation of the annual cycle of the plant's activity, it cannot flower, much less fructify. This appropriate sum has hitherto been determined for very few plants. For the common lilac, it is 4264 square centigrade degrees (Quetelet, *Probab.* p. 164, Transl.) As the effect of each day's warmth progresses in a higher ratio than that of simple proportionality, it is easily seen that a short and hot summer may (as experience shews it does) far outweigh, in its influence on reproductive vitality, the rigour of a prolonged and severe winter.

(339.) The general influence of climate in accelerating or retarding the fructification of plants and the ripening of their seeds, will be best exemplified by the periods at which the wheat harvest commences on an average of years, in different latitudes, which we find stated by Dr Balfour as follows:—

Localities	Mean Period of Sowing.	Mean Time of Harvest	Difference in Days
Malta . . .	Dec 1	May 13.	162
Palermo . .	Dec. 1	May 20.	170
Naples . .	Nov. 1.	June 2.	195
Rome . .	Nov. 1.	July 2	242
Berlin . . .	...	...	299
Alps (3000 ft.)	Sept 12	Aug 7	329

Owing, however, to the comparatively higher summer heat in Sweden, and the more rapid vegetation than in England, the wheat harvest at Upsala is not later than that in the south of England; and barley ripens ten days earlier. According to M. Berghaus (*Alm. de Gotha*, 1840) the time of *flowering* of plants in general is retarded by 34 days, by an increase of 10° in latitude in the north of Europe, by 40 days in the more temperate countries, and by 74 days (for a similar increase of latitude) in south Europe and Asia Minor. M. Quetelet (*Probab.* 172) assigns 5 days for the general retardation of flowering due to 100 yards of elevation above the sea.

(340.) The local distribution of genera and species of plants over the globe tends very strongly to suggest the idea, now become prevalent among botanists, of specific centres in which they have had their origin, and from which they have spread, by divergence in all directions, till intercepted in their progress of propagation by some insuperable barriers, whether of climate, soil, or sea. The greater or less areas over which they have so spread have, of course, been determined by the natural facilities for the dissemination of their seeds by winds, by birds, or by water transport; while mountain ranges have in some cases supplied, as it were, stepping-stones for traversing regions, the plains of which are not adapted to their growth. This taking place at an earlier geological epoch, when much that is now sea was land, and when a continuity existed between countries now widely divided, affords a satisfactory explanation of many otherwise unaccountable phenomena. Thus, for example, we find the flora of Iceland to be nearly identical with that of the Scandinavian mountains. Europe and North America have many plants in common. The flora of the mountain districts of west and south-west Ireland, as Prof. E. Forbes has shown, is similar to that of the north and west of Spain; that of the loftiest British mountains refers itself to the same origin with that of the Scandinavian Alps. Thus, too, the chain of the Andes has afforded a line of communication of identical species from the equator to the very extremity of Terra del Fuego. The only question at issue is, as to the singleness or multiplicity of these specific centres in the case of one and the same species. Professor Schouw contends for the latter view of the subject, grounding his reasoning on the fact of identical plants appearing in regions so very far remote and separated by such natural obstacles, as to render the idea of migration untenable, as when, for instance, we find European plants, such as Phragmites communis, Alisma Plantago, and others, in America, New Zealand, and Van Diemen's Land, and not in intermediate countries. Sir W. Hooker has enumerated more than thirty antarctic species, as identical with European ones.

(341.) The total number of plants known to exist has been estimated by Dr Balfour at 120,000, and those ac-

tually described, at 96,000, viz., of acotyledonous plants 15,000, monocotyledonous 14,000, and dicotyledonous 67,000. These, however, differ in their relative proportions to each other widely in different quarters of the globe. The lower forms of vegetation, the acotyledons, bear a larger proportion to the others in polar and alpine regions. In equatorial regions, the monocotyledons are to the dicotyledons as 1 to 5 or 6, in temperate as 1 to 4, and in cold climates, as 1 to 3. In the extreme climates of the arctic islands, however, the proportion diminishes, while on the other hand, in the antarctic islands, they are comparatively much more numerous; the ratio in Kerguelen's island being as 1 to 2, and in Lord Auckland's group, according to Hooker, 1 to 2·2. In central and southern Europe the proportion is 1 to 4 on the plains, decreasing with increase of altitude up to 8500 feet, where it is 1 to 7. Among the monocotyledons gramineous forms especially flourish in temperate and cool climates.

(342.) Ferns bear the least proportion to phænogamous plants in the middle temperate zone, where they form about 1–70th of the whole flora, the ratio increasing both towards the equator and the poles. In the low plains of the great continents within the tropics they amount to 1–20th, while in their mountainous districts the ratio is as high as 1 to 7. The proportion of ferns attains its maximum in small islands situate in great oceans. Thus, in Otaheite their proportion to phænogamous plants is as high as 1 to 4, and in St Helena and Ascension as 1 to 2.

(343.) Among the phænogamous plants, the orders of gramineæ, cyperaceæ, and juncaceæ, increase in proportion to the rest as the latitude increases. The reverse is the case with the rubiaceæ, leguminosæ, euphorbiaceæ, and malvaceæ, while the natural orders of cruciferæ, umbelliferæ, and compositæ, are comparatively more abundant in the temperate latitudes, the proportion of the latter rising as high as 1 to 6 in the temperate regions of America.

(344.) The following classification of plants, according to their climatic distribution, specifying those families which are more especially characteristic in each zone, has been given by Von Humboldt, in illustration of the different aspects of vegetation presented in ascending a lofty equatorial mountain, in which the several zones are traversed in rapid succession. Here we find that the—

Region of	Corresponds to the
Palms and Bananas, ...	Equatorial Zone.
Tree Ferns and Figs, ...	Tropical Zone.
Myrtles and Laurels, ...	Subtropical Zone.
Evergreen Trees, ...	Warm Temperate Zone.
Deciduous Trees, ...	Cold Temperate Zone.
Pines, ...	Subarctic Zone.
Rhododendrons, ...	Arctic Zone.
Alpine Plants, ...	Polar Zone

The zones here in question are not limited by parallels of latitude, nor by the mean isothermal lines, but rather by those which we have called isotheral, or those which have an equal mean summer temperature, so as to present on the globe undulated outlines comprising between them plants which have a certain general resemblance. These therefore have been denominated Homozoic zones by Professor E. Forbes. Their limits, however, are necessarily ill defined, as they overlap or run into each other by a community of more or fewer genera and species, and in greater or less abundance of individuals of each such conterminous species.

(345.) The equatorial zone, according to Dr Balfour, besides the palms and bananas, which may be regarded as its most abundant characteristics (including the cocoanut and plantain), comprehends also arborescent grasses, orchidaceous plants and lianas, the coffee-trees, the ginger and its congeners, together with the cinnamon, the nutmeg, and other rich spices. The baobab (Adansonia digitata) of Senegal, the most massive, and supposed to be among the longest-lived of trees, is a native of this zone, as are also many others of gigantic growth, and of great commercial importance, as the mahogany-tree of Honduras and Cuba, the locust-tree of the West Indies, the logwood, the mora of Guiana, and the ebony; and among edible products, the pineapple, breadfruit, and the finest of all fruits, the mangosteen (Garcinia Mangostana), a native of Malacca.

(346.) In the tropical zones, besides the tree ferns and ficus family, to which the banyan of India belongs, which are its predominant characteristics, we find the piperaceæ (pepper and its congeners), melastomaceæ, and convolvulaceæ, among which the C. Batatas or sweet potato, is among the most useful. The yam also (dioscorea) belongs principally to this zone, as does also the teak, one of the most valuable of timber trees.

(347.) In the subtropical zones few palms occur; we find in it, however, the date palm of Egypt and North Africa, and the Chamærops Palmetto, which extends even into Sicily. These, however, are the zones *par excellence* of the euphorbias and cactuses, the magnolias, proteas, heaths (erica), and their Australian representative, the epacridaceæ. The zamia and cycas also occur. This zone is remarkable for the enormous growth of several of its timber trees. In California (included in it) has been discovered the Wellingtonia gigantea, the loftiest and grandest of trees, said to attain the almost fabulous height of 400 or even 500 feet, with a diameter of forty or fifty feet near the ground. The Californian pine (Abies Douglassii) is also of enormous stature, sometimes attaining 245 feet in height, with a circumference of fifty-seven feet three feet from the ground. The Araucaria imbricata of Chile also attains the magnificent altitude of 260 feet, the Norfolk Island pine (Eutassa excelsa) 224, the Snuglok (a species of tropical oak in the Valley of Teesta, in Sikkim) 200, &c.

(348.) Besides the evergreen oaks in the south of Europe, we also find in the warmer temperate zones, in perfection, the esculent fig, the orange, the pomegranate, and the vine, with numerous species of cistus, vaccinium, smilax, and melaleuca.

(349.) In the colder temperate zone we find the vegetation so familiar to us in England and in north Europe—the oak, the ash, the beech, the chestnut, and the walnut; great forests of coniferæ, the hemlock spruce, and the sugar maple of the American forests. In the southern hemisphere the blue gum-tree attains a gigantic size in Van Diemen's Land. Elwes (*Tour round the World*, p. 268) records a specimen in Lory Bay 27 feet in girth at five feet above the ground, a quite straight tree, which would square 2 feet 6 inches at 200 feet, and containing 5000 cubic feet of timber!

(350.) The subarctic zone is that of coniferæ, willows, birch, and poplar. In the valley of the Black Irkut, in Siberia, Atkinson found a ravine filled with ice, and large poplars growing in it, with their trunks imbedded 25 feet in snow and ice, while the branches were in full leaf. Around each stem was a hollow of 9 inches, thawed and full of water.

(351.) In the arctic zone the willow, the birch, and the alder are dwarfed. The Pinus sylvestris and Abies excelsa in north Europe; rhododendrons, azaleas, and andromedas in North America, with some grasses and numerous lichens and mosses also occur.

(352.) Finally, in the polar zone neither trees nor bushes, nor any cultivable esculent plants can exist. Yet Melville Island produces 67 species of flowering plants, and Spitzbergen 45. Kane found 22 species at Sylvia

Headland in 78° 41′ N. lat. Saxifrage, dryas, papaver, ranunculus, juncus, potentilla, salix, and some other genera, are enumerated as among the plants of these regions. In the southern hemisphere the vegetation of the subarctic zone is confined to a few cryptogamous plants, and that of the arctic and polar zones may be considered as *nil.*

(353.) Botanists, however, have considered the distribution of plants under another and more special point of view, taking account, not so much of the general contents of the zones of climate, as of those regions or districts over which particular families of plants prevail in their fullest state of development, or to which they are exclusively confined. Of these distributions, perhaps, the most generally received is that of Schouw, who divides the surface of the globe into regions, on the principle that, to constitute a botanical "region," at least one-half of the *species*, and one-fourth of the *genera*, of some one or more natural families of plants, should be peculiar to it, and that individual *orders* should either be peculiar to, or reach their maximum in it. Where this condition is either imperfectly fulfilled, or the flora of a district, though evidently peculiar, is not sufficiently known to afford a phytological designation to it, the "region" must be accepted as a provisional one.

(354.) The first botanical region thus marked out is nearly co-extensive with the polar and arctic zones of the former subdivision, including all the land within the polar circle and the northern parts of the two great continents, from the ice down to the zone of trees; and the upper parts of the European mountains and those of North Asia, down to the arborescent belt. *Saxifrages* and *mosse* are the especial characteristics of this region, gentianaceæ, caryophyllaceæ, cyperaceæ, and salicaceæ, also abound. In the northern portion of this region carices predominate. On the more southern alpine heights primroses and campanulas appear. On the warmer borders of this region forests of fir and birch, to the exclusion of other trees, begin to present themselves.

(355.) The region which extends in northern Europe and Asia from the warmer limit of the former down to the Pyrenees, Alps, the Balkan, and Caucasus, and the Altai range of mountains, is especially characterized by the predominance of *umbelliferous* and *cruciferous* plants. In this region also (which is nearly conterminous, in the quarters of the globe to which it belongs, with the zone of deciduous trees) coniferous and amentaceous trees abound; and of shrubs and other plants, the families rosaceæ, ranunculi, carices, and fungi, are largely developed. In its north European portion, chicoraceous plants abound (the dandelions and their congeners), while in southern Asiatic Russia and the countries bordering on the Caucasus, cynarocephalæ (the thistle and artichoke tribe) and astragali, as well as many saline plants, appear as prominent features. The cultivated plants are those of the temperate zones.

(356.) The next botanical region may be considered as including the Mediterranean flora, that is, of south Europe, Asia Minor, and north Africa, down to the Desert, the Canaries, and Madeira, with exception, of course, of the Alpine heights, which belong to the first region. Here stand prominent the *labiatæ* and *caryophyllaceæ* (families of which the blind nettle and pink afford instances). This, within its limits, coincides with the zone of evergreen trees, and nourishes those fruit-bearing trees enumerated in our account of that zone. Rice also and millet, cotton, guinea corn, and the almond, are here cultivated. The cistus abounds in Spain and Portugal; the aromatic labiatæ and scabiosæ in France and Italy; the shrubby labiatæ in Greece and Asia Minor; the oleander adorns the Mediterranean coast, and many balsamiferous and gum-yielding trees and shrubs flourish in Asia Minor and North Africa. In the Canary Isles the family of houseleeks (sempervivum), and in Madeira arborescent heaths are common. Four-fifths of the Azorean species are European, the remainder are peculiar to the Atlantic islands. A specimen of the Dracæna Draco, on Teneriffe, in the Canaries, is said to be the oldest existing tree.

(357.) The flora of the eastern portion of North America, from the limits of the arctic region to the 36th parallel, differs from that of the corresponding district in Europe in the paucity of umbelliferous, cruciferous, and cynoracephalous plants; in the absence of heaths; and in the predominant abundance of *asters* and *solidagos.* Maize is much cultivated in the southern part of this region. Among its forest trees the hemlock, spruce, and the sugar maple, the hickory, the tulip-tree, and the liquid amber, as well as many peculiar and magnificent oaks and others, which in autumn assume the most vivid tints of red and yellow. Kalmias, azaleas, rhododendrons, hydrangeas, and other richly flowering shrubs, occur also in great abundance.

(358.) The western flora of North America, down to the same parallel, is less known, and constitutes a region apart—that of California, Oregon, Vancouver's Island, and Russian America. It is remarkable for the beauty and brilliancy of colour of its flowers, among which the eschscholzia would seem to have imbibed the quintessence of the Californian gold. The nemophilas, clarkias, and innumerable others of this region, have become the pride of our gardens. But it is chiefly in the grandeur of its timber trees that this region stands conspicuous. The Wellingtonia, or "Mammoth tree," has already been mentioned (art. 347), and a vast number of peculiar coniferæ, such as the Abies balsamea, grandis, alba, canadensis, Douglassii, the Pinus ponderosa, Lambertiana, insignis, Fremontiana, and many others, of which A. grandis attains the height of 224 feet, A. alba 160, P. Fremontiana 224, and Lambertiana 235. The Thuyia gigantea of the Rocky Mountains attains 200 feet. Many of these thrive well in England.

(359.) The southern region of North America, which may be called, *par excellence*, the region of *magnolias*, is distinguished from the corresponding region of the old continent by the paucity of labiatæ and cayrophyllaceous plants. Its trees have broad shining leaves and beautiful flowers. The tulip-tree here attains 120 feet in height. Here, too, we have the long-leaved pitch pine (one of the most picturesque of trees), clothing the "pine barrens," while the swamps of the southern states produce the deciduous cypress, the aquatic oak, and the swamp hickory. Among the more beautiful and curious of the flowers are the Nelumbium luteum and the Dionæa Muscipula. The forests of Florida and Alabama are hung with air-plants (Tillandsia usneoides). In this region also many tropical forms occur—zinziber, cycas, cactus, anona, &c. Of 2891 species of phanogamous plants in the United States, only 385 occur in northern or temperate Europe.

(360.) In the subtropical, or warm temperate region of east Asia, from the 30th parallel northward, comprehending Japan, the north of China, and Chinese Tartary, plants of the order *ternstræmiaceæ* (tea and its congeners) and *celastraceæ* chiefly abound. Camellia, thea, citrus, rhamnus, and lonicera, occur abundantly, the two latter in Mantchouria so much so, as to give a peculiar character to the vegetation, and to merit for it the name of the region of *rhamni* and *caprifoliaceæ.* The flora of this region is, in many respects, intermediate between that of the Old and New World. The loquat, the tallow-tree (Stillingia sebifera).

the camphor-laurel, and the Westaria sinensis, are natives of this region. The south of China forms a distinct region, having many peculiar plants, among which the rice-paper plant of Formosa, and that delicate fruit, the litchi, may be mentioned.

(361.) The flora of India, Ceylon, and the south-eastern Asiatic peninsula, to the height of 4000 or 5000 feet, is more expressly marked by the number of *zinziberaceous* plants, by leguminosæ, cucurbitaceæ, and tiliaceæ. Here also we find the cocoa-nut, the mangosteen, cinnamon, cloves, turmeric, indigo, cotton, and pepper. Teak is abundant in the Birman empire and on the Malabar coast. The varnish-tree and that which produces the stick-lac; mangroves, casuarinas, immense bamboos, the satin-wood, (Chloroxylon Swietenia), the Borassus flabelliformis, a magnificent palm, said to grow 100 feet high, and to produce leaves large enough to shelter twelve men, and the Amherstia nobilis, the most magnificent of flowering trees belong to this region.

(362.) The mountain country south of the Himalaya, to the height of 10,700 feet, including the Sub-Himalayan provinces of Upper India, form a region which has some European plants. Ranunculus, nasturtium, veronica, and polygonum, mix with a rich vegetation peculiarly Indian. Here occur the Cedrus deodara, supposed by Hooker to be a variety of that of Lebanon, sometimes attaining 200 feet in height and 36 in girth; the Pinus excelsa, Webbiana, longifolia, and others. In the higher portions of this region are found species of oak, rhododendron, berberis, and primula; in the lower, many tropical plants. In the valleys of the Central and East Himalaya, arborescent ferns and orchids occur in great luxuriance. The Saul wood too, (Shorea robusta), that dreadful poison the Aconitum ferox, and that most beautiful of magnolias (M. insignis), are natives of this region. India abounds with urticas (nettle), the sting of some of which, as U. crenulata, is most formidable in its effects.

(363.) To the region of the Asiatic islands, including those of the Indian Ocean and those between the Eastern Peninsula and Australia, below the altitude of 5000 feet, belong most of the plants of tropical India, with many peculiar ones, as the Carica papaya (papaw-tree), which occurs also in Central America, the Jatropha manihot, the bread-fruit, coco-de-mer, the poisonous upas of Java, and a nettle even more formidable than the Urtica crenulata, whose sting sometimes produces death (the Daoun Satan or Devil's leaf of Timor), as well as that of Sumatra, called tenacissima, which makes excellent cordage. The Rafflesia Arnoldi of Sumatra, a parasitical plant, bears the largest of flowers, being 3 feet 6 inches in diameter. Orchideæ and other parasites load the trees in the rank forests of Java, and ferns also are abundant. This is especially the region of spices. The forests produce an infinite variety of useful and ornamental woods. In Borneo are found the Dryobalanops camphora and the Pandanus odoratissimus or screw pine, a tree with buttress-like roots, every branch of which terminates in an enormous head, like the pine-apple plant. The sugar-cane is cultivated in Mauritius, and the whole character of the vegetation of this region is rich and luxuriant beyond imagination.

(364.) The higher portions of this district, where it exceeds 5000 feet in altitude, has a flora of its own, nearly allied to that of the higher elevations of India, in which extra-tropical forms replace the tropical, and where we find forests of various species of oak, podocarpus (a species of yew), plantagos, gentians, and vaccinia, and other genera of colder regions.

(365.) The islands of the Pacific (Oceanica) form a region the character of whose vegetation partakes of the Asiatic and Australian. Of their 214 genera, 173 are found in India. In the Sandwich Islands nearly one-third of the vegetation consists of ferns. No less than 50 varieties of bread-fruit, the paper mulberry, the Dracæna terminalis or ki, which supplies food and an intoxicating drink, the Tacca pinnatifida or Otaheite saleep, which produces a starch, with several other peculiar fruit-bearing trees and esculents are found here. Lobelias, grapes, sedges, myrtles, and arums also abound. In common with the Australian flora, we find in this region species of casuarinæ, proteaceæ, epacridaceæ, and acacias.

Physical Geography

(366.) The Arabian region, which includes that part of the Asiatic continent stretching across Persia and Afghanistan to the plains of north-west India, is more especially characterized as that of balsamic trees, mimosæ, acaciæ, balsamodendron, and amyris. The coffee, the sensitive plant, numerous species of ficus, senna, &c., are also products of this region. The Boswellia serrata produces frankincense. *Coffee* is supposed to be originally a native of Abyssinia, where in *Kaffa* it forms dense thickets.

(367.) The Desert region, comprising the sandy wastes of Africa and Syria, as may easily be supposed, is poor in plants. It has no peculiarly characteristic genera, and the species which chiefly inhabit it are those of acacia, mimosa, cassia, and zygophyllum or caper-bean, the date, palm, and the dourra (sorghum) supply food, and the pennisetum grass and Alhagi maurorum form the chief support of the camel.

(368.) The flora of tropical Africa is but imperfectly known. Leguminous, rubiaceous, and cyperaceous plants abound throughout. On the west coast we find the baobab and the palm-oil plant (Elais guineensis), ground nuts, and the akee (Cupania sapida), the envelope of whose seed is eaten, the kola nut, the Pentadesma butyracea, the butter and tallow tree of Sierra Leone, and the poison bean of Calabar. On the east coast the distinguishing genera are danais, ambora, dombeya, and senacia. Cotton, indigo, tobacco, the sugar-cane, ginger, yams, cassada, bananas, cocoa-nuts, papaws, oranges, pine-apples, and many others, form the rich catalogue of vegetable delicacies and commercial treasures furnished by this important region.

(369.) Central America (including Mexico and South America to the Amazon river, from the sea level to 5500 feet in altitude) is the region especially characterized by *cactuses and piperaceous plants.* In the West Indian isles, ferns and orchideous plants also prevail. In Panama, besides these, we find abundant leguminosæ, melastomaceæ, compositæ, and cinchonaceæ. That noble flower, the Victoria Regia, occurs in this region, and in all the warmer parts of south-eastern America. The lower parts of Mexico, Guiana, New Granada, and Peru, abound in palms. The vegetable-ivory palm is a native of the last-named province. The Anona Cherimolia, or Peruvian pine-apple, is celebrated. Indeed this region is the original *habitat* of the pine-apple. The fragrant vanilla, and that kind of vanilla called chica, are cultivated in this province, with the Theobroma cacao or chocolate. The sugar and tobacco culture of the West India islands is too well known to need mention. The agave, or American aloe, which yields the pulque wine, the custard-apple, and guava, the cassava or manioc, and the capsicum; among woods, the Hymenæa Courbaril, or copal tree, logwood, mahogany, &c.; and among poisons, the ourali or woorara (Strychnos toxicaria), are also indigenous in this most rich and productive region.

(370.) The Mexican highlands (above 5500 feet) offer, of course, the prevailing families of the colder countries. Many peculiar coniferæ, as the Pinus religiosa Apul-

censis, Hartwegii, and Montezumæ, sixteen species of quercus, and the deciduous cypress (which here attains a height of 120 feet, and 30 or 40 feet in girth) grow here.

(371.) Between 5° and 20° S. lat., and the altitudes 5000 and 9600 feet in the Cordilleras of the Andes, the *cinchonas*, which yield the medicinal alkaloids, quinine and cinchonine, are found almost exclusively. The Ceroxylon andicola, which produces wax on the surface of its stem, and the Chenopodium Quinoa, a Peruvian plant affording a nutritious meal from its seeds, are native here.

(372.) The still loftier elevations of the Andes are particularly rich in *escallonias* and *calceolarias*, associated with many alpine plants. The cultivated vegetation of the warm temperate zone is not altogether absent from this region, since we find the vine, the orange, and the olive succeeding well in La Paz, on the plateau of Bolivia, 12,200 feet above the sea-level. (K. Johnston.)

(373.) The basin of the Amazon river, and the upper part of that of the Parana, comprising the portion of South America east of the Andes from the equator to the southern tropic, is rich beyond description in every form of forest vegetation. *Palms* and *melastomas* are its more characteristic forms. We have reeds of 100 feet high, grasses of 40, and tree ferns. The magnificent forest trees are covered, and, in some cases stifled, with overwhelming masses of parasitical creepers, with orchideæ, araceæ, tillandsias, epiphytic cactuses, peperomias, and gesneras, or with lianas, including bignonias, passifloras and aristolochias, &c. The Eriodendron saumauma (which, from its habits, ought to be called Excelsius), puts forth no branches till it has overtopped every other tree of the vast Amazonian forests, over which it then predominates unrivalled. The Siphonia elastica, which yields caoutchouc, is indigenous in Brazil. That wonderful product, the coca leaf or ipadu (from the Erythroxylon coca), is obtained from the tropical valleys of the eastern slope of the Andes. The yerba maté, or Paraguay tea, represents in its general use, as it partakes in its properties, and in the presence in it of *theine*, the tea plant of China.

(374.) Extra-tropical America, from the southern tropic to 40° S., including South Brazil, La Plata, and Chili, is more especially the region of *arborescent compositæ*. Its flora exhibits an approach to those of South Africa and Australia, in the families of protea, polygala, oxalis, araucaria, and goodenia. That superb tree, the Araucaria imbricata, which may be also considered as a valuable fruit tree, is a native of Chili, as are also some species of arbor vitæ. The chief approximation of this region is European, more than half its genera being common to both. The vine and peach are cultivated. The potato is found wild both in Peru and Chili. The loasa, a stinging climber, has been introduced into our gardens from the latter.

(375.) The portion of America south of this, with the Falkland and other antarctic islands, constitutes another region, in which the forms of the northern and arctic zones prevail. A greater number of plants, in Terra del Fuego, identical with, or nearly allied to those of Britain, occur here, than in any other part of the southern hemisphere. Some of the beech trees are peculiarly beautiful. The flora of the higher mountains is European. Evergreen plants prevail, and the fuchsia, in winter, presents a singular spectacle—arborescent, and covered with snow, while still green, and frequented by humming birds (King.) The Falkland Isles are treeless, but rich in the vegetation of the tussac grass and bolax globaria, which forms dense round balls, or sometimes a dense bushy mass, along the top of which it is practicable to walk when impenetrable to the traveller at the ground level. The character of the antarctic islands, south of these, is one of utter desolation. In Kerguelen's Land only eighteen species of flowering plants exist.

(376.) South Africa has a very peculiar and striking character of vegetation. The *mesembryanthemum* and *stapelia* families are especially abundant, but little conspicuous in comparison with the heaths which there luxuriate in astonishing profusion, as well as the geraniums and pelargonia. Innumerable bulbous genera and everlastings clothe the sandy flats and mountain terraces with beautiful flowers; and the proteaceæ form a rich and peculiar feature, especially the P. (leucodendron) argentea, with its silver-silky leaves. The heaths and proteas are chiefly abundant in the most southern districts. Northward, thorny acacias abound, among which the "wait-a-bit" (A. detinens) is the traveller's plague, with a profusion of aloes and great succulent euphorbias, which attain a tree-like development. In the desert plains of Latakoo, Burchell describes scanty plants not two feet high, with hard woody stems, and two or three centuries old, which abide their time to put forth a transient life on the few and far-between occasions (sometimes several years asunder) when rain falls. The flora of South Africa is connected with that of Australia by the links of the proteæ, restiaceæ, iridaceæ, diosmas, and others.

(377.) The vegetation of Australia is also exceedingly peculiar. Taken as a whole, it has been characterized as the region of *eucalypti* and *epacridaceæ*, which latter represent, in this continent, the heaths of the old world. "Several entire orders of plants are known only in Australia, and the genera and species of families which grow elsewhere assume new and singular forms. Persistent-leaved trees, with hard, narrow leaves of a sombre, melancholy hue, are prevalent, and there are whole shadowless forests of leafless trees, the footstalks of the leaves, dilated and set edgewise on the stem, supplying their place. Plants in other countries have glands on the under-side of the leaves, but in Australia there are glands on both sides, and the changes of season have no influence on the unvarying olive-green of the Australian forests. Even the grasses are distinguished from those of other countries by a remarkable rigidity."—(Mrs. Somerville.) Among the Australian forms are many proteaceæ. Nearly half the known species of this order grow in the parallel of Port Jackson on both coasts. There are 100 species of eucalypti, and 93 leafless acacias. Casuarinas, with long-jointed, drooping branches, afford the principal timber; and the Norfolk Island pine (Eutassa excelsa) is one of the most superb of trees. The roses of the old world are replaced by banksias, which are already naturalized in our gardens.

(378.) New Zealand furnishes another, and the last, of those botanical regions. Its flora connects itself with that of Australia, South America, and the Pacific islands. Out of 1900 or 2000 species of plants it contains, only 730 are flowering ones, and of these, two-thirds are absolutely peculiar to it. Of the rest, according to Hooker, 193 species are Australian, 89 South American, 60 European, and 50 antarctic. The Phormium tenax (New Zealand flax) is a very valuable product. 120 ferns, some arborescent, rising to a height of 40 feet, occur. The forest trees are peculiar, and furnish excellent timber, the Kauri pine being one of the most remarkable. One palm only grows here, the Areca sapida, and, among flowering trees, the Metrosideros tomentosa is remarkable for its rich crimson blossoms.

(379.) *Marine Vegetation.* It would lead us too far to enter into any particular account of marine botany. Like

that of the land, it has its regions:—1. Northern; 2. North Atlantic; 3. Mediterranean; 4. Tropical Atlantic; 5. Antarctic; 6. Australian and New Zealand; 7. Indian Ocean and Red Sea; 8. Japan and China Seas; 9. Pacific. The sargasso, or gulf-weed, forms a mass of almost continuous vegetation in the Atlantic, covering 260,000 square miles. The Macrocystis pyrifera is of universal distribution; wherever the sea is exempt from ice, it occurs in immense masses, at a mean depth of 6 to 9 fathoms. Individual plants attain 700 feet in length. Fucoideæ abound in the higher north latitudes, and cystophora in southern. The lavers of the British seas (as if to carry out the general resemblance noticed in art. 375) occur at the Falkland Isles, where also is found the Durvillæa utilis, "a vegetable cable several hundred feet long, and as thick as the human body."

(380.) In depth, according to Professor Forbes, one great zone lies between the high and low water marks; a second (the region of fuci and laminariæ), from low-water mark to 7...15 fathoms. Ordinary algæ exist only within 50 fathoms of the surface. In the Mediterranean and Ægean seas, marine vegetation occurs at the depth of 100 fathoms.

(381.) *Cerealia.* WHEAT has been lately referred by M. Fabre, as its origin, to the Ægilops ovata, a native or the south of France and the Mediterranean coasts, which by careful culture he finds to shoot into varieties, and these again into others more and more nearly resembling wheat, till, after fifteen or sixteen years, a true wheat results. The conclusion, however, has been still more recently more than called in question by Dr Godron, who considers the case one of hybridation from neighbouring wheat fields (*Jour. R. Agricult. Soc.* xix. 108). Wheat will not yield produce within the tropics at the sea level, at least during the hotter season, though, in the colder months, it may be grown a few degrees nearer the equator. Its northern limit is 58° N. in Britain, 64° N. in Norway, 60° in Russia, and lower in Siberia. In Chili and Peru it grows luxuriantly at 8500...10,000 feet above the sea. Humboldt saw a wheat plant in Mexico with 70 stalks, some bearing ears of 100 grains. BARLEY can be grown as far north as 70° in Lapland, and 68° in Siberia; on the Alps, as high as 3500 feet, and on the Himalayas, up to 12,000. RYE has its northern limit in Norway at 67°; in Siberia, perhaps 68. Fraser found large fields of it, and of BUCKWHEAT, at 11,405 feet, near the temple of Milun, in the Himalaya. RICE can only be cultivated where a high mean summer temperature (not under 73°), and such an excess of moisture as actually to flood the fields, combine; for which artificial irrigation is almost always resorted to. In India and China it is the universal food and chief support of their teeming populations. In Ceylon alone there are one hundred varieties of rice used, and thirty of MILLET, which is cultivated, for the most part, in southern and western Asia and north-eastern Africa; also to some extent in Italy, and even so far north as Bagneres de Bigorre, in the Pyrenees, where we have seen it growing. MAIZE was brought from America by Columbus, in 1593, and has since been propagated very extensively: its colder limit is the isotheral line of 65°.

(382.) *Distribution of Animals.*—The distribution of animals on the earth, like that of plants, is far from being solely determined by the conditions of a suitable climate and sufficient food. The evidence of radiation or dispersion from local centres or primary *habitats,* is of the same nature, and equally cogent as in the case of plants, though modified by the locomotive powers of animals. We find the indigenous Faunas of the Old and New Worlds, of Australia, and of many islands, separated from each other by quite as strong lines of demarcation as their Floras; and that not by reason of any peculiarity rendering the soil or climate of the one unsuited to the indigenous animals of another. On the contrary, the animals of one region, when introduced by man into another not too different in climate, are usually found to multiply with extraordinary rapidity. The Pampas of South America swarm with wild cattle and horses, the descendants of European breeds. Strayed oxen in Australia have been found multiplied into vast herds; the sheep has proved prolific there beyond the most sanguine hope; and already the song of the nightingale and the lark has begun to be heard in its woods.

(383.) Another point of resemblance in the distribution of these two great divisions of organic creation is found in the fact that, though the species differ, yet many families and genera are represented in the several zoological regions, even those most independent, by genera and species, bearing a certain considerable parallelism or representative relation to them. Thus the lion and tiger of the Old World are represented by the puma and jaguar of the New, both belonging to the same genus (felis); the crocodile of the Nile by the cayman of the Orinoco; and the seals of the Arctic Ocean by other seals resembling them in general form and in all their habits, though specifically different, in the Antarctic. In the New World we find, it is true, no pachydermata provided with trunks like the elephant, but an approach to that form is preserved in the tapirs, of which South America produces two species, strongly allied in form and habits to the Malayan tapir, though specifically distinct. Even in the Old World we find species distinctly localized, to the mutual exclusion of each other. Three species out of four of the African rhinoceros have two horns, the Asiatic only one. The Asiatic and African elephant are quite distinct from each other, and both from the Siberian elephant (primigenius), which, though now extinct, evidently existed there during the geological epoch in which we are now living. In the inferior forms of animal life we find examples of a similar and almost startling kind. In the Mammoth Cave of Kentucky occur three genera of *eyeless* insects (anophthalmus, adelops, and bathyscia), members of a subterranean fauna, whose common character consists in *blindness*. And these generic forms are found to be reproduced in the limestone caverns of Carniola, and that in the case of anophthalmus, with an approximation almost amounting to specifical identity (*Schiödte Specimen Faunæ Subterraneæ*). We find, too, cases of restricted localization quite as marked as any afforded by the vegetable kingdom. That the chamois and ibex should be peculiar to the Alps, and the llama to the Cordilleras and high plateaus of the Andes, may not appear extraordinary when the habits of these animals, in keeping to the loftiest summits, are considered; but the limitation of an active insect, well formed for flight (Glossina morsitans, the Tsetze fly), to a limited district of small extent in South Africa, marked out by no apparent natural boundary, yet so definite, that for a horse to cross a well-known line is certain death (the trial has been deliberately made—*Livingstone*, p. 81, 82), assuredly does seem very astonishing.

(384.) The great majority of animated beings are confined to zones of temperature more or less restricted according to their organization, few only (man and those domestic animals which he has succeeded in acclimatizing) being capable of resisting the two extremes of temperature. And within these limits, among herbivorous animals, the botanical limits which restrict the growth of their habitual food constitutes another boundary, which may or may not be conterminous with the former,

though few animals of higher organization than insects are restricted in their range of food to a single or to a very few species of plants. The carnivora have, however, in this respect a wider range, their limit of food being no other than that placed by the absence of animal life itself. Thus we find in the neighbourhood of the Baikal lake both the Fauna and Flora of hot and cold regions intermixing. At Nertschinsk the wild peach grows near the dwarf birch, and the tiger and the bear range the same forests. The former finds his way even to Barnaoul, crossing the Kirghiz steppes and the Irtisch river for prey.—(*Atkinson.*)

(385.) The total number of species of animated creatures known to exist in the present state of the world may be roughly stated at about 155,000, which zoologists have classed as follows:—

	Species.
1. Vertebrata, viz.:—	
Mammalia, about	1,700
Birds,	6,000
Reptiles,	1,500
Fishes,	6,000
	15,200
2. Mollusca,	10,000
3. Articulata, including insects,	120,000
4. Radiata,	10,000
	155,200

Of these the number of existing mammalia may be considered as pretty accurately known, and of birds with some approach to certainty. The number of reptile species, whose *habitat* is determined, and of which scientific descriptions have been published, is set down by K. Johnston at 657, and 1500 is perhaps a somewhat large estimate for what may be considered as *known* reptiles. The articulated animals, which are all, in common parlance, classed as worms and insects, are no doubt as yet but very inadequately known, and such large additions to them are yearly made, that it is very likely the real number may be double of that set down. As for the last class, comprehending, as it does, the countless multitudes of infusoria and polypes, the number here assigned is doubtless a most inadequate one. In stating the species of existing animated organisms at 200,000 we are probably within the mark, and if fossil species be included, even this large number may perhaps be doubled.

(386.) It will be impossible, within the limits of this article, to do more than indicate some of the leading facts relative to the distribution of the more interesting to man among these classes of animated beings. Of these the MAMMALIA claim the first place. They are divided by naturalists into eight orders: Quadrumana, Marsupialia, Edentata, Pachydermata, Carnivora, Rodentia, Ruminantia, and Cetacea. The *Quadrumana* (apes, monkeys, baboons, gibbons, &c.) are divided between the Old and New World in the proportion of 14 genera and 111 species in the former, to 9 genera and 91 species in the latter, none of the genera being common to both. They are all tropical animals, the great majority being denizens of the torrid zone. One species only, the Barbary ape, is found in Europe (Gibraltar), one only so far north in East Asia as the Isle of Niphon, in lat. 38°; two south of the Orange River, in South Africa, while, in South America, a few extend as far as 38° S. Australia possesses none. The small monkeys, called *makis*, or Prosimiæ (the lemurs, lorises, &c.), are chiefly natives of Madagascar and the neighbouring Mozambique coasts. The ourang-outang is a native of Sumatra and Borneo, and its African congener, the chimpanzee, the most gentle, human, and intelligent of them all, inhabits the forests of south-western Africa between Cape Negro and the Gambia. The brown monkeys of the New World (the sapajous and sajuans) are, for the most part, smaller and less ferocious than the Simiæ of the Old, and differ from them in their system of dentition and the absence of cheek-pouches. Their chief *habitat* is in the forests of Brazil and Guiana.

(387.) The *Marsupials* (or those which carry their young in pouches, including the opossums, kangaroos, wombats, phalangers, &c.) constitute 14 genera, including 123 species. Of these only one genus, the opossum, is found in America, distributed, in 21 species, over the whole continent, from Canada to 36° S. All the other genera belong exclusively to Australia, Van Diemen's Land, and the islands of the Asiatic archipelago as far as Java. In Australia they constitute an immense majority of the mammalian species, in which, with this exception, that singular continent is exceedingly poor. In the islands of the archipelago only seven species are enumerated, among which one kangaroo is said to occur (in Java). In no other part of the Old World are any marsupial animals belonging to this class found living; and if we would seek for indications of them, singularly enough it is in the fossil remains in the oolites of the south of England, the antipodes of the region which they now almost exclusively possess.

(388.) The genera of edentata, or toothless animals (the sloths, armadillos, ant-eaters, manises, &c.), eight in number, are equally distributed between the Americas and the rest of the world; the former, however, being richer in species in the proportion of 20 to 8. The sloths live entirely in trees, chiefly in the Brazilian forests; the armadillos range through Central and Southern America, as far as the 43d degree of S. lat. That rare and most curiously formed little animal, the chlamyphorus, is found only in the provinces of Cuyos, in Mendoza —(*Sir W. Parish.*) The ant-eaters (myrmecophagi) extend no farther south than Buenos Ayres (of which the largest is the M. jubatus, remarkable for his enormous mane). Among the Asiatic and African edentata, the manises, or scaly ant-eaters, have the widest range, being found in Senegal, North-east India, and the Eastern and Southern Asiatic isles. Australia possesses two genera, the echidna or porcupine ant-eater, and that most extraordinary animal, the ornithorhynchus paradoxus; the only mammal which lays an egg. It is found in the Murrumbidgi and other rivers in S.E. Australia.

(389.) Of the 39 species of pachydermata, arranged in 9 genera, none are Australian, one only (the wild boar) European. The elephant is limited to Southern Asia, Scythia, the Archipelago, and Central and Southern Africa; the hippopotamus is exclusively African; the rhinoceros conterminous, or nearly so, with the elephant. The swine and the horse (including the wild ass and zebra) are the most numerous in species of this class, nine species of the former being scattered over Europe, and Asia, three (the wart-hogs) in Africa, and two (peccaries), being South American representatives of this family. The wild ass frequents the deserts and high plateaus of Asia, and the zebra is exclusively African. The tapirs have been already noticed.

(390.) The *carnivora* form a very large class, consisting of 514 species, arranged in 61 genera, and divided, by strong natural characteristic distinctions, into five families, viz., the *digitigrades*, or those clawed beasts of prey, which spring and leap on their prey, and which comprehend, as *cats* (feles), the lion, tiger, leopard, panther, &c.; and as *dogs* (canes) the wolf, fox, &c., and which comprise the most active and formidable. The *plantigrades*, as bears, badgers, racoons, &c., which use the whole lower joint of the leg as their

support, and (in the bear) stand often erect on it as a broad basis. The insectivorous (hedgehogs, moles, shrew-mice, &c.), a family little formidable: the *flying cats*, a small family confined to tropical Asia: and the *bats*. We find by far the majority of species, and, with exception of the bears and wolves, all the larger and most formidable ones, confined to the tropical countries. This is so marked, that, if we divide the world into austral, tropical, north temperate, and arctic (understanding by austral the extreme South America, from 40° S., with Australia and its connected islands), we shall find the *mean density* of species inhabiting each of these *seriatim*, to stand in proportion nearly as follows, viz.:—[1]

Austral,	3
Tropical,	26
North Temperate,	9
Arctic,	7

The disproportion in the southern division would be still greater were it not for the comparatively large proportion of bats found in the Australian and Oceanic islands, the greater number of which, however, it should be observed, belong to the "frugiverous" bats, which only by courtesy of structure belong to the carnivora.

(391.) Among animals of this class a few only can here be specially noticed. The *lion* is found over all Africa, Egypt and the Libyan Desert excepted; and in Asia, only in the districts bordering on the Euphrates, in Persia, and the jungles of India. The *tiger*, whose migrations, as we have seen, take a wide, extratropical range, has its chief *habitat* in the forests and jungles of Bengal, the southern mainland of Asia, Java, and Sumatra. The *puma* ranges over both Americas, from 50° N. to 53° S.; the jaguar is principally found in Brazil and Paraguay. The wolf, though now nearly driven out of the more populous portions of Europe, is indigenous (with its American congeners) over the whole northern hemisphere, from the arctic latitudes down to the tropical ones. The bear is largest and most formidable within the arctic circle, as the white or polar bear, and in the North American forests, as the grisly bear of the Rocky Mountains and Western Savannahs. Within the tropics their species are not numerous, and in the austral region none occur; neither is any species of the *insectivora* native in these regions, though otherwise pretty equally distributed over all the others. The *bats* are chiefly tropical, 55 species occurring in the tropical region of America, 41 in that of Africa, and 67 in that of Asia. Of these the only formidable one is the vampire, a West Indian and South American species, which sucks the blood of animals during sleep, and occasionally of man. The immense numbers of the bat tribe, which suspend themselves, head downwards, in caves in tropical regions; and, when disturbed, rush forth, rendering the darkness hideous with their ill-omened flappings; are always dwelt on with peculiar emphasis by those who have visited such scenes.

(392.) The *Rodentia*, though a very numerous class, will not detain us long. They consist of, 1. *Sciuridæ*; 2. *Muridæ*; 3. *Hystricidæ*; 4. *Leporidæ*, or animals allied to the *squirrel*, *mouse*, *porcupine*, and *hare*, divided as follows:—

	Genera.	Species.
Sciuridæ,	14	169
Muridæ,	47	306
Hystricidæ,	30	99
Leporidæ,	2	46
	—	——
	93	620

Of these genera 44 belong exclusively to America, and 5 exclusively to Australia (the total number of Australian species being only 21, and those confined entirely to the muridæ). Excluding these, the *mean density* of species in the temperate to that in the tropical regions of the globe is the ratio of 16 : 19.[2]

(393.) Among the rodentia the most remarkable are the beavers and the porcupines. The former (classed by a rather strained analogy among the squirrels) are represented in North America by the genus Castor, in Europe by Fiber. This latter form of beaver, within the records of history, inhabited Britain. Of the porcupines, 77 species belong to America, and only 6 to the Old World. The common porcupine is a native of south Europe: we remember to have picked up the quill of one, which seemed to have freshly dropped from the animal, in the immediate neighbourhood of Rome. The flying squirrels are natives of the Malayan peninsula and Java.

(394.) Of all the mammalia, and, indeed, of the whole animal creation, the *Ruminantia* are the most important to man. Of these there are 8 genera and 180 species, divided by Mr Waterhouse as follows:—

	Species.	Old World	New World.
Camels,	2	2	0
Llamas,	3	0	3
Musk Deer,	7	7	0
Deer,	51	37	14
Giraffes,	2	2	0
Antelopes,	48	47	1
Goats,	20	18	2
Sheep,	27	25	2
Oxen,	20	18	2

Of *camels*, the African and Asiatic (or Bactrian) are distinguished by having respectively one and two humps. Both inhabit arid regions, and are singularly provided with an additional stomach for the retention and conveyance of water in their long wanderings in dry places. The *llama* was the only beast of burthen known in Peru in the time of the Incas. It is the American representative of the camel, and has no hump. It is described as the "characteristic quadruped of Patagonia" by Mr Darwin. Among *deer*, the rein-deer is by far the most important, as an animal of wonderful endurance, speed, and docility—the special gift of Providence, as it would seem, to the inhabitants of the regions bordering on the arctic circle. The *cameleopard* is exclusively African; and of its two species, the one belongs to North, the other to South Africa. The *antelope* also, though represented in Europe by the chamois, in America by the prongbuck, and in Asia by eleven other species, is yet, *par excellence*, an African animal, both in respect of the number of the species, and of the countless multitudes of individuals which, in their migrations in search of water, are described as covering the whole surface of extensive tracts of country like the waves of the sea. Among the *goats*, the ibex frequents the loftier regions of the Swiss Alps. The Asiatic species frequent the Taurus mountains and Kamschatka. The *sheep*, domesticated in Europe, would appear to be traceable to Western Asia, where, as well as in Africa, the wild species frequent the more inaccessible mountain districts. Of the two American species, the argoli of the Rocky Mountains is remarkable for the enormous horns of the ram. Among *oxen*, the South African buffalo is wild and ferocious, the Indian domesticable. The American congener, the bison, exists in immense herds on the north-western American prairies,

[1] This estimate is founded on the enumeration of species in particular districts, given in the *Physical Atlas*, and is so framed as to be, as far as possible, independent of overlapping.

[2] These numbers are concluded from Mr Waterhouse's statement of the number of species in the *Physical Atlas*.

from California to 60° N., a huge, ugly, and terrible animal, the very type of blind brute force. It is in rapid process of extermination. The musk-ox is the only considerable ruminant of the arctic region of America. Australia produces no ruminant animal.

(395.) The *Cetacea* are a very peculiar class, numbering among them many forms which never leave the water, and have the external aspect and general attributes of fishes, as the whales, the cachalots, and the narwhals (balænæ, physeters, and delphinidæ), as well as the lamantin of the Orinoco, the dugong, and the porpoises, but they also comprehend two genera of animals, bearing little resemblance to fishes, and which are properly amphibious—the seal (phoca), and walrus or morse (trichecus), the latter of which is exclusively confined to the polar seas, unless drifted southwards on floating ice. The former has a considerably wider range; sometimes reaching the Orkneys and Hebrides, and even the Isle of Wight, where, within our own recollection, a specimen has been captured in Freshwater Bay.

(396.) *Distribution of Birds.*—Six thousand species of birds are said to exist in the Museum of Berlin alone, but of those which are accurately described and classified, and of which the *habitat* is satisfactorily known, the number is much smaller. Not much above half that number are enumerated as such by Mr K. Johnston, and of these the mean densities of species in the several great divisions of the globe, concluded from the data of his enumerations, are, in proportion to each other, as follows, viz.:—

Europe,	15
Asia,	5
Africa,	6
America,	6
Australia and Oceanica,	4

As regards the mean density of species, then, we see that, of these divisions, Europe far exceeds any of the others. As is the case with the mammalia, the mean density of species increases on approaching the equator. The distribution in zones of temperature, calculated on the same principle as before adopted, will give for the several zones the following proportions:—

Northern Frigid Zone,	3
Northern Temperate do.,	8
Northern Warm do.,	5
Tropical do.,	11
Southern Warm do.,	5
Southern Cold do.,	1

Where the abundance of European species is again apparent is the disproportionate percentage of the northern temperate zone, which here includes the whole of Europe. In this statistical view, the *habitat* of the migratory birds is assumed to be that in which they settle during their breeding season. Wide as the range would seem to be which the power of flight gives to birds, they appear to be retained to particular regions, independent of temperature, chiefly, no doubt, by the condition of their finding their appropriate insect and vegetable food; but partly also by local association of another kind, which seems to be strong in this class of animals; since we find instances of migratory birds identified as returning to the same spots for breeding in successive seasons.

(397.) The paucity of species in the arctic regions, both north and south, is compensated, especially in the former, by the multitude of individuals, which, mostly living on fish or other marine products, find there abundant food. Thus we find that even in so extreme a latitude as 80° 17′ N., at Cape Andrew Jackson, Dr Kane reporting, that "never had they seen the birds so numerous. The water was absolutely black with dovekies, and the rocks crowded" with these and with ivory gulls, mollemokes, eider-ducks, brent-geese, &c. In 71° 56′ S. on Possession Island, in like manner we find the penguins assembled in countless multitudes, and fringing every ledge of rock.

(398.) Birds are divided into the orders of Rapaces (birds of prey), Scansores (climbers), Oscines (singing birds and perchers, including the humming-birds), Gallinaceæ (poultry), Grallatores (waders and long-legged birds), and Natatores (swimmers). Of *rapacious* birds, the eagle is the noblest. The golden eagle inhabits the higher grounds of Central and Southern Europe, extending his range across the Crimea to the Caucasus, and being also a denizen of the Scotch and Scandinavian mountains. The condor, the largest of vultures (spanning 15 feet across the wings), soars far above the highest peaks of the South American Andes, but never crosses the isthmus to the northern range. The albatros disdains the land, and sleeps on the wing over the widest extratropical oceans, above which he seldom rises to any great height. Swan-like in apparent size, his wings extend 10 or 11 feet. The vulture of the Old World is a native of Africa and India, and sometimes visits Sardinia.

(399.) Among the climbers, the most beautiful and interesting are the parrots, cockatoos, and lories. They are chiefly tropical, but in South America range to the extremity of the continent, and are abundant in Australia. Birds of paradise are found exclusively in New Guinea and the neighbouring islands, with the Moluccas and Aroo islands. Toucans are confined to the tropical region of South America. The tropical region of Africa is poor in climbers, the species being to those in the corresponding region of America only as 21 to 122, or about as 1 to 6.

(400.) In the number and variety of its singing birds, Europe stands pre-eminent—110 species are especially so characterized; and the total number of birds of this order in Europe is 186. The nightingale (of which there are nine European species) sings, in England, nowhere north of the Tees and nowhere west of Exeter. Whatever the richness of European bird-song, however, North America can produce its single mockbird, the very embodied spirit of woodland melody (a native of Louisiana and Carolina), which, besides possessing an unrivalled song proper to itself, imitates in perfection, and even surpasses, that of every other species. The humming-birds also belong to this order. They are chiefly restricted to tropical America, but a few species range very widely. One has even been found on the shore of Behring's Straits, in 61° N., and others in Terra del Fuego, flying about in a snow-storm; so that, so far as climate goes, there is no reason why they should not be naturalized in Europe. In the Cape Colony they are represented by the "Sugar-birds."—(Certhia).

(401.) Of *Gallinaceous* birds, the peacock is a native of India; the pheasant is indigenous through Asia, from the Caucasus to Sumatra. That beautiful bird, the Argus pheasant, is a native of China, and the lyre-bird, the most elegant of the whole order, is the Australian representative of the pheasant family. The turkey, in its wild state, is peculiar to North-west America. The pigeon family is equally indigenous, both in the Old and New World, there being 6 European and 8 American species. They are found in countless myriads in the North American forests, where, in congregating to roost, they cover every tree, over large tracts, to crowding, and even break down great limbs by their weight, producing all the havoc of a storm. Flocks, consisting of millions, pass, twice in the year, over Canada and the northern states in their migrations north and southward. The dodo, a large galli-

naceous bird of Madagascar, which has become extinct within the memory of man, is considered, from the structure of some of its bones, to have been a gigantic pigeon, too heavy for long flights, and thus, as in a similar case in the Isle of Rodriguez (that of the solitaire), to have fallen an easy prey to man.

(402.) The order *grallatores* or waders, besides storks, flamingoes, herons, &c., which really wade, is made to take in many long-legged birds which frequent the dry places of the earth, as the ostrich, the emu, the cassowary, &c. The two-toed ostrich, the largest existing bird, is at present nearly confined to Africa, in the Old World, being, however, represented in South America by the three-toed ostrich Suri or Tuju (Rhea). Though unable to fly, its wings assist it in running, in which it is the fleetest of animals. In ancient times, its range extended through Asia Minor, Persia, and South Asia, to the farthest East, but it has become exterminated except in Arabia. The cassowary, which has hair for feathers. inhabits south-east Asia, and the Indian archipelago, as far as New Guinea. The emu (remarkable for its long, narrow double feathers) affords another instance of the singular bizarreries of Australian organization, as does also the Deinornis of New Zealand, which should it be (as is barely possible) not yet entirely extinct in the unknown interior of the Australian continent, must take the precedence of the ostrich as the giant of living birds, its skeleton standing 11 feet in height.

(403.) To the *swimming* birds belong the swan (which in Australia is black), the pelican, the eider-duck, and the penguin, besides innumerable geese, ducks, &c., which people the colder lakes and sea shores of Arctic Asia and of Northern America. Of 112 European species, 44 belong to this family, and 33 to the gulls. The pelican is a native of Eastern Europe, and is not uncommon on the Danube, and very common in Africa, in the tropical islands of Asia, at Siam, and in China. It occurs also, very widely diffused, in North America, and even in South Australia, so that it is one of the most widely distributed of birds. The eider-duck is exclusively confined to the northern seas, though it has been known to breed as low as the coast of Northumberland. The penguin, on the other hand, haunts the desolate islands of the South Seas, the Straits of Magellan, and the Falkland Isles, and is unknown in the northern hemisphere.

(404.) *Distribution of Reptiles.*—Of the 1000 or 1500 species known to exist, those described and well ascertained as to *habitat* amount to 657, divided into families and genera as below, viz.—

Families.	Genera.	Species.
Testudines (tortoises),	3	69
Sauria (lizards),	9	203
Ophidia (serpents),	9	265
Batrachia (frogs),	5	120

And the proportions (in respect of the mean densities of species) in which these are distributed over the great divisions of the globe, and the zones of temperature are these, viz.—

Europe,	3
Asia,	5
Africa,	5
America,	8
Australia and Oceanica,	3

And in zones, in the proportions (*inter se*) of the numbers :—

Temperate,	11
Tropical,	29
Austral,	2

It is chiefly to the forests and swamps of Brazil and Guiana, which swarm with reptile life, that the marked disproportion between America and the other divisions of the globe is owing. The tortoises (including the turtles) are almost entirely tropical, very few land species existing anywhere beyond 30° or 40° of latitude, and the turtles frequenting only the tropical seas. The alligators or caymans occupy tropical America, frequenting the rivers from 30° south to 32° north. Of these, some species during the dry season bury themselves in mud, and remain encrusted and torpid till the first rains, when they at once start up, shake off their crust, and rush down to the first indication of a stream. Humboldt was, one rainy night, surprised by such a resurrection of one, over whose dormitory he had unknowingly made his own. The true crocodile is African and Syrian, and is found in the Nile and in all the rivers of tropical Africa, as well as the Euphrates. The gavial infests the Ganges. Chameleons abound in Africa, both north and south, and are even found occasionally in Spain and Italy. The iguana is eaten in the West Indies and in Central Africa (Livingstone), and considered very delicate food. Among the frogs, the most remarkable seem to be a species, called Matlametlo, described by Dr Livingstone as inhabiting the Kalahari district of South Africa; whose instincts, like that of the cayman above mentioned, excite him from torpor on the first symptom of rain, and one of which furnishes an excellent repast. In the case of the Surinam toad or pipal, the female hatches her eggs on her back, the young from which, when produced, bury themselves in her skin, and there undergo their transformations. This toad is 8 inches, and the bufo agua of Brazil 10 or 12 in length.

(405.) Of 265 known species of serpents, only 58 are venomous. The serpents of America are, without exception, *specifically* different from those of the Old World; and in the latter, they are entirely absent in all the Pacific islands, while in those of the Indian archipelago they abound, though with singular and capricious exceptions. Thus in Java 56 species occur, in Borneo not one; in Australia 10, 7 of which are venomous. Of 6 species found in Japan, none exist elsewhere. In no class of animated beings is the localization of species so marked. In general, however, in common with nearly all others, the abundance of species increases with proximity to the equator. Sea serpents, of which 7 species are known, all venomous, are found only in the Indian Ocean, and the seas of the Indian and Oceanic Archipelago. As regards particular and remarkable serpents, the rattle-snake (Crotalus horridus) is North American, where it represents the European viper. The cobra-capello, or hooded snake (the dancing snake of the Indian jugglers) is common everywhere, from Malabar to Sumatra. The boas are peculiar to the tropical forests of South America; their representatives in the Old World, the pythons (one species of which attains 20 feet in length) range over North Africa, through tropical Asia, to China and Japan. This snake (which is not venomous) is probably that which gave rise to the extravagant exaggeration, in the accounts handed down to us, of Regulus's invasion of Africa. Lucan's description of the serpents which annoyed Cato's army is not less extravagant. Africa, in fact, as regards species, is not comparatively rich in serpents.

(406.) *Distribution of Fishes, Molluscs, and the Lower Aquatic Organisms.*—The *habitat* of Fishes, like that of land animals, is necessarily limited by the condition of their supply of appropriate food, as well as by that of an appropriate temperature, which for them is that of the surface water, since very few fishes are capable of sustaining the pressure of a greater depth of water than a

100 or 150 fathoms, and in these the air-bladder is either entirely absent or in an imperfect or rudimentary state of development, such an apparatus being useless under the heavy pressure of 20 or 30 atmospheres. The way in which surface temperature may set a limit to the excursions of marine animals, even those of the widest range, is curiously exemplified in the case of the whale. The "right whale" (Balæna mysticetus), according to Lieutenant Maury, is incapable of crossing the equator, and the whales of this class taken in the Southern Ocean are specifically different from those of the Arctic and North Seas. Yet, as we have seen (art. 49), the temperature of the tropical seas is superficial, and at a depth of two or three thousand feet would be so much mitigated, that but for the necessity of rising to the surface for air, which is common to all cetacea, there is no reason why he might not pass, since the whale habitually plunges down to immense depths, and seems quite unaffected by a pressure sufficient to "waterlog" the wood used in constructing whaling boats.

(407.) The ultimate food of such fishes as do not prey on one another is either the soft parts of marine vegetables, or such animal organisms of inferior orders as either draw their food from these, or extract it chemically from the water. Such are, of course, far more abundant, or at least more varied, in the neighbourhood of the shores, or upon shoals affording marine vegetation, or the estuaries of rivers bearing supplies from the land; and it is therefore to the vicinity of these that a very large portion of fishes is confined. The widest oceans, it is true, abound in organic life at and near their surfaces. Even in very cold latitudes countless millions of creatures of the genus Beroe exist, and others of a larger size, medusæ (or jelly fish), zoophites, &c., swarm to such an extent, as to convert the surface water in some places almost into a kind of soup, which furnishes food not merely to small fish but to cetaceæ of the largest growth; and in tropical regions the sea teems with minute forms of animal life in infinite variety—small mollusca, crustacea, and luminous creatures, as salpæ, pyrosomas, &c., many of them gelatinous; and where the sea is covered with floating weeds, these become the haunts of a numerous population of species, crabs, sea-slugs, &c., peculiar to them. Thus, whatever be the distance from shore, food is not wanting for such fish as are fitted for its assimilation, and the fish of prey (as is also the case with land animals) are confined by no limits but those which temperature sets to their range.

(408.) The cetacea are not properly fishes, but belong to the class of mammalia; and inasmuch as many of them breathe air, and are obliged to come to the surface for its renewal, border on, and, in the cases of the seals and walrus, really are *amphibia;* in those of the lamantin and dugong, nearly such (art. 395). The larger whales, as a family, have a very wide range, and some of the species are found in almost every sea. The Balæna mysticetus, as we have seen, does not appear between the tropics, nor does the narwhal, which is specially arctic. The Rorqual (which furnishes whalebone, and is said to attain 100 feet in length) is a denizen of high latitudes (70°—80° N.) The Cachalot (Physeter macrocephalus), on the other hand, does not visit the colder seas, but wanders over the whole of the temperate and torrid ocean, affecting always the central and deepest parts. The grampus, porpoise, and dolphin occur in almost every sea.

(409.) Among fishes of prey, the sharks, though not confined to the tropical seas, are there by far most abundant. Some occasionally visit our own seas. The largest of the family (Squalus maximus), the Basking Shark, visits pretty high latitudes. It has been seen off the north-west coast of Scotland, where it has been taken for the "sea serpent." It attains 50 or even 60 feet in length, and one of the former size was lately taken at Kuraci, at the mouth of the Indus. Happily its voracity is not in proportion to its size, as it lives chiefly on medusæ and sea-slugs, small fishes, &c.

(410.) The localization of those fish which live near the shore, and furnish the principal part of the marine contribution to human food, is often very limited, and we find almost as many littoral "provinces" of fish as there are lines of coast characterized by some common feature either of soil, rivers, or climate. In general it may be noted as a universal feature that the colder waters furnish those species best fitted for food, and that even in the same species the individuals taken in cold waters are far superior in flavour and nutritious quality to those in warmer seas. According to Lieutenant Maury, the excellent fish with which the Atlantic cities of the United States are supplied owe all their value to the stream of cold water which sets down the coast out of Baffin's and Hudson's Bay, between it and the Gulf Stream (art. 55.) "The 'Sheep's-head' (? species), so much esteemed in Virginia and the Carolinas, when taken on the warm coral banks of the Bahamas, loses all its flavour, and is held in no esteem. The same is the case with other fish. When taken in the cold water of that coast they have a delicious flavour, and are highly esteemed; but when taken in the warm water on the other edge of the Gulf Stream, though but a few miles distant, their flesh is soft, and unfit for table." "A current of cold water from the south sweeps the shores of Chili, Peru, and Columbia, and reaches the Gallapagos Islands under the line" (art. 64.) "Throughout this whole distance the world does not afford a more abundant or more excellent supply of fish. Yet, out in the Pacific, at the Society Islands, where coral abounds and the water presents a higher temperature, the fish, though they vie in gorgeousness of colouring with the birds, plants, and insects of the tropics, are held in no esteem as an article of food. I have known sailors, even after long voyages, still prefer their salt beef and pork to a mess of fish taken there" (*Phys. Geog. of the Sea*, p. 55.)

(411.) The phenomenon of coloration referred to in the last sentences of the above extract is a general one. The arctic and northern fishes have little colour, and as the zones of temperature ascend in the scale towards the equator, the species, not only of fishes, but of all marine animals in all seas, become more highly and more variously coloured. The brilliancy of colour of the fishes, shells, and sea-weeds of tropical, and especially of the Indian and the Caribbean Seas, is spoken of with admiration by every voyager, and is enhanced by the purity of the water in those bays and recesses which are kept clean and scoured by the indraft of currents from the deep ocean.

(412.) A bare enumeration of the several "littoral provinces" of marine life (and our limits would allow little more) would be of small interest, and it will suffice to observe that, with exception of arctic forms, which have a common origin in the polar seas, and are, therefore, propagated downwards in both oceans, scarcely any forms of littoral marine life are specifically identical in the Atlantic and the Pacific, and that even on opposite sides of the Atlantic itself but few species are common to both.

(413.) Of migratory fish, some resort to rivers to spawn. The principal of these is the salmon, which is found in most of the rivers of cool temperate coasts down to the 45th degree of latitude; and so definite are the habits of the fish in this respect, that in adjacent rivers, on the N.W. coast of Ireland, abounding in salmon, the fish of each river are known to the fishers by some peculiarity sufficient to ground a recognized claim on the

part of one proprietor to fish accidentally straying into the precincts of another. On the other hand, such fish as migrate seaward, as the cod, the herring, and the pilchard, appear to be driven southward by the cold of winter, or by the failure of their food resulting from it, and descend in immense shoals, and at fixed periods, like the birds. Thus the cod arrives annually on the banks of Newfoundland, along the cold current inside the Gulf Stream, and also in the North Sea, descending by the coast of Norway in February to the Dogger Bank in shoals so dense that the sounding-line can hardly pass between them. The herring also visits our coasts in winter, its migrations being very definitely limited to water of a certain precise temperature, a circumstance which, taken in conjunction with the fluctuations known to exist from year to year in the limits of the Gulf Stream, and the surface-drift currents from the S.W. (art. 55), may serve to explain the seemingly capricious desertion of certain bays and haunts of these fish in some years, and their appearance in others not previously frequented by them.

(414.) About 853 species of European fishes have been described, of which 643 are marine, 210 live entirely in fresh water, and 60 of the marine species resort to fresh water to spawn. Of the marine species 444 inhabit the Mediterranean, 216 are found off the British coasts, and 171 are peculiar to the Scandinavian seas.

(415.) It would be wrong, in speaking of fish, to omit all mention of that remarkable and very curious power manifested only in this class of animated beings—the power of giving forth a voluntary electric shock. This is possessed by several distinct species: among sea-fish, by the torpedos, four species of which are found in the Mediterranean, and others in the Indian seas. They occur also in Table Bay at the Cape of Good Hope. The Isle de Rhe, on the French coast, is remarkable for the frequency of the occurrence of one species. The Gymnotus electricus, whose shocks are most formidable, and even dangerous, is a species of eel which inhabits the Orinoco, but is more common in pools and marshes on the eastern bank of that river. It is also found in other rivers of the eastern part of South America; and Humboldt calculates that each square league of the Planos de Caracas contains two or three ponds filled with these creatures. It is caught also in Guiana.

(416.) The distribution of the marine mollusca and other animals of the invertebrate classes is very powerfully influenced by the element of vertical depth. In that of vegetable life we have seen how increase of altitude in the air acts with all the influence of increased latitude, as bringing the plant into a colder region; but the influence of depth in marine life is one of a quite different kind. As regards temperature, no doubt the water in the shallow sea-bords is subject to diurnal and annual fluctuations of temperature to a considerable extent, though much less than the air, and this affords a condition of existence which cannot but be very influential in determining the species which can exist at the extreme borders of the sea. But the amount of this fluctuation diminishes very rapidly with the depth. Not so, however, another very important element of all life, viz., light. The light which penetrates to great depths is not merely much less in quantity, but very different in its photo-chemical qualities, from the entire solar light of the surface, and this, though at present we are ignorant of the mode and laws of its agency on the animal economy, we are very sure is an element of exceeding importance. The food, &c., afforded by submarine vegetation is different—the texture and constitution also of the sea-bed, as consisting of finer particles carried out far to sea, affects its quality as a nidus for habitation; so that we find the zones of habitable depth in the water to succeed one another with far greater rapidity, and to be confined within far narrower limits than those of atmospheric altitude on land.

(417.) Professor E. Forbes, to whose researches we owe a very large portion of our knowledge of this part of natural history, has discriminated the zones of depth affected by marine animals into, 1*st*, Littoral, between high and low water-marks—a zone which might, *à priori*, be expected to be very strongly characterized, as we find it to be, by species capable either of maintaining an active existence in air as well as water, such as crustaceous animals, crabs, &c., of various families, or of such testacea and shell-less animals as close themselves up, or seal themselves hermetically on the rocks, and remain dormant during the recess of the water, of which the patellas, mytili, littorinas, purpuras, &c., and, among the zoophites, the common sea anemone, afford examples: 2*d*. The "circumlittoral zone," with a depth from low-water mark to about 15 fathoms. 3*d*. The "median zone," from 15 to 50 fathoms. 4*th*. The "infra-median;" and, 5*th*. The "abyssal zone," the former from 50 to 100 fathoms, the latter from thence to the lowest depth at which life is possible, which in some of the minuter forms would seem to include almost the lowest deeps that the sounding-line has reached (see art. 118). Each of these zones is characterized by species which belong to no other, and each passes into the other by the intermixture of species common to several. It would carry us quite beyond our limits to enumerate these, and without specific detail the mere enumeration would afford no instruction. Suffice it to observe, that in these, as in other departments, proximity to the tropics carries with it increase in the number and variety of species and genera, greater development in size, form, and colour. The shells of the Indian Seas, and the Eastern Archipelago in particular, are prized not merely by the zoologist as illustrative of animal organization, but by collectors for their exceeding beauty, brilliancy of colour, and elegance of form. It is in these seas also that the pearl fisheries are conducted, the true pearl oyster being confined to them, though pearls of inferior quality are produced also by certain species of mytilus; and Suetonius has recorded that Cæsar's first idea of invading Britain arose from the report of pearls being found on its coasts (*Britanniam petiisse spe margaritarum*). The depth, moreover, has quite as marked influence on the colour of shells as the warmth of the water on the flavour of fish. Below the level, where light can penetrate copiously, the colours of shells wax faint and dilute, and even individuals of the same species taken at different depths exhibit a marked difference in their intensity of colour. The circumlittoral zone, it may be generally observed, is that of the reef-building corals (art. 87), of star-fishes, sea-urchins (Echini), and cuttle-fishes—the medial of sponges, corallines—the infra-medial of the deep-sea corals—and, in particular, of the valued red corals of the Mediterranean. As respects all the zones, also, it is remarked by Professor Forbes, that as we descend, the regions of depth characterized by the same species become of greater extent, *and the range of species (in a horizontal direction) wider.*

(418.) *Distribution of Insects.*—All nature seems to swarm with insect life; but here, as in all departments of natural history, we find fewer species inhabiting the colder regions; and their maximum of development, both in variety, richness of ornament, and what may be termed *intensity of quality*, is found in the hottest countries. There it is that the greatest singularity of form and habit, the greatest pungency of bite, and every other mode of insect annoyance, are found in perfection. The only exception

seems to be in the case of coleopterous insects, which are specifically more abundant in temperate climates.

(419.) According to Mrs Somerville, the rate of increase of insect life, in proceeding from either pole to the equator, is very various in different longitudes. Their numbers are small in both the polar regions—more abundant in Tasmania and New South Wales—more so in Southern and Western Africa, Columbia, and a maximum in Brazil; but North America has fewer species than Europe in the same latitude; and Asia is comparatively poor in species, in proportion to its great extent. The horrors of insect annoyance in the swamps of the great rivers of tropical America are vividly described by Humboldt. The air is one dense cloud of poisonous insects to the height of 20 feet. In Brazil the vivid colours and metallic brilliancy of many of the beetles is extraordinary. Among the more remarkable varieties of insect life deserve special mention, 1*st*, the bees and ants. Of the former each country has peculiar species; but it is singular that the honey bee of North America has been introduced from Europe.[1] The ants, of which the species are almost innumerable, are found chiefly in hot and dry climates, and are, perhaps, of all insects the most remarkable in their habits. The termite of tropical Africa builds pyramidal nests ten or twelve feet in height, hollowed into chambers of elaborate structure. The white ant of India devours everything of animal and vegetable origin, ascending by covered galleries (for they cannot bear the light) to the sap of furniture, beams, &c. But perhaps the most singular species of all is that of the parasol ants of Trinidad, in the West Indies, which walk in long procession, each carrying a cut leaf over its head, as a parasol, in the sun, and these they deposit in holes 10 or 12 feet deep under ground, apparently with no other object than to form a comfortable nest for a species of white snake, which is invariably found coiled up among them on digging out the deposit (Mrs Carmichael's *Domestic Manners, &c. &c., in the West Indies*, ii. 327). The scorpion extends in Europe to the north coasts of the Mediterranean, but is more abundant in Africa, both north and south, where its bite has the singular peculiarity, that, although excessively painful on the first occasion of its infliction, and even dangerous to life, the constitution becomes hardened to it, the suffering is less on every subsequent occasion, and at length comes to be little regarded. Brazil produces a scorpion six inches in length. The locust, one of the most formidable scourges in countries infested by it, migrates in such masses as to darken the air for successive days, and when driven into the sea is sometimes thrown up as banks on the shore, poisoning the air by their decomposition for many miles in length. They are frequent in Syria and Barbary, whence they occasionally migrate to Italy, and within this last summer (1858) several individuals have even been taken in England, and one or two in London. They are even said to cross the Mozambique Channel from the African coast to Madagascar.

(420.) *Fossil Organic Remains.*—Buried in the strata of which the earth's crust is composed, we find in every part of the world, and in all the strata properly so called (excluding thereby granitic and other igneous formations, and the metamorphic rocks in which the evidences of stratification appear to be obliterated by partial fusion, or softening at least, by heat), either the actual harder exuviæ, such as shells, bones, scales, &c., or impressions of the softer and more destructible parts of animals, and the remains of vegetables silicified or otherwise fossilized, affording evidence of the abundant existence of organic life in every stage of the world's history. It is only in the newest and most superficial strata, however, that we find imbedded the remains of any species, either animal or vegetable, now existing in a living state, and these consist almost exclusively of the shells of marine and some freshwater mollusca. As we go deeper in the order of stratification, existing species rapidly become rarer, existing genera thin out, and we find ourselves very soon landed in an order of things where the Fauna and Flora have nothing in common with the present, or rather in a succession of such (art. 11).

(421.) The strata in which we find this gradually decreasing community of organic life with that now in existence, are those which lie wholly above the chalk formations, and which have been termed by Sir C. Lyell, Tertiary, drawing the line between these and the secondary deposits at this point, and they have been subdivided by him into three stages or epochs, the Pleiocene, or that *more* nearly approximating (πλειων) to the present *new* state (καινος); the Meiocene, or that *less* recent (μειων), or in which the number of species, common to them with the present epoch is less; and *Eocene* (ἠως), that in which, as it were, only a *dawning* of the present state is visible. The upper of these three has been subdivided into *older* and *newer* pleiocene or pleistocene, that which approaches nearest, by the abundance of fossilized species identical with living ones, to the modern state. Now in these, if we reckon only the fossil shells as compared with those recent, we find, according to Sir C. Lyell, in the newest or pleistocene strata, nearly 96 per cent. of recent, and only about 4 per cent. of extinct species; in the older Pleiocene, the recent species still predominate, varying from 50 to 66 per cent. of the whole number, while in the Meiocene, the proportion falls already as low as 18 per cent., and in the Eocene, does not exceed 3½.

(422.) In the strata forming under our eyes, in estuaries, lakes, and shoal deposits, of course the remains of all existing animals and vegetables become imbedded; but already in the Pleistocene strata an immense majority of the existing mammalia and birds has disappeared, and those few species which can be identified with now existing ones are confined mainly to the *very newest* of these formations, designated by some geologists as Post-pleistocene, or in "Bone caverns" in some of the older formations still open to day, and which have served as dens for carnivora, or places of refuge for other animals during all that period which may have elapsed since those formations were raised above the ocean. It is in the Pleistocene and these Post-pleistocene beds that we find the remains of a few terrestrial animals which have become extinct during the present geological epoch, and which either certainly have, or may reasonably be presumed to have, been contemporary with man, such as the Dodo, and the Solitaire (art. 401), the Deinornis of New Zealand (art. 402), six species of which have been discovered, and Opyornis of Madagascar, second only to the Deinornis in size, whose *egg-shell* has been found equal in bulk to six of that of the Ostrich, and which has only recently become extinct. Such also are those remains of gigantic elephants (art. 220) preserved in ice in Siberia, the Mastodon of North America, so slightly covered as to have been known to the aborigines, and to have given rise to obviously fabulous and mythological traditions of its contemporary existence,[2] those gigantic Sloths of the Pampas of Brazil (art. 238)

[1] We take this fact on the report of Mrs Somerville (*Phys. Geog.*, p. 307), but is there not some mistake? At all events, the search for wild honey has, from the earliest settlement, been a feature of American forest life, but the indigenous species is, perhaps, undomesticable.

[2] At Bigbone Lick, in northern Kentucky, the *contents of the stomach* of the Mastodon Giganteus have been found, consisting of crushed branches, leaves, and a species of reed now well known in Virginia (De la Beche.—*How to Observe*, p. 365).

and the fossil Elks (Cervus Megaceros) of the Irish peat mosses, which are found in soft muddy deposits just below the peat, where they would seem to have perished by becoming embogged, a group of eleven of their skeletons having on one occasion been discovered in a standing position, and without signs of violence.

(423.) If we take in the whole range of the tertiary formations, we embrace nearly the total extent in time of the full development of Mammalian existence, as well as that of birds, though the latter would seem (as might indeed be expected from their power of migration and readier escape from destructive events, to take a somewhat wider range through past time than the others. In the cretaceous strata we find no mammals, and only a few indistinct vestiges of one or two genera of birds. Below the chalk in the Oolitic beds (art. 387) only two or three genera of Marsupial animals have been detected, and the footprints of birds even as low as the Permian series; while, on the other hand, we find in the Eocene formations, enumerated by Prof. E. Forbes, 25 genera of mammals and 8 of birds; in the Meiocene and Pleiocene, 81 genera of mammals, and many birds of existing genera, and in the Pleistocene and Post-pleistocene, no less than 88 extinct mammal generic forms, besides those still existing, and among the birds, many of the now existing *species*.

(424.) The distribution of these extinct forms over the globe affords matter of highly interesting and important remark. A marked and almost complete separation subsists between the fossil Faunas of the Old World, America, and Australia; while, on the other hand, subject to that condition, the range of genera and species within those limits appears to have been much wider than it is at present. And what is still more striking is the fact, that the types which, in their several divisions, are more especially characteristic of them in the recent epoch, or what is equally so, the absence of particular types, are found no less to prevail in the fossil Faunas. Thus Australia is especially characterized (art. 387) by the exclusive prevalence of the marsupial type, which is altogether absent in other parts of the Old World, and represented only by a single genus in the New. And in its fossil Fauna we find an equally striking prevalence of the same singularity. According to Professor Owen, whose views in this and the following articles we adopt from the striking address pronounced by him from the chair of the British Association at Leeds, on the formations of the more recent tertiary periods, and in the limestone caverns of Australia, abundance of mammalian fossils have been found, but *except a single tooth of a mastodon*, all of marsupials. Among them are fossil kangaroos, potoroos, wombats, dasyuri, &c., equalling the lion and leopard in size, a wombat (phaseolomys gigas) equalling the tapir, and others of peculiar characters, rivalling the ox and rhinoceros in bulk. The skull of one of these great marsupials (the nototherium) from the "Darling Downs," presents the strangest peculiarities hitherto seen among mammalia; and that of the diprotodon, from the same locality (remarkable for two large and strong tusks projecting horizontally, straight forward from the lower jaw), is hardly less extraordinary. On the other hand, Europe, Asia, and Africa have not offered a single marsupial fossil in the pleiocene and pleistocene deposits, and those in America are limited to the genus didelphis (opossum), species of which at present exist there. In the meiocene and eocene deposits, however, didelphidæ are found both in France and England (from which it would seem reasonable enough to conclude that in those periods a land communication existed between the continents).

(425.) The distinction between the fossil Faunas of America and the Old Continent is not less marked. "All the fossil remains of quadrumana in the Old World belong to the family (Catarhina), which is still exclusively confined to that great division of dry land;" but the quadrumanous fossils of the New World exhibit exclusively platyrhine forms—those, *i. e.*, of a family peculiar to South America, among which is one larger than any now known to exist, found in Brazil.

(426.) So again of the camels. The camel and dromedary, the two European genera of that family, are represented in America by genera (the llamas and vicugnas) characteristically distinct. And the fossil camels of Asia are referable to the same type (camelus) as those there now existing, while those of America belong to the llama type (auchenia).

(427.) The giraffe and hippopotamus are at present African. Fossil remains referable to these families are, however, found in the pleiocene strata, both of Asia and Europe, but none have been met with in the New World; neither has any form of rhinoceros been discovered in its strata, though Europe, which is now deprived of that form, anciently possessed several species, one destitute of the nasal horn, and three provided with two of those weapons, one of these being fur-clad, adapting him for a cold climate.

(428.) As regards the elephant family, the case is somewhat different. This family, according to Professor Owen, has been more "cosmopolitan" than any other hoofed herbivorous quadruped. Yet even here the distinction between the Old and New World type is by no means obliterated. Especially corresponding to the representative of the elephant in America is the mastodon. Of elephants we have *now* an African and an Asiatic species, and no American. But while we find in a fossil state one North and two South American mastodons, and one elephant at least, it appears that double that number of species, both of elephant and mastodon, all specifically distinct from each other and from the American, inhabited Europe during the pleiocene epoch. Of these elephants, the largest ever found, which appears, by the only remaining bone, to have been of at least twice the *linear* dimensions of the large mastodon exhibited in the British Museum, was found in making a railway cutting, in the Valley of the Thames, at Grays, in Essex, through the upper pleiocene. The skeleton, when found, was nearly complete, but was *broken up* by the workmen. and sold as bone manure to a neighbouring farmer, one only metatarsal bone finding its way to our national collection! In further illustration of this wider range of the elephant family in past epochs, Professor Owen observes, that not only China (in which at present there are no elephants), but even Australia (witness that single tooth before alluded to) has furnished evidence of the fact.

(429.) The distribution of fossils of the class of edentata furnishes additional evidence of the same laws. The manis or pangolin of Asia and Africa corresponds in South America to the ant-eaters; and at present neither does the one form exist in Europe nor the other in North America. In the European tertiary beds, however, a large pangolin has been discovered, while the domain of the armadillos and sloths, as well as the ant-eaters, in the same geological epochs, is now ascertained to have extended over North as well as South America, though still confined to that continent. Their present peculiar *habitat*, however, Brazil; and the neighbouring regions of South America, were then, as now, the head-quarters of the family, the sloths being represented by the gigantic genera of megatherium, megalonyx, mylodon, &c., (of which the megalonyx, an animal as large as the rhino-

ceros, ranged at least as far north as Virginia), and the armadillos by the glyptodon, hoplophorus, pachytherium, chlamydotherium, &c. The mylodon, an animal of the most enormous strength, and which probably lived by uprooting large trees and feeding on their branches, though found near Buenos Ayres, was probably floated down by the Parana or Uraguay; but the glyptodon, which was discovered by the horse of a gaucho striking his hoof through its huge carapace (Parish, *Buenos Ayres*, &c., 222), must have lived and died on the spot during the recent epoch.

(430.) One of the most remarkable features of the Mammalian fauna and birds of the tertiary world is the gigantic size attained by many of the species. Several instances of this have been noticed in the preceding articles, and many more might be added; in particular, the Deinotherium, the largest of terrestrial mammals, a creature 18 feet long, with two enormous tusks curving downwards from the extremity of the *lower* jaw. This animal has been of wide distribution, during the Meiocene period, having been found in strata of that age at Eppelsheim, in Hesse-Darmstadt, in France, Switzerland, and the Sivalik Hills in India; several reasons exist why, supposing all the species of a genus to have been at one time coeval, and to have ranged to the utmost extent to which the then existing impassable barriers restricted them, the larger species should have died out first, and the limits of the genus (especially it of non-migratory habits) have become restricted. "In proportion to its bulk," observes Prof. Owen, "is the difficulty of the contest which, as an organized whole, the individual of such species has to maintain against the surrounding agencies, which are ever tending to dissolve the vital bond, and subjugate the living matter to the ordinary chemical and physical forces. Any changes, therefore, in such external agencies as a species may have been originally adapted to exist in, will militate against that existence in a degree proportioned, perhaps, in a geometrical ratio, to the bulk of the species. If a dry season be gradually prolonged, the large mammal will suffer from the drought sooner than the small one; if such alterations of climate affect the quantity of vegetable food, the bulky Herbivoræ will first feel the effects of stinted nourishment. If new enemies be introduced, the larger and conspicuous quadruped" (and we may state the more helpless birds, if provided with none, or only rudimentary wings) "will fall a prey, while the smaller will conceal themselves and escape; smaller animals are also usually more prolific than larger ones. The actual presence, then, of small species of animals in countries where larger species of the same natural families formerly existed, is not the consequence of any gradual diminution of size of such species. . . . . . The smaller and feebler animals have bent and accommodated themselves to changes, which have destroyed the larger species."—*Zool. Trans.* iv., p. 15.

(431.) *Bone Caves and Osseous Breccias.*—The caves noticed in art. 420 exist in great abundance over most parts of the world in which limestone, of whatever age, abounds (art. 197), and they are peculiarly important in respect of this inquiry, by reason of the vast abundance and variety of fossil remains they contain of animals, which we may be assured inhabited the surface while they were open and accessible. The most remarkable of such caves in Britain, are the Kirkdale cave in Yorkshire, examined by the late Dr Buckland, Kent's Hole near Torquay, the cave of Paviland or Goat's Hole near Swansea, and that of Yealm Bridge near Plymouth. In Belgium such caverns occur at Chockier near Liége. In France we find the Grotte de Fouvent, and the caverns of Miallet near Anduze (dep. du Gard) in dolomite, that of Bize (dep. de l'Aude), those near Lunel-viel (dep. du Herault), and the Grotte d'Osselles near Besançon. In Germany a tract of country nearly 200 miles in extent has been pointed out by Cuvier as full of such caves, and those of Gaylenreuth are particularly celebrated for the number of extinct bears, hyænas, &c., they have yielded, and for the singularly inaccessible situation (at present) of some of them. In Sicily several bone caverns have been examined within a few miles of Palermo. But perhaps those that have yielded the most striking results are the Brazilian bone caverns examined by Mr Lund, and others which have been found full of those strange and wonderful forms which especially characterize the South American fossil fauna, large Amadillos, Glyptodons, Megatheria, Scalidotheria (nearly equalling the rhinoceros in bulk), &c.; and those in Wellington Valley, 200 miles N.W. from Sydney in Australia, where were found the principal among those extinct marsupials above mentioned.

(432.) In these bone caves, not unfrequently two or three layers of bones, separated from each other by stalactitic floorings, are found; and when this is the case, the upper usually contains remains of living, or *very* recently extinct species, and not seldom human skeletons. But wherever this has been the case, there has also been reason to conclude, from circumstantial evidence, that the caves have been used as places of sepulture or of refuge; and though, in many instances, such remains are doubtless of great antiquity (using the term as referring to human history), there has never been discovered any fossil human bone so embedded in even the most recent geological *stratum*, other than the merest superficial alluvium, as to afford the slightest ground for believing the earth to have been inhabited by man during the epoch of its formation. On penetrating through the stalactite beneath the first loose layer of bones, the species found in the lower beds are usually found to belong to genera of earlier epochs.

(433.) Not less remarkable than the accumulation of bones in caverns, is the frequent occurrence in all parts of the world of osseous breccias, or beds of bones either reduced to fragments or entire, cemented together by calcareous stalactite. Such are found in great abundance all along the north coast of the Mediterranean—at Gibraltar, Montpellier, Nice, &c. Some of the Greek isles, too, as Cerigo, abound in such breccias, the bones from the latter being crushed and comminuted in the most extraordinary manner. To any one who reflects on the destructive effects of sudden inundations, in sweeping away and drifting together the drowned carcasses of tens or hundreds of thousands of animals (as recorded in the floods of the South American rivers), the causes of such accumulations will offer no difficulty.

(434.) Among the Mammals of the earliest tertiary or eocene period, the most remarkable are those discovered by Cuvier in the Lacustrine formations of the Paris basin, and especially in the gypsum quarries of Montmartre, scarcely a block taken from which does not disclose some fragment of a fossil skeleton. Here, among extinct species of extinct genera, we find the Palæotherium, Anoplotherium, Cheropotamus and Adapis, and among extinct species of genera still existing, bats, wolves, racoons, genettes, dormice, squirrels, and several birds, besides a small didelphis allied to the American opossum. The Deinotherium belonged to the Meiocene, and the Machairodon to that and the Pleiocene, the latter being a genus of very wide distribution, species of it having been found at Buenos Ayres, in Britain, in France, in Germany, and in the Sivalik hills in India.

(435.) Among the fossils of the tertiary epochs, occur many reptiles, the most remarkable of which is the

gigantic tortoise discovered in India by Messrs Falconer and Cautley, the colossochelys; but the greatest development of reptile life appears to have taken place during the deposition of the secondary strata. Thus, we find enumerated by Professor E. Forbes, in the Cretaceous formations, 8 genera of reptiles; in the Oolitic and Wealden, including the Lias, 24; and in the Triassic beds, 16. They extend, indeed, somewhat lower in the scale, as in the Permian members of the upper Palæozoic rocks four genera are enumerated; and even below the coal, in the Devonian strata, two genera are found among these animals. The most remarkable forms are those of the Saurian family, most of them aquatic lizards furnished with paddles in lieu of legs, and many of them marine (Enaliosauria). Among them occur several of gigantic dimensions or monstrous form, as the Mososaurus of the upper chalk, near Maestricht, a species allied to the Monitor, 25 feet in length; the Hylæosaurus, of equal dimensions; the Icthyosaurus and Plesiosaurus of the Oolite and Lias, and others. In the Stonesfield slate occurs the Megalosaurus an amphibious or land lizard, carnivorous like the crocodile, and from 40 to 50 feet in length; in the newer Oolite or Wealden, the still more gigantic but herbivorous iguanodon, which, according to Dr Mantell, attained 70 feet. In the strata below the Lias, in the upper red sandstone, we find that extraordinary gigantic Batrachian, the Labyrinthodon, and the Cheirotherium, whose footmarks only have been discovered. But the most singular reptile form of the whole series is that of the Pterodactyl or flying lizard, with bat's wings and crocodile jaws, furnished with 60 pointed teeth, which first appeared in the epoch of the Lias, and became extinct in that of the chalk, and of which several species have been found.

(436.) Comparatively few fossil serpents have been discovered, and those only in the tertiary formations—the Eocene deposits of England have afforded some of the largest, forming two genera, Palæophis and Paleryx—the largest of which was equal in size to the largest boa constrictor of the present day. Some small snakes have been found in the Meiocene and Pleiocene formations of France.

(437.) Among the fishes, no existing genus is found below the chalk. In the inferior chalk there is one living genus, Fistularia; in the true chalk, 5; in the tertiary strata of Monte Bolca, 39 living and 38 extinct, according to M. Agassiz, to whom we owe a system of classification of this order of vertebrata by their scales, a character peculiarly adapted to fossil fish, of which frequently only the scales and a few of the harder bones remain, according to which they are divided into four great groups, Placoid, Ganoid, Ctenoid, and Cycloid. Of these four great families, the two latter are found only in the cretaceous and tertiary strata, and not a single species is of older date. In the cretaceous strata, they occur mixed with species of the two former classes. The epoch when the chalk began to be deposited forms therefore a very decided break in the history of this class of animals. And again, of the two more ancient orders, the Palæozoic rocks contain almost exclusively the remains of that class of fishes known as heterocercal, in which the upper lobe of the caudal fin is much more developed than the lower; while the secondary rocks contain the homocercal, in which the lobes are equal. The most remarkable deposits of fossil fishes are those of the Monte Bolca limestone near Verona—the coal formation of Saarbrück in Lorraine, the bituminous shale of Mansfield in Thuringia,—the blue slate of Glaris, and the marl stones of Oëningen in Switzerland, and of Aix in Provence, and our own old red sandstone. The distribution of genera, according to Professor E. Forbes, is as follows:—Newer Tertiary, 40 genera; Older Tertiary, 38; Cretaceous, 61; Oolitic, 61; Triassic, 15; Permian, 14; Carboniferous, 31; Devonian, 43; and Silurian, 2. (?)

(438.) The mollusca, from the durability of their shells, have left behind them almost a complete record of the ancient zoology of this class of animals. Their remains furnish the chief and most available practical means of determining the relative ages and order of superposition of strata, and are thus the main stay of geological science. As such, then, their study assumes a technical aspect, and can only be followed up in professedly geological works (see the article on that subject in this work, and every geological treatise of note). The same evidence is afforded of the continual introduction of new genera and species, and dying out of old, as in every branch of zoology, the range, however, being far wider than in any before treated of. In fact, these, and the forms of radiata and articulated animals, and of zoophytes, occur as the first vestiges of animated existence in the earliest fossiliferous strata. As might be expected, from the greater probable uniformity of condition afforded in marine over terrestrial life, the families have been much more persistent than those of the higher organisms. Thus the lingula, a brachiopodous genus of the very earliest silurian epoch, has its generic representatives still living. The nautilus, a cephalopod of the older palæozoic series, has still its place among living genera. We have also natica, eulima, solarium, and capulus among the gasteropods, and cardium, mytilus, arca, isocardia, avicula, and terebratula among the acephalous molluscs; while, on the other hand, some of the genera of earliest appearance (as orthoceras, cyrtoceras, phragmoceras, gomphoceras, and lituites) died out before the commencement of the secondary period. The ammonites, a most extensive and characteristic genus of the secondary period, in like manner died out before its close, as was also the case with the belemnitic, scaphytic, and turrilitic forms. This is the more remarkable in the case of the ammonites, as there is scarcely any generic form of organized life which seems to have luxuriated into so vast a variety of species. Bivalves are rare in the older formations.

(439.) Among the articulata, the trilobite, a form long since extinct, is highly characteristic of the earliest formations. They extend up to the carboniferous epoch. Crustaceous animals, gradually approaching recent forms, commence from the oolitic and cretaceous epoch. Insects are of comparatively rare occurrence. Fossil scorpions are recorded in the coal formation of Chomle, in Bohemia. Among the radiated animals and zoophytes (to which belong the very earliest vestiges of animated being) are a great variety of very remarkable and exquisitely beautiful forms, those, for instance, of the encrinites, apiocrinites, and actinocrinites, which have more resemblance to plants than animals, whence their name of "stone lilies." They seem to have attained their maximum in the carboniferous period. The pentacrinites of the lias are particularly beautiful. Sea urchins (echini) first appeared in the lias period, became abundant in the oolitic, continued so during the cretaceous epoch, and are still denizens of our seas. Corals and corallines belong to every age in which limestones have been formed.

(440.) *Fossil Plants.*—The lowest palæozoic strata exhibit indications of what may be taken for sea-weed, and in the grauwacke strata (which belong to these and to the lower devonian), fucoid plants occur abundantly. In Pennsylvania a hundred layers of them have been found in a thickness of 20 feet (Buckland, *Bridgw. Tr.* i., 452), but it is not till the carboniferous period that fossil vegetation assumes any notable proportions. There, however, it stands forward in most singular and wonderful promi-

Physical Geography.

nence, as there is no doubt that the whole of the immense deposits of coal in every part of the world owe their origin entirely to the fossilization of vegetables. "The most elaborate imitations of living foliage," says Dr. Buckland, "upon the painted ceilings of Italian palaces, bear no comparison with the beauteous profusion of extinct vegetable forms with which the galleries of the Bohemian coal mines are overhung. The roof is covered as with a canopy of gorgeous tapestry, enriched with festoons of most graceful foliage flung in wild profusion over every part of its surface. . . . Trees of forms and characters now unknown, are presented to the spectator almost in the beauty and vigour of their primeval life. Their scaly stems and bending branches, with their delicate foliage, are all spread before him, little impaired by the lapse of countless ages." The plants thus wonderfully preserved are equisetaceæ, ferns, mostly arborescent (indicating the prevalence of a tropical climate and insular arrangement of the land), lepidodendra, sigillaria, calamites, and stigmaria, the lepidodendra offering a transitional step between cryptogamous and flowering plants of high botanical interest. Above the carboniferous series the vegetation undergoes a great change. Cycadeæ occur in abundance, associated with peculiar ferns, but now coniferous plants, such as pines, araucarias, &c., begin to appear in the lias and oolite; and it is singular that the genera in our own lias approximate rather to the recent species of the southern than the northern hemisphere. It is worthy of remark, that where the stumps of these trees are found rooted in strata now inclined at a high angle to the horizon, the direction of the remaining portion of the stem is similarly inclined to the vertical. The pandaneæ, or screw pines (now confined to the Indian archipelago and tropical Pacific islands), are also found in our oolitic beds.

(441.) In the tertiary strata, the Dicotyledons assume nearly the same ratio to the Monocotyledons as at present, and the greater number of fossil plants, though of extinct species, bear much resemblance to living genera. Great deposits of Brown Coal or Lignite (as those of Poole in Dorset, Bovey Traccy in Devon, Soissons in France, the Surturbrand beds in Iceland, and those on the banks of the Rhine, belong to the Eocene epoch, those of Oeningen in Switzerland to the Meiocene. Independent of these, we find fossil palms in the British tertiary beds, and even the date and cocoa-nut in the isle of Sheppey, as well as at Brussels, where also the fruit of the areca-nut is found fossil, but with abundant evidence of having been drifted thither by oceanic currents from a warmer climate.

(442.) As we approach the recent epochs, the remains of vegetables are assembled in *submarine forests,* such as we find at Hastings, on the coast of Sussex, and indeed along the shores of western Europe, from Scandinavia to Spain and Portugal. They stretch sometimes inland under gravel sands and clays to a considerable distance, usually on slopes dipping slightly seaward. In the Baltic, trunks of oaks, pines, &c., the roots in their natural position, several layers one above the other, and four or five feet under water, occur at Griefswald, in the island of Usedom, and near Colberg. In the submarine forest of Minehead, Somerset, the bones and antlers of the red deer (which are still found wild in Exmoor) are found among the still upright oak stumps. In one of these forests in South Wales, near the mouth of the Neath river, among the stumps are found footmarks of a gigantic species of ox in the clay, apparently of the "*Bos primigenius,*" whose horns and skull have been discovered near the spot.

(443.) A great portion of the fossilized plants which occur in various parts of the world, are found silicified, the vegetable matter having been, as it were, extracted molecule by molecule, and silex deposited in its place, and that without destroying the cells, fibres, and tissues of the organization, which remains perfectly distinguishable under the microscope, in sections thin enough to be transparent. The chemical or electro-chemical process by which this change has been accomplished, is ill understood. Whatever the nature of the process, it goes on, as it were, under our eyes in siliceous springs; as in the Azores, where wood and reeds are found to become silicified; in the Geysers of Iceland; and even in the waters of certain streams not usually considered siliceous, as in the case of Trajan's bridge, the piles of which, still extant in the Danube, are externally converted into silex. But other cases occur where the mode of change is much more mysterious. Thus in the sand of the Isthmus of Suez, an immense abundance of silicified palm-trees makes its appearance, which would seem never to have undergone submergence in water. At Ober Dollendorf, on the Rhine, occurs a deposit of silicified wood, in which not only the living organization of the wood is preserved, but when the wood has become decayed, and almost disintegrated by decomposition, the silicifying process has arrested the progress of decay, and preserved every fibre in *loose spiculæ* of most wonderful delicacy and beauty.

(444.) *Ethnology.*—Our limits oblige us to be very brief on this part of our subject, and in this we acquiesce the more readily—1st, Because the reader will find, under that heading, an elaborate article in another part of this work; and 2dly, Because whatever *properly* belongs to the scope of the present essay, may be comprised in a very small compass. And first, then, as to the date of the introduction of the human species on earth. So far as geological research has hitherto gone, there can hardly be said to be any absolute unequivocal proof that men have been coeval with any one quadruped now extinct, or any bird but the dodo and the solitaire or bluebird, whose extinction is distinctly referable to his agency in times comparatively recent. The geologist, however, needs not to be reminded that this admission leaves a margin wide enough for any, even the most extravagant interpretations, of sacred chronology or traditional history. 3dly, That the unity of the human species, as a matter of natural history, rests upon quite as valid physiological arguments as that in the case of several other animals, as the dog among quadrupeds, or the domestic fowl among birds (to say nothing of the sheep and ox, in which the varieties are less marked), and in which the "races" are distinctly referable to the influence exercised by their domestication and *association with man;* not only as to varieties of stature or form (which go to an infinitely greater extent than anything observable among different races among men), but as to the development of new and peculiar psychological qualities.[1] Of all the merely physiological arguments which have been adduced in support of this unity, the most satisfactory seems to be that drawn from the identity of the period of gestation in all the races of mankind. 4thly, That, nevertheless, the difference between the human and all other species of animals is so vast, that it is impossible to ground a perfectly secure inductive argument or any such analogies. Our definition of "species" breaks down; and 5thly, That though we have absolutely no measure whatever, and cannot even conjecture what time or what number of

[1] It is probable that the full value of the Elephant as an *intelligent* servant of man has never been developed, owing to the neglect of all rational and persevering attempts to breed them in captivity. An absurd prejudice has too long been suffered to prevail as to its impossibility, but this has been distinctly disproved, and is now, we believe, exploded.

generations would be required to convert the descendants of (say) a Georgian or a Circassian pair, established in Congo or Guinea, and cut off from all communication with the rest of mankind, into negroes, or *vice versâ*, we are very sure that the change would require an immense period; and yet that such transformation, if it ever took place at all, must have taken place antecedent to all history. The negro was as much a negro in the time of the Romans as at the present day. The fair hair and blue eyes of the Germanic races were as much matter of general notoriety and contrast with the dark standard of South Italian beauty (*nigris oculis, nigroque crine*), in the days of Juvenal,[1] as now. If, therefore, we accept the idea of a single creation, and of the divergence of the human race on the world from a single centre; since we must then make up our minds to accept with it whatever consequences, as to the great duration of man's denizenship on earth, the existing diversity of races shall carry with it, we must not be surprised if those should be found who maintain that every trace of the primeval language has been totally obliterated indefinite ages ago, and that, whatever clue language may afford us in tracing out migrations and affiliations during the last few thousands of years, it can give us absolutely none towards the discovery of that point or that region on the surface of our planet first inhabited by man. All that the division recognized by ethnologists of the existing population of the globe into three, or five, or more races differing by marked peculiarities (a Caucasian or Aryan, a Mongolian and a Negro, or these, with an American or Polynesian type), can teach us is, that certain great districts, having certain features more or less influential in determining moral and physical habits, have remained for a sufficient number of ages in a state of comparative insulation from each other. On this subject we must refer our readers emphatically to the great work of the late Dr. Pritchard on "the Natural History of Man."

(445.) We cannot conclude this article without acknowledging our obligations to the authors of several valuable and excellent works on this general subject which we have consulted, and which have furnished us with useful guidance, especially the Physical Atlas of Mr Keith Johnston, a perfect treasure of compressed information; Mrs Somerville's "Physical Geography," and the unpretending but most useful treatise on the same subject by Professor Ansted, in the "Manual of Geographical Science." To cite the special authorities from which we have drawn the great mass of our statements, or to which the reader must be referred for further information, would be almost equivalent to giving a *catalogue raisonée* of voyages, travels, and works on geology, geography, and natural history. (J. F. W. H.)

APPENDIX A.

Table of the Heights of Mountains.—I. *Mountains of Europe.*

N.B.—When the heights in the table differ from the text, the former are to be preferred. (V) denotes an active volcano.

Mountains of Europe.	Height in English feet.	Country or District.
Mont Blanc	15,744	Sardinia.
Monte Rosa	15,151	Sardinia.
Mont Cervin	14,836	Sardinia.
Finsteraarhorn	14,026	Switzerland.
Jungfrau	13,716	Switzerland.
Kleine Mt. Cervin[2]	13,703	Sardinia.
Monte Viso	13,599	Sardinia.
Grande Jorasse (Mt. Blanc)	13,496	Sardinia.
Pic des Ecrins or Arsines	13,467	France.
Aiguille Verte (Mt Blanc)	13,432	Sardinia.
Schreckhorn	13,397	Switzerland.
Mt Iseran	13,272	
Aiguille du Geant (Mt. Blanc)	13,099	Sardinia.
Oertler Spitz	12,822	Tyrol.
Breithorn	12,800?	Sardinia.
Gross Glockner	12,431	Austria.
Mulhaçen	11,664	Spain.
Pico de Veleta	11,398?	Spain.
[illegible]	11,168	Pyrenees.
[illegible]	11,063?	Austria.
Mont Perdu	10,994	Pyrenees.
Muschelhorn	10,948?	Tyrol.
Cylinder of Maburé	10,897	Pyrenees.
Etna (V)[3]	10,872	Sicily.
Maladetta	10,866	Pyrenees.
Vignemale	10,820	Pyrenees.
Sierra de Gredos	10,552	Spain.
Hochspitze	10,330	Vorarlberg
Dreyherrn Spitz	10,122	Austria.
Monte Corno (Gran Sasso d'Italia)	10,144	Apennines.
Mt. Buet	10,112?	Sardinia.
Sharah Tagh	10,000?	
Ruska Poyano	9,912	E. Carpathians.
La Marmolata	9,802	Tyrol.
Olympus in Europe	9,749	Thessaly.
Gross Kogl	9,700?	Carinthia.
Monte Santo	9,628	Greece.
Mt. Budosch	9,594	Transylvania.

Mountains of Europe.	Height in English feet.	Country or District.
Mt. Surul	9,593	E. Carpathians.
Pic du Midi	9,439	Pyrenees.
Mt. Terglou	9,366	Austria.
Mt. Butschetje	9,256	Transylvania.
Mt. Legnone	9,206	
Cima d'Asta	9,191	Tyrol.
Canigou	9,138	Pyrenees.
Mte. Amaro di Majella	9,113	Apennines.
Mount Kom	9,000?	Illyria.
Great Balkan (Hæmus)	8,874	Balkan Mts.
Lomnitzer Spitz	8,862	Carpathian
Monte Rotondo	8,767	Corsica.
Monte d'Oro	8,701	Corsica.
Mt. Tatra	8,524	W. Carpathians.
Mt. Tornavacas	8,500?	Spain.
Mt. Kesmark	8,500?	Hungary.
Pic d'Abrizon	8,344?	Pyrenees.
Mt Csabi	8,316	W. Carpathians.
Rilodagh (Rhodope)	8,313	
Mt. Guiona	8,241	Greece.
Peña Laza	8,222	Spain.
Mont Spinal	8,203	Tyrol.
Schneehätten[4]	8,102	Scandinavia.
Skagtoltind	8,101	Scandinavia.
Parnassus	8,068	Greece.
Schlern	8,045	Tyrol.
Taygetus (Mt. St Elias)	7,904	Greece.
Monte Gazza	7,898	Tyrol.
Mte. Velino	7,851	Apennines.
Mt. Kelmos	7,726	Greece.
Cima di Portole	7,416	Tyrol.
Mt. Olonas	7,293	Greece.
Siete Picos	7,244	Spain.
Koldetina	7,224	Scandinavia.
Termenillo Grande	7,212	Apennines.
Sognefield	7,182	Scandinavia.
Pindus	7,000	Greece.
Monte Cimone	6,975	Apennines.
Pighätten	6,788	Scandinavia.

[1] Cærula quis stupet Germani lumina, flavam Cæsariem.

[2] By a barometrical measurement in 1821 by the author of this article.

[3] By a barometrical measurement in 1824 by the author of this article.

[4] K. Johnston makes the Schneehatten 7520. We follow the Annuaire du Bureau des Longitudes.

Table of the Heights of Mountains—(Continued).

Mountains of Europe.	Height in English feet	Country or District.
Mt. Athos	6,776	Greece
Langfield	6,598	Scandinavia.
[illegible]	6,584	Jura
El Gador	6,575	Spain.
Mt. Priel	6,565	Austria
Pizzo di Cane	6,509	Sicily.
Monte Genargentu	6,293	Sardinia. (Isl.)
Mont Ventoux	6,263	France.
Pic de Sancy (Mt d'Or)	6,238	France.
Sulitelma	6,178	Scandinavia.
Plomb du Cantal	6,096	France
Mont Rigi	6,050	Switzerland.
Aetscher	5,990	Austria
Mont Mezen (Cevennes)	5,794	France.
Monte Amiata	5,794	Tuscany.
Mount Helicon	5,738	Greece.
Delphi	5,725	Greece.
Mont Lozere	5,535	Central France.
Puy Mary	5,435	Central France.
Riesekoppe	5,394	Germany.
Wechselsberg	5,352	Styria.
Mt. Hussoko	5,328	Moravia.
Schneekoppe	5,376	Bohemia.
Puy de Violan	5,229	Central France.
Kasberg	5,215?	
Mt Adelat	5,145	Sweden.
Tschatir Dagh	5,000	Crimea
Riesenberg	4,961	Bohemia.
Melderskin	4,859	Scandinavia
Gross Arberg	4,832	Bavaria.
Puy de Dome	4,807	Central France.
Schneeberg	4,784	Riesengebirze.
Ballon des Vosges	4,688	France
Feldberg (Schwartzwald)	4,675	Germany.
Belchenberg (Schwartzwald)	4,642	Germany.
Rachelberg Bohmerwald	4,561	Germany.
Seisser Alp	4,553	Tyrol.
Mt. Celeno	4,500?	Greece.
Ben Nevis	4,406	Scotland.
Lyngen Mountains	4,300	Scandinavia.
Ben Macdui	4,296	Scotland.
Kammkoppel (Schwartzwald)	4,265	Germany
Cairn Tuol (Aberdeen)	4,225	Scotland.
Puy de Longchamp	4,190	Central France.
Puy de Come	4,173	Central France.
Kandelberg (Schwartzwald)	4,160	Germany
Sonnenwerbel (Erzgebirge)	4,124	Germany.
Cairn Gorm	4,090	Scotland.
Puy de Pariou	4,012	Central France.
Puy de Cliersou	3,992	Central France.
Ben Lawers	3,984	Scotland.
Vesuvius (V) [1]	3,922	Italy
Puy de Chopine	3,910	Central France.
Mt. Eryx	3,894	Sicily.
Mte. Somma	3,869	Italy.
Ben Avon (Aberdeen)	3,821	Scotland.
Grand Sarcouy	3,799	Central France.
Brocken (Hartz)	3,740	Germany.
Sierra de Foya (Algarve)	3,609	Portugal
Mt. Rona	3,593	Shetland.
Snowdon	3,590	N. Wales.
Schehallion [2]	3,547	Scotland.
Steinberg (Moravia)	3,511	Germany.
Cairn Llewellen	3,471	N. Wales.
Schneeberg (Fichtelgebirge)	3,461	Germany.
Mte. Cuccio (Palermo) [3]	3,435	Sicily.
Ben Wyvis	3,422	Scotland.
Curran or Cairn Tual (Kerry)	3,405	Ireland.
Hymettus	3,378	Greece.
Gross Bier (Thuringia)	3,361	Germany.
Cuchullin (Skye)	3,242	Hebrides.
Ben Lomond	3,192	Scotland.
Ben More (Mull)	3,185	Hebrides
Mte. Cavo (Campagna)	3,130	Italy
Helvellyn (Cumberland)	3,115	England.
Skiddaw (Cumberland)	3,058	England.
Cader Idris	2,959	N. Wales
Chicciola (V) (Stromboli)	2,957	Lipari Islands
Cross Fell (Cumberland)	2,928	England.
Shebh Donard	2,788	Ireland
Gross Feldberg (Taunus)	2,775	Germany.
Blessberg (Thuringia)	2,748	Germany.
Cheviot	2,669	England.
Coniston Fell (Lancashire)	2,649	England.
Nephin (Mayo)	2,638	Ireland.
Morne Mountains (Down)	2,493	Ireland.
Schunner Fell (Yorkshire)	2,348	England.
Soracte (Sorretto)	2,271?	Italy
Skaling Fell (Stromoe)	2,172	Feroe Islands.
Ben More (South Uist)	2,035	Hebrides.
Lowenberg (Siebengebirge)	2,024	Germany.
Hecla (South Uist)	1,992	Hebrides
Mt Ronas (Shetland)	1,475	Scotland.
Gibraltar	1,439?	Spain
Volcano Island (V)	1,304	Lipari Islands.
Valdai Mountains (culm)	1,100	Russia.
Arthur's Seat (Edinburgh)	822	Scotland.

II. *Mountains of Asia.*

Mountains of Asia.	Height in English feet.	Country or District
Deodunga or Chingo-pamari	29,002	Nepal.
Kinchinjunga (W peak)	28,178	Sikkim.
——— (E peak)	27,826	Sikkim.
Dwalagiri	26,861 [4]	Nepal
Nandadevi	25,749	Himalaya.
Juwahir	25,669	Kemaon.
Jumnotri	25,660	Nepal.
Jumnu	25,313	Sikkim.
Setghur	25,261	Nepal.
Daibhun	24,740	Nepal.
Gossain Thau	24,700	Himalaya.
Khabru	24,005	Sikkim.
Chumalari	23,929	Thibet.
Momonangli or Gurla	23,510	Thibet
Webb's Peak, No 12	23,263	Himalaya.
Powhunri or Donkiah Lah	23,175	Sikkim
Webb's Peak, No. 3	22,832	Himalaya.
Api	22,799	Nepal.
Webb's Peak, No. 23	22,727	Himalaya.
——— St. Patrick	22,638	Himalaya.
——— St. George	22,500	Himalaya.
——— No 13	22,313	Himalaya.
——— No. 25	22,277	Himalaya.
Kanchangow	22,000	Sikkim.
Jownili	21,940	Kemaon.
Zwillingo	21,600	East Himalaya.
Gangoutri Pyramid	21,219	Himalaya.
Kailas	21,000	Thibet.
Hindu Koh (summit N. of Cabul)	20,232	Affghanistan.
Bolor Mountains	19,000	
Elbruz	18,493	Caucasus.
Kohibaba	17,905	Hindu Kho.
Ararat (Agridagh)	17,112	Persia
Kasbek	16,532	Caucasus.
Klieutschewsk (V)	15,763	Kamschatka
Savalan	15,750	Caucasian Mts.
Demawend (V)	14,695 [5]	Persia
Argæus (Argisch Tagh)	13,197 [6]	Asia Minor.

[1] By a barometrical measurement by the author of this article.

[2] We follow the Annuaire du Bureau des Longitudes.

[3] By a barometrical measurement by the author, June 23, 1824.

[4] We follow the Annuaire du B. des L. K Johnston makes it 27,600.

[5] Humboldt (Kosmos, iv. 385) makes Demawend more than 19,000 feet. Mr Thomson and Lord Schomberg Kerr are said to have determined its height by recent barometrical measurement at 21,500 feet. (*Times Newspaper*).

[6] Humboldt makes it 12,600. We follow Mrs Somerville.

Table of the Heights of Mountains—(Continued).

Mountains of Asia.	Height in English feet	Country or District.
Opalinski (V) 51 21 N	12,000	Kamschatka.
Jebel el Makmel	12,000	Syria
Uschinskaia (V)	11,721	Kamschatka.
Koriaskaia (V)	11,210	Kamschatka.
Belouka	11,062	Altai.
Takt-i-Suleiman	11,000	Affghanistan
Tangnou Mountains (Oubsa River)	11,000	Central Asia.
Kronozkaia (V)	10,609	Kamschatka.
Schiwelutsch (V)	10,544	Kamschatka.
Hermon	10,000	Syria.
Taurus (culminating point)	9,800	Asia Minor
Krestowskaia	9,592	Kamschatka.
Libanus	9,517 ?	Syria.
Um Shomah	9,300	Syria.
Jupanowa (V)	9,055	Kamschatka.
Awatscha or Gorelaia (V)	8,910	Kamschatka.
Dodabetta Peak	8,760	Nilgheri Mts.
Horeb	8,593	Syria.
Kudiakad Peak	8,502	Nilgheri Mts
Bevoybetta Peak	8,488	Nilgheri Mts.
Murkurti	8,402	Nilgheri Mts.
Daversolabetta Peak	8,380	Nilgheri Mts.
Kundah	8,353	Nilgheri Mts.
Tolbatschuskaia (V)	8,313	Kamschatka.
Poworotnoi (V)	7,931	Kamschatka
Kundamaya	7,816	Nilgheri Mts.
Sinai	7,498	Syria.
Wiljutschinskaia (V)	7,373	Kamschatka.
Utacamund Peak	7,361	Nilgheri Mts.
Tamburbetta Peak	7,292	Nilgheri Mts.
Hokulbetta Peak	7,267	Nilgheri Mts
Bonasson	7,000	Western Ghauts.
Urbetta	6,915	Nilgheri Mts.
Kodanad	6,815	Nilgheri Mts.
Jebul Serbal	6,760	Syria.
Wilutschinskaia (V)	6,746	Kamschatka.
Davebetta	6,571	Nilgheri Mts.
Kotagiri	6,571	Nilgheri Mts.
Kundabetta	6,555	Nilgheri Mts.
Olympus in Asia	6,332	Asia Minor.
Dimhutti	6,330	Nilgheri Mts.
Cunur	5,886	Nilgheri Mts.
Tandiamole	5,781	Western Ghauts.
Pupugiri	5,682	Western Ghauts.
Koniakofsky Kamen	5,397	Ural.
Tremel or Iremel	5,075	Ural.
Mount Abu	5,000	Aravulli Mts.
Constantinow Kamen	5,000	Ural.
Jatara	4,800	Affghanistan.
Mahabuleshwar	4,700	Western Ghauts.
Purundar	4,472	Western Ghauts.
Singhur	4,162	Western Ghauts.
Hurrechundernagur	3,894	Western Ghauts.
Taganai	3,592	Ural.

III. *Mountains of Africa and the Atlantic Islands.*

Mountains of Africa and the Atlantic Islands.	Height in English feet.	Country or District
Kilimanjaro	20,000	Equatorial Africa
Mount Woso, 6 30. N.	16,350	Ethiopia.
Mount Dajan, 13. 15. N.	15,740	Ethiopia.
Abba Jarrat, 13. 10. N.	15,008	Abyssinia.
Geesh	15,000 ?	Abyssinia.
Buahat, 13. 12. N.	14,362	Abyssinia.
Mont Fatra, 10. 42. N.	14,350	Abyssinia.
Cameroon Mountains	13,000	Bight of Biafra.
Pico de Teyde (V) (Teneriffe)	12,205	Canary Islands.
Atlas (Miltsin)	11,400	Morocco
Lamalmon	11,200 ?	Abyssinia.
Fez Mountains	10,000 ?	Morocco
Chahorra (V) (Teneriffe)	9,885	Canary Islands.
Peak of Fogo (V)	9,152	Cape Verde Is.
Peak of St Antonio	8,815	Cape Verde Is.
Gondar Mountains	8,450 ?	Abyssinia
Tristan d'Acunha (V)	8,236	T d'Acunha Is.
Taranta	7,800 ?	Abyssinia.
Pico de Cruz (Palma)	7,730	Canaries
Pico (Peak of Azores)	7,613 [1]	St Michael's, Azores.
Trigo	7,400 ?	Canaries.
Blue Mountains (culmination of)	7,277 [2]	Jamaica.
Montano del Cobre	6,890	Cuba
Beerenberg	6,871	Jan Mayen's Is.
Los Rexas (Gt Can)	6,400	Canaries.
Morne Diablotin (V)	6,075	Dominica.
Pico Ruivo	6,059	Madeira.
Mount Chaco	6,000	Hayti.
Oraefa Jokul (V)	5,927	Iceland.
Eyafialla (V)	5,685	Iceland.
Hecla (V)	5,117 [3]	Iceland.
Snaefell Jokul	5,112	Iceland.
Morne Garou	5,007 [4]	St Vincents.
Souffriere (Guadaloupe)	4,867 [5]	
Montagne Pelée or Carbet	4,432 [6]	Martinique.
Alto Geraona (Gomera Is)	4,400	Canaries.
Swart Spitz (Pte. Noire)	4,399	Spitzbergen.
Mount Parnassus	3,917	Spitzbergen.
San Anton (Ferro)	3,907	Canaries.
Table Mountain	3,816	Cape of G. Hope.
Mount Misery (St Kitts)	3,720	Antilles.
Pico de Vara (St Michaels)	3,570	Azores.
Caldeira de S. Barbara (Terceira)	3,560	Azores.
Pico de S Jorge	3,198	Azores.
Morro Gordo (Flores)	3,087	Azores.
Asses' Ears (Fuentaventura)	2,770	Canaries.
Diana's Peak	2,692 ?	St Helena.
Caldeira de Corvo	2,460	Azores.
Lion's Head	2,166 ?	Cape of G. Hope.
Santa Lucia (V)	1,920	Antilles.
Mount Esk (V)	1,600	Jan Mayen Is.
Morne Rouge (V) (Granada)	640	Antilles.

IV. *Mountains of America.*

Mountains of America.	Height in English feet.	Country or District.
Aconcagua	23,910	Chile.
Sahama (V)	22,350	Peru.
Parinacota	22,030	Peru.
Tupungato	22,016	Chile.
Gualatieri	21,960	Peru.
Pomarape	21,700	Peru.
Chimborazo	21,424	Equatorial Andes.
Sorate	21,288	Bolivian Andes.
Ilimane	21,148	Bolivian Andes.
Chaquibamba	21,000	Bolivian Andes.
Viejo	20,500	Peru.
Concae	20,386	Chile.
Chachacomani	20,355	Bolivian Andes.
Huaina (Potosi)	20,260	Bolivian Andes.
Angel Peak (16. 10. S.)	20,115	Bolivian Andes.
Chipicani	19,745	Peru.
Charcani (V)	19,708 ?	Peru.

[1] Keith Johnston makes this mountain 7808 feet. We follow Humboldt.
[2] K. J. gives 6000. We follow the Annuaire du B. des Long.
[3] The Annuaire makes Hecla only 3314. We follow Humboldt.
[4] Mrs Somerville makes Mt Garou only 4370. We follow Keith Johnston.
[5] According to St Clair Deville. K. J makes it 5110.
[6] Dupuger makes this mountain 4706 feet high. We follow K. J.

Table of the Heights of Mountains—(Continued).

Mountains of America.	Height in English feet.	Country or District.
Coyambe	19,535	Equatorial Andes
La Mesada	19,356	Bolivian Andes.
Antisana (V)	19,137	Quito.
Sierra de Santa Marta	19,000	Venezuela.
Cotopaxi (V)	18,877	Equatorial Andes
Arequipa (V)	18,876 ?	Peru.
Queñuta, 17. 41. S.	18,765	Peru.
Nevado of Anaclache	18,500	Peru
Cacaca, 16. 25. S.	18,210	Bolivian Andes.
Tolima	18,120	Quito.
Cololo	17,930	Bolivian Andes.
Orizaba (V) or Citlaltepetl	18,879	Mexico.
Mount St Elias[1]	17,850 ?	N W. America.
Popocatepetl (V)	17,726	Mexico.
Maypu (V)	17,644	Chile.
Apu Cunaranu	17,590	Peru.
Vilcañota	17,525	Peru.
Ilinissa	17,380	Equatorial Andes
Sangay (V) or Macas	17,124	Quito.
Puracé (V)	17,006	N Granada.
Mount Hooker (Rocky Mountains)	16,730 ?	N W. America.
Chorolque	16,550	Bolivian Andes.
Tunguragua (V)	16,491	Quito.
Sinchulagua	16,434	Quito
Cerra de Potosi	16,152	Bolivian Andes.
Muiquiri	16,100	Bolivian Andes.
Dona Aña Peak	16,070	Bolivian Andes.
Nevado de la Vinda	16,000	Peru.
Uvinas	16,000	Bolivian Andes.
Mount Brown	15,990	Cascade Mountains, N. W. A.
Pichincha (V)	15,923	Quito.
Iztacihuatl (V)	15,705	Mexico.
Carguairazo	15,673	Quito.
Cumbal (V)	15,680	Quito.
Mount St Helens	15,500	Cascade Mountains, N. W A
Mount Hood	15,500	Cascade Mountains, N. W. A
Sierra Nevada	15,170	Mexico.
Toluca (V)	15,168	Mexico.
Tupungate (V)	15,100	Chile
Agua (V)	15,000	Guatemala.
Cerro di Buen Tempo	14,710	N. W. America.
Monte de las Litanias	14,500	Bolivian Andes.
Inchocaio	13,656	
Fremont's Peak, Rocky Mountains	13,568	N. W. America.
Pasto	13,450	Quito.
Monte de Azupe	13,450	
Cope de Perote	13,416	Mexico.
Amilpas, 15. 10. N.	13,160	Guatemala.
Colima (V)	13,003	Mexico.
Tuqueres (V)	12,821	Los Pastos.
Atitlan (V)	12,506	Guatemala.
Mont Regnier (V)	12,320	Cascade Mountains, N. W. A
Mount Taylor	12,256	Rocky Mountains, N. W. A
Iliämän (V) 60. N.	12,066	N. W America, Cook's Inlet.
Wrangell's Volcano	12,064	N. W. America, Coppermine R.
Cerro de Azusco	12,052 ?	Mexico.
Irasu (V. de Cartago)	11,478	Guatemala.
St Nicolaus, 60. 40. N.	11,270	N. W. America.
Pico de Tancitaro	10,498 ?	Mexico.
Orosce or Papagajo	9,976	Guatemala.
Votos (V)	9,848	Guatemala.
Viejo (V)	9,600	Guatemala.
Mount Pitt or Laughlin	9,549	Cascade Mountains, N.W.A.
Antuco (V)	8,918	Chile.
Silla de Caraccas	8,600	Venezuela.
Mount Aquarius	8,526	Rocky Mountains, N W.A.
Yanteles (V)	8,030	Patagonia.
Minchinmadeva (V)	8,000	Patagonia.
Sierra de Guayraima	7 600	Venezuela.
Osorno or Lanquihue (V)	7,549	Chile
Corcobado (V)	7,510	Patagonia.
Congrehoy Peak	7,482	Honduras.
Roraima	7,450	Guiana.
Melimoya	7,400	Patagonia.
Duida[2]	7,149	Venezuela.
Mount Omoa	7,000	Honduras
Mount Sarmiento	6 910	Terra del Fuego
Mount Darwin	6,800	Terra del Fuego
Mount Washington	6,428	Appalachian Mts, N.A.
Mount Stokes	6,400	Patagonia.
White Mountains, Massachusetts	6,230 ?	N. America, U S.
Mount Werner	6,000 ?	East Greenland.
Blaaserk	6,000 ?	East Greenland.
Itambe	5,960	Brazil.
Mount Adams	5,960	Appalachian Mts
Mount Jefferson	5,860	Appalachian Mts
Sierra da Piedade	5,830	Brazil.
Mount Burney	5,800	Patagonia.
Itacolumi	5,750	Brazil.
High Peak (Adironbeck)	5,467	Adironbeck Mts, N A.
Mount Katahdin	5,360	Maine, U. S, N. A
Itabira	5,250	Brazil.
Monte Giganta	4,600	California.
Jorullo (V)	4,265	Mexico.
Mount Buckland	4,060	Terra del Fuego.
Cockscomb Mountain	4,000	Honduras
Monte del Diablo	3,672	Sacramento River
Sierra Ventana	3,500	Buenos Ayres.
Kaatskill Mountains	3,454 ?	New York, U.S.
Mount Jacinto, 57. 1. N.	3,000	N America.
Guanacaure	3,000	Guatemala.
Mount Edgecumbe, 57. 3. N.	2,920	Lazarus Island, N.W.A.
Izalco (V)[3]	2,132	Central America.
Cosiguina (V)	1,000	Guatemala.
Mount Bridgeman (V)	400	South Shetland.

V. *Mountains of Polynesia, Australia, and Pacific Islands.*

Mountains of Polynesia, Australia, and Pacific Islands.	Height in English feet.	Country or District.
Singalang (V)	15,000	Sumatra.
Mowna Kia (V)	13,951	Sandwich Isls.
Mount Terror	13,884	South Victoria.
Mount Ophir (Gunong Passama) (V)	13,840	Sumatra.
Mowna Roa (V)	13,758	Sandwich Isls.
Merapi (V)	13,200	Sumatra
Mount Erebus (V)	12,366	South Victoria.
Rindjani (V)	12,363	Sunda Islands.
Tobreonou	12,250	Otaheite.
Semeru Gunong (V)	12,235	Java.
Fusi-no-yama (V)	12,443	Japan.
Sesarga (V)	12,000	Solomon Islands.
Alaid (V)	12,000	Kurile Islands.
Gunong Dempo (V)	12,000	Sumatra.
Mount Ambotismene	11,506	Madagascar.
Gunong Slamat or Tegal (V)	11,116	Java.
Gunong Ardjuno (V)	11,030	Java.
Sumbing or Sunding	11,028	Java.
Mount Luse	11,000	Sumatra.
Mowna Wororai or Hualai (V)	10,790	Owyhee.
Gunong Lava (V)	10,727	Java.
Walierung (V)	10,300	Java.
Merbabu (V)	10,220	Java.
Gunong Raon (V)	10,180	Java.
Sindoro (V)	9,880	Java.

[1] According to Captain Denham, Mount St Elias is only 14,968 feet in height.
[2] Mrs Somerville makes Duida 8280 feet. We follow K. J.
[3] K. J. assigns 1500 feet for the height of Izalco or Sonsonate. We follow Humboldt.

Table of the Heights of Mountains—(Continued).

Physical Geography

Mountains of Polynesia, Australia, and Pacific Islands.	Height in English feet	Country or District.
Gedee (V)	9,850	Java.
Merapi (V)	9,708	Java.
Mount Edgecumbe	9,630	New Zealand.
Schischaldinskoi (V)	8,953	Aleutian Islands.
Mount Egmont	8,840	New Zealand.
Gunong Api (V)	8,800	Sumatra.
Gunong Tengger (V)	8,700	Java.
Lombock Island (V)	8,688	Sunda Islands.
Wielis (V)	8,480	Java.
Mount Pedrotallagalla	8,280	Ceylon.
Tchermai (V)	8,280	Java
Bourbon Island (culm.) (V)	8,001	Indian Ocean.
Patuha (V)	7,907	Java
Bukit Tunggul (V)	7,800	Java.
Tomboro (V)	7,600 [1]	Sumbawa.
Adam's Peak	7,420 [2]	Ceylon
Sulak (V)	7,204	Java.
Ungarang (V)	7,100	Java.
Papandjam (V)	7,039	Java.
Dasar (V)	7,034	Java
Klut (V)	7,000	Java.
Mount Koschiusko	6,500	Australia.
Pogromnoi (V)	6,500	Aleutian Islands
Tankuban Prahu (V)	6,427	Java
Agung (V)	6,400	Java
Tongararoro	6,200	New Zealand.
Wayang (V)	6,149	Java
Tilu (V)	6,062	Java
Mount Seaview	6,000	New South Wales
Tombak-ruyung (V)	5,896	Java
Idjem or Taschem (V)	5,800	Java
Gunong Lama Lama (V)	5,755 [3]	Ternate
Mount Lindsay, 28. 20. S.	5,700	Australia.
Burungrang (V)	5,690	Java
Sumbung (V)	5,582	Java
Mount Humboldt	5,520	V. Diemen's Land
Ben Lomond	5,502	V. Diemen's Land
Mount Dargal	5,490	New South Wales
Talaya Boda (V)	5,490	Java
Makutschinskaia (V)	5,474	Aleutian Islands
Langle	5,350	Japan.
Gunong Lamongan (V)	5,339	Java.

Mountains of [illegible] and [illegible]	Height in English feet	Country or District
Golgatha (V)	5,263	Java.
Volcano of East Sitkin (V)	5,036	Aleutian Islands
Atka Island (V)	4,852	Aleutian Islands.
Cradle Mountain	4,700	V. Diemen's Land
Mount Canoblas	4,610	New South Wales
Sarytschew (V) Matua Island	4,505	Kurile Islands
Mount Wellington	4,195	V. Diemen's Land.
Tchikura (V)	4,144	Java
Mount Mitchell	4,120	New South Wales
Wunzen (V)	4,110	Japan.
Mount Pinnabar	4,100	New South Wales.
Mount Arrowsmith	4,075	V. Diemen's Land
Mount Bathurst	4,000	New South Wales
Valentine Peak	4,000	V Diemen's Land
Ben Nevis	3,910	V Diemen's Land.
Mount Arthur	3 900	V Diemen's Land
Kirauia	3,870	Owyhee.
Mount Sturt	3,735	New South Wales
Mount Adine	3,726	New South Wales
Narborough (V)	3,720	[illegible]
Mount George	3,620	[illegible]
Mount York	3,440	[illegible]
Ringitt (V)	3,400 [4]	Java.
Akutan (V)	3,332	Aleutian Islands
Squall or Sugarloaf Hill	3,288	New South Wales
Mount Blaxland	3,256	New South Wales.
Mount Tomah	3,240	New South Wales
Saddle Hill	3,001	New South Wales.
Strzlecki Peak	2,550	Flinders' Island.
Mount Hundawar	2,515	New South Wales.
Mount Munro	2,500	Bass's Strait
Mount Hay	2,425	New South Wales.
Stony Hill	2,400	New South Wales
Cockatoo Hill	2,356	New South Wales
Mount Wilson	2,350	New South Wales
Mount St Patrick	2,227	V. Diemen's Land.
Assuncion (V)	2,096	Mariana Islands.
Gunung Api (V)	1,948	Banda Island.
Barren Island (V)	1,700	Sunda Islands
[illegible] (V)	1,502	Aleutian Islands.
[illegible]	1,200	V. Diemen's Land.
Kosima (V)	746	Japan Islands.

APPENDIX B.

Lengths, &c., of the Principal Rivers of the World.

N.B.—O. S. G. B R. are used as contractions of the words Ocean, Sea, Gulf, Bay, River.

Name of River.	Length in Statute Miles.	Length in Geographical Miles	Area of River basin in thousands of square Geographical Miles.	Sea, Lake, or River into which it flows
Albany	644	560	...	Atlantic Ocean.
Amazon or Maranon	3545	3080	1512	Atlantic Ocean.
Amur	2739	2380	583	Sea of Japan.
Anadir	460 ?	400 ?	63	S. of Kamschatka.
Arkansaw	1840	1599	...	To Mississippi.
	2370	2727	...	To the Sea
Churchhill	976	848	74	Hudson's Bay.
Colorado	921	800	170	Gulf of California.
Columbia	1565	1360	194	Pacific Ocean.
Connecticut	310	270	8	Atlantic Ocean.
Danube	1722	1496	234	Euxine Sea.
Delaware	304	265	9	Atlantic Ocean.
Dnieper	1243	1080	170	Euxine Sea.

Name of River.	Length in Statute Miles.	Length in Geographical Miles.	Area of River basin in thousands of square Geographical Miles.	Sea, Lake, or River into which it flows.
Dniester	505	440	23	Euxine Sea.
Don	1104	960	168	Sea of Azof.
Douro	505	440	29	Atlantic Ocean.
Duna	644	560	33	Baltic Sea.
Dwina	1041	864	106	White Sea.
Ebro	483	420	25	Mediterranean S.
Elbe	787	684	42	German Ocean.
Essequibo	483	420	62	Atlantic Ocean.
Euphrates	1716	1492	196	Persian Gulf.
Forth	120	104		German Ocean.
Francisco, St	1551	1400	187	Atlantic Ocean.
Gambia	700	608	90 ?	Atlantic Ocean.
Ganges	1938	1680	432 [5]	Bay of Bengal.

[1] Humboldt makes Tomboro only 5862 feet.
[2] Mrs Somerville sets down Adam's Peak as 6152 We follow K. J.
[3] As stated by Humboldt. K Johnston sets down the Volcano of Ternate Island at 4093 feet (? if same).
[4] According to K. Johnston. Humboldt makes it 2845 only.
[5] This includes the basin of the Brahmaputra.

Lengths, &c., of the Principal Rivers of the World—(Continued).

Name of River.	Length in Statute Miles.	Length in Geographical Miles	Area of River basin in thousands of square Geographical Miles.	Sea, Lake, or River into which it flows
Garonne	368	320	24	Bay of Biscay.
Gihon or Amu	1611	1400	194	Sea of Aral
Glommen	340	296	..	German Ocean
Godavery	861	748	93	Bay of Bengal
Gogra	830	725	...	To the Ganges
	1440	1250	...	To the Sea
Guadalquivir	299	260	15	Atlantic Ocean.
Guadiana	483	420	19	Atlantic Ocean.
Hoang-ho	2624	2280	537	Pacific Ocean.
Humber	190	165	...	German Ocean
Illinois	500	434	...	To Mississippi R
	1360	1241	...	To the Sea
Indigirka	1045	908	86	Arctic Ocean.
Indus	2256	1960	312	Arabian Sea
Irawadi	2532	2200	331[1]	Indian Ocean.
Jordan	104	90	...	Dead Sea
Jumna	780	898	...	To Ganges.
	1550	1783	...	To Sea
Katanga	442	384	...	Bay of Katanga.
Kistna	791	688	82	Bay of Bengal
Kolyma	921	800	107	Arctic Ocean.
Kour	736	640	65	Caspian Sea
Lawrence, St	2072	1800	298	G. St Lawrence.
Lena	2762	2400	594	Arctic Ocean.
Loire	598	520	34	Bay of Biscay.
Mackenzie	2440	2120	442	Arctic Ocean.
Magdalena	983	828	72	Caribbean Sea.
Maritza	320	278	...	Euxine Sea.
Maykan or Mekong	2417	2100	216[2]	China Sea
Menam	1182	940		Gulf of Siam
Minho	221	192	12	Atlantic Ocean.
Mississippi	1930	1677	...	Gulf of Mexico
Missouri	2310	2008	...	To the Mississippi.
	4096	3560	982[3]	To Sea
Motagua	299	260	7	Gulf of Honduras
Nerbudda	760	660	...	Arabian Sea.
Neva	506	440	67	Gulf of Finland.
Niemen	529	460	32	Baltic Sea.
Niger	1010	878	?	Atlantic Ocean.
Nile	2578	2240	520	Mediterranean S.
Obi	2670	2320	925	G of Obi, Arctic O
Oder	552	480	39	Baltic Sea.
Ohio	1200	1043	...	To the Mississippi.
	2270	1973	...	To the Sea.
Olenek	1151	1000	77	Arctic Ocean.
Orinoco	1556	1352	252	Atlantic Ocean.
Oural	771	670	83	Caspian Sea.
Paraguay	1133	984	...	To Parana River.
	1864	1620	...	To the Sea
Parana	1500	1304	...	To the La Plata R
	2265	1968	...	To the Sea
Paranahyba	857	744	115	Atlantic Ocean
Petchora	690	600	49	Arctic Ocean.
Piasina	449	390	...	Arctic Ocean.
Plata, La	2210	1920	186	Atlantic Ocean.
Pilcomayo	967	840	...	To Parana River.
	1871	1626	...	To the Sea
Po	405	352	30	Adriatic Sea
Potomac	410	357	...	Atlantic Ocean.
Pregel	115	100	6	Baltic Sea
Pruth	620	538	...	To Danube River.
	740	643	...	To the Sea
Red River	1500	1293	...	To Mississippi R.
	1800	1564	...	To the Sea
Rhine	690	600	65	German Ocean.
Rhone	644	560	28	Gulf of Lyons.
Rio del Norte, or Bravo	2138	1840	180	Gulf of Mexico.
Salado	829	720	...	Parana River.
	1119	972	...	Sea
Saskatchewan	1915	1664	360	Hudson's Bay
Scheldt	180	156	...	German Ocean
Seine	391	340	23	British Channel.
Senegal	960	834	?	Atlantic Ocean.
Severn	240	191	...	
Sir or Sihon	1390	1208	237	Sea of Aral.
Susquehanna	630	547	...	Atlantic Ocean.
Tagus	552	480	22	Atlantic Ocean
Tarim Ergeugol	940	816	177	Lake of Lob
Tay	120	104	...	North Sea.
Tchekiang	1105	960	99	China Sea
Thaluain or Martaban	2152	1870	[4]	Indian Ocean.
Thames	220	191	5	British Channel
Tigris	1010	878	..	To Euphrates River
	1100	956	...	To the Sea
Tocantins	1289	1120	285	Atlantic Ocean.
Tonquin	552	480	92?	Gulf of Tonquin.
Vardoc	270	235	...	Medit., Archipel
Vistula	598	520	57	Baltic Sea.
Volga	2762	2400	397	Caspian Sea.
Weser	322	280	13	
Yana	483	420	...	Arctic Ocean.
Yangtsekiang	3314	2880	548	Pacific Ocean.
Yenesei	3222	2800	785	Arctic Ocean.

PHYSICS (*φυσικόν, natural*, from *φύσις, nature*), is, in its most general signification, the science of nature. Modern usage, however, has limited the acceptation of the term to those sciences which treat of *body* or *matter*, thus standing distinguished from the mental sciences on the one hand, and from mathematics, or the science of quantity, on the other. Physics, or physical science, thus understood, falls to be divided into the two great heads of ABSTRACT PHYSICS and CONCRETE PHYSICS. The former is co-extensive with *natural philosophy*, and treats of mechanical philosophy, including under it mechanics, hydrostatics, and hydraulics, on the one hand; and with *chemical philosophy*, including under it optics, electricity, and magnetism, on the other. The latter includes natural history, descriptive and philosophical, embracing physiology, geology, and physical astronomy, on the one hand, and concrete chemistry, analytical and explanatory, on the other; as well as zoology, botany, descriptive astronomy, meteorology, mineralogy, and physical geography. Auguste Comte, in his classification of the sciences given in his *Philosophie Positive*, restricts the term *physics* to what, in ordinary language, is loosely termed *natural philosophy*. Physics, according to him, have for their object the discovery of the general laws of the inorganic world. "In physics we study the laws which govern the general properties of bodies ordinarily viewed in their mass, and constantly placed in circumstances capable of maintaining intact the composition of their molecules, and most frequently even their state of aggregation."

PHYSIOGNOMY (*φυσιογνωμονία*) is the art of determining the mental character of an individual by an examination of his countenance. (See PHRENOLOGY.)

[1] Including the basin of the Martaban River.

[2] The joint basin of both rivers.

[3] The joint basin of the whole Mississippi–Missouri river system.

[4] The basin of the Martaban is included in that of the Irawadi.

PHYSIOLOGY.

Physiology. THE word PHYSIOLOGY, derived from φύσις, *nature*, and λόγος, *a discourse*, means literally the doctrine or the history of nature, and, strictly speaking, would comprehend a knowledge of all the physical and natural sciences. But as these in the course of time came to be more particularly studied, they received distinct names,—such as, on the one hand, astronomy, chemistry, and natural philosophy, and on the other, mineralogy, geology, botany, zoology, &c. That science which treats of the functions of living beings, however, still retained the old name, although even now its meaning is every day more and more restricted, as other branches of knowledge become better defined. At present, by physiology is generally understood a knowledge of vital actions in a state of health, as distinguished from pathology (παθος, *disease*), which means a knowledge of the same functions when unhealthy. Again, the modern term histology (ἱστός, a *tissue* or *web*), which is limited to an acquaintance with the functions of the elementary textures of a living body, as distinguished from the study of organs and organisms, also encroaches upon physiology. Thus, vital action, as manifested in the ultimate fibre of a muscle, may be considered histological, as appertaining to elementary structure; vital action as exhibited in a group of muscles, for the purposes of speech, deglutition, respiration, locomotion, and so on, may be called physiological, as belonging to the functions of organs; and vital action in muscle, as shown in perversion of those functions during spasm, convulsion, or paralysis, is more properly called pathological.

It must be evident, however, that these distinctions are altogether arbitrary, and that the three subjects constitute one study. Thus, our knowledge of muscular action is derived from an acquaintance with its ultimate structure and the contraction of its individual fibres, and from an observation of its diseased conditions. Where health terminates and disease begins has never yet been settled; nay, more, what is health to one man would be disease in another, just as the degree of strength which is natural to a delicate frame would be considered weakness in a strong one: histology, physiology, and pathology, then, are closely allied, and are only different divisions of the same subject. The facts of one are available for the study of all; and any theory deduced from this branch cannot be correct unless in accordance with the data furnished by the others. In the present article, therefore, we shall employ the term physiology in the enlarged sense of comprehending the doctrine of life, whether in health or disease,—which would, perhaps, more properly be denominated biology (βίος, *life*),—and avail ourselves of all the knowledge put within our reach by its modern investigators.

THE DOCTRINE OF LIFE IN GENERAL.

In order to understand the general doctrine of life, we must first attend to the characters of the bodies which manifest it. These may be arranged under five heads. All living beings possess,—1. A peculiar arrangement of matter, called *organized*, consisting of a combination of solid and fluid parts, which exercise a reciprocal action on each other.—2. Origin from parents in the form of a germ, which afterwards becomes separated to enjoy an individual existence.—3. The power of taking in from, and giving out substances to, the external world, or what is called assimilation and excretion.—4. The property of passing through certain definite changes, constituting the ages of a living being.—5. Certain derangements from which they may recover, constituting disease. These characters are not possessed by inorganic or brute matter.

Organized or living beings may be further distinguished from inorganized matters, or such as are incapable of living,—1*st*, *By their form.*—An organized being is of a definite form, presenting convex or concave surfaces, and bounded by curved lines. It is of determinate bulk, and invested by a general envelope. Whereas an inorganized body is of indefinite form, or of one presenting flat surfaces bounded by straight lines, such as a crystal. It is of indeterminate bulk, and without any general envelope. 2*d*, *By arrangement of parts.*—An organized being consists of an aggregation of heterogeneous parts, each of which bears a certain relation to the rest. An inorganized body consists of an aggregation of homogeneous parts, no one of which bears any certain relation to the rest. 3*d*, *By the substances of which they are composed.*—An organized being is composed of solid, liquid, and aeriform substances conjointly, constituting the tissues and fluids,—the fluid parts being included within the solid. An inorganized body is composed exclusively of a solid, liquid, or aeriform substance, the particles of which are merely either superimposed upon, or intermingled with, each other. 4*th*, *By their chemical composition.*—An organized being is composed of several elements, associated, at least after the cessation of their vitality, into ternary or quaternary compounds, called *proximate principles*, which, as the result of nutrition, are not capable of being imitated by art, and which are prone to spontaneous decomposition. An inorganized body is composed but of few elements, associated into binary compounds; which are formed by common chemical attraction, are easily imitated artificially, and are not prone to spontaneous decomposition.

The eggs of birds and seeds of plants do not possess all the characters of living beings, and yet they live. Once place them in conditions favourable for the development of their existence, and they become transformed into animals or plants. Such bodies are regarded as collections of organic matter possessing dormant vital properties, which, under certain circumstances, waken up and become active.

Numerous efforts have been made to define life. Without entering upon a criticism of these, it may be said that they are all faulty. Most authors have felt the necessity of presupposing some organized structure, the existence of which is taken for granted in their definitions. Bichat says, "Life is the sum total of the functions which resist death;" Treviranus calls it "The constant uniformity of phenomena with diversity of external influences;" Lawrence says it consists "in the assemblage of all the functions or purposes of organized bodies, and in the general result of their exercise;" Duges calls it, "The special activity of organized bodies;" and Béclard, "Organization in action;" which last gives us, as far as a short phrase can, what is understood by life.

With regard to the nature of life itself, two opinions have been held concerning it:—1. That life is an independent entity, a vital principle—an idea which has come down to us from the ancients, and is founded on the notion that the union of this principle with the body caused it to live, and its separation to die. 2. That life is the collection of phenomena in organized beings, dependent partly on a certain structure and chemical composition, and partly on the existence of external agencies which stimulate them into action. We do not think it worth while to enter into the long arguments by which both these theories have been supported. It is sufficient to say that the latter is the view

which has been adopted by modern physiologists, who believe that the various tissues of an organized body are endowed with various properties, some physical and some vital; that the latter require what are called stimuli to bring them into action; and that a knowledge of the tissues, their properties, their stimuli, and the forces evolved from them, is the true method of arriving at just conclusions concerning life as manifested in health, and as modified by disease. Before, then, we can arrive at a just theory of life in general, we must acquaint ourselves with the structure, chemical composition, and vital properties of the tissues themselves.

PART I.—HISTOLOGICAL PHYSIOLOGY.

Histology comprehends the functions, mode of development, and chemical transformations of the ultimate textures of the body, and has become the recognised basis of our physiological knowledge since the important generalizations of Schleiden and Schwann as to the cell theory were published in 1841. These ultimate or elementary textures are only made visible by means of the achromatic microscope, and have been variously arranged by physiologists. We shall describe them under four heads,—viz., 1*st*, Molecule Tissues; 2*d*, Cell Tissues; 3*d*, Fibre Tissues; and 4*th*, Tube Tissues.

MOLECULE TISSUES.

On examining the different textures under high magnifying powers, we invariably observe a greater or less number of molecules and granules. A molecule is a minute body, presenting optically the appearance of a point or minute dot. A granule is a larger body, in which we can discover a centre and an external ring or margin, which are alternately dark or light according to the focus it is examined with. Molecules may become granules by magnifying them, and granules may appear as molecules by diminishing the magnifying power; so that structurally they are the same bodies. In composition they may be various, consisting of albuminous, fatty, pigmentary, or mineral matter, which may be determined by the action of re-agents. In shape they are usually round, although mineral molecules may be angular or many-sided. They may be isolated and equally diffused, or collected together in groups or masses. In size they may be uniform, but more generally vary from a point scarcely visible up to a magnitude of considerable but varying size, when they are often called globules, as in the milk.

Molecular Fluids.—All fluids in which organization is proceeding, and out of which the higher tissues are formed, are rich in molecules, as may be well seen among plants in the embryonal sac and in the extremity of the pollen tube. The chyle of all animals contains a molecular basis (Gulliver), which gradually becomes cleared up after it has joined the blood, and perfect blood corpuscles are formed. There can be little doubt that the floating molecules enter directly into the substance of nuclei and cell-walls. Molecules are also numerous in the fluid within cells, sometimes being the commencement of new germs, at others the deposits of secreted or effete matter.

Molecular Fibres.—The molecules formed in organic fluids frequently assume a fibrous arrangement. This is well observed in *mucin*, the viscous substance of which frequently exhibits, especially on the addition of acid, a multitude of fibres, composed of molecules aggregated end to end. Similar fibres are formed in the coagulum of blood, the fibres being deposited as molecules, which rapidly assume a fibrous arrangement.

Molecular Membrane.—Albuminous fluids may frequently be observed to contain shreds, which can be spread out into a membrane, and are composed of molecules aggregated closely together. Such membranes may readily be produced artificially by shaking the fluid, adding slight heat, or mixing them with acids or oil. If a fluid drop of oil and another of liquid albumen are brought together, a membrane is immediately produced (*haptogen membrane* of Ascherson). If the two drops are mechanically rubbed together, an emulsion like milk,—containing granules and globules,—is produced; and the latter may readily be shown to be composed of an envelope of this membrane containing a drop of oil. Numerous membranes in the animal body are formed directly by the deposition of albuminous matter, originally in the form of minute molecules, which subsequently melt into a homogeneous layer. Amongst these the substance of cell-walls is perhaps the most important.

Molecular Movements.—All molecules floating in a fluid have distinct movements, which were first described by Robert Brown; hence called Brunonian movements. They may be vibratile, circular, spiral, serpentine, or irregular in character, but seem to be governed by certain laws of attraction and repulsion, which have not yet been minutely investigated. In the interior of cells they frequently pursue certain directions, hence assuming the nature of a circulation, well seen in large vegetable cells. Within the salivary cell they may be seen to move in minute circles, and present a trembling character; in the vibriones so common in putrid fluids, they are vibratory or serpentine.

The Molecular Theory of Organization.

When we consider that all embryonic forms are developed from molecular fluids, and that in adult animals all organizable matter used as food is first reduced to minute molecules, in order that it may become organized, it must be evident that the primary source of vegetable and animal forms must be sought in the molecular element. When, moreover, we know that essentially different fluids, as oil and albumen, when brought into contact, immediately precipitate molecules that assume a globular, fibrinous, or membranous form, and that such a process is facilitated by numerous chemical re-agents, acids, or alkalies, acting on albuminous, fibrinous, or mineral solutions, we readily observe one way in which histological elements may be produced within the body. Such elements, subject to the laws of vitality, may be formative elements (*histogenetic*), whilst others may be retrograde, and give evidence of vital cessation (*histolytic*). Hence the first and last formative element is the molecular. Organic formative fluids deposit molecules, which arrange themselves, subject to vital laws, into nuclei, cell-walls, and higher textures. These, once produced, subsequently decay in an inverse order, breaking down into individual fragments, and ultimately into minute molecules. During the whole life of an individual organism we observe in it a constant series of these formations and disintegrations—of these histogenetic and histolytic actions. The object of these appears to be fitting or elaborating, by chemical and histological processes, organic matter in such a way as to perform its appointed office in assimilation or excretion. A knowledge of the vital and physical changes occurring in these molecules, and of the fluids in which they are formed and dissolved, must evidently not only constitute the basis of physiology as a science, but must ultimately form a groundwork for the arts of horticulture, agriculture, and medicine. It is only by the *conjoined* study of histology and organic chemistry that this great work can ever be accomplished.

CELL TISSUES.

When we examine the structures of living beings under high magnifying powers, numerous tissues, but more especially the fluids, the surfaces of membranes, and the various glands, are seen to contain multitudes of minute vesicles or shut sacs, which have received the name of cells. These have long been recognised with the microscope by observers, particularly in plants; but their importance has only been understood since the labours of Schleiden and Schwann (1841) pointed them out as the elementary form of all organisms. They vary greatly in shape, size, and function, a circumstance which necessitates some arrangement of them. We shall divide them into temporary cells and cells of transition,—understanding by the first, cells which do not proceed further in development than the cell form; and by the last, cells which are transformed into more permanent textures. Referring to the article BOTANY for a description of vegetable cells, we shall here confine ourselves to those found in animals, especially such as are highest in the scale.

1. *Chyle and Lymph Cells.*—These are blood-cells in an early stage of development.

2. *Blood Cells.*—These are of two kinds, coloured and colourless. The coloured cells in fishes, reptiles, and birds are for the most part oval, being largest in reptiles, and smallest in birds. They contain an oval vesicle or nucleus, occupying about a third of their area, which resists the action of acetic acid, while that agent partially dissolves the cell-wall, and destroys the colour. Between the nucleus and cell-wall is a fluid of a yellowish tint. In mammals, with the exception of the order Camelidæ, in which they are oval, the blood corpuscles present the form of bi-concave circular discs, smallest in the Napu musk-deer, and largest in the elephant. They have no included body or nucleus, and consist of a vesicle containing a coloured fluid. On the addition of water, they swell out so as to become globular, and lose their colour; acetic acid rendering them transparent and almost invisible. In consequence of their shape, they readily become piled upon one another in the form of rouleaux. The colourless cells are globular, having a finely molecular aspect externally, and a distinct nucleus, which, on the addition of acetic acid, usually presents two or three granules. In mammals they are somewhat larger, and in the other vertebrate tribes, smaller than the coloured corpuscles.

The different corpuscles of the blood originate in the chyliferous and lacteal system, and are elaborated as the result of the primary or secondary digestion in the various lymphatic glands. In the lymphatic vessels and thoracic duct they are colourless, but the different stages of their development may readily be observed in chyle, which, in addition to the two kinds of corpuscles previously described, contains a multitude of minute molecules, or what is called a molecular basis of fine fatty particles, communicating to it a milky appearance. The bi-concave disc is fully formed in the chyle, and on joining the venous blood of the jugular vein, is rapidly conveyed through the heart to the lungs, where, coming in contact with the oxygen of the air, its contents become coloured, and communicate its characteristic tinge to the blood. In the fœtus the blood corpuscles are formed in the interior of the cells, which are ultimately changed into vessels, and they are rapidly multiplied by a process of fissiparous development.

The functions of the blood-cells are intimately connected with the exchange of oxygen and carbonic acid continually going on between the blood and atmospheric air in the lungs and in the tissues; but their especial function is the further elaboration and preparation of the *liquor sanguinis*, or fluid part of the blood, in which they swim and are ultimately dissolved. This contains all the elements of nutrition necessary for every part of the organism, as well as the effete matters derived from the wearing away of the tissues. The blood corpuscles, therefore, as the formative cells of the nutritive fluid of the body, must be regarded as the most essential of the constituents of the animal frame.

3. *Nerve or Ganglionic Cells.*—These cells, of various sizes and shapes,—simple, bi-polar, or multi-polar,—are composed of a delicate wall and distinct nucleus, with more or less granular contents. Their function is to form a means of communication between the different nerve tubes, and to evolve that peculiar force which is so essential for carrying on the motor, sensitive, and mental processes of the nervous system.

4. *Adipose Cells* constitute the substance of fats, and secrete in their interior the oily and oleaginous matters so necessary, as we shall subsequently see, for various processes in the economy of all living beings.

5. *Pigment Cells* present remarkable variations in size and shape, and are so called from their property of forming in their interior, in a fluid or granular form, the various coloured substances which tint the different textures of plants and animals. This appears to be effected by a species of vital chemistry, which will be subsequently described.

6. *Glandular or Secreting Cells.*—Under this head may be grouped together all those cells, various in form, size, and composition, which have the common function of attracting and selecting from the blood the secretions formed in different glands. Though allied in the performance of this common function, they differ with regard to the nature and amount of the secretion produced, which, so far as can be determined, is not dependent on the structure, chemical composition, or connection with other anatomical elements of the cells themselves. Why some of these cells should secrete bile, others urea, a third class saliva, a fourth milk, and so on, is only explicable by attributing to these minute corpuscles the possession of vital properties, whereby one attracts and selects from the neighbouring blood-vessels the materials which it forms into bile, a second such as it fashions into urea, and so on. No other explanation can be given of a phenomenon which is an ultimate fact in physiology.

7. *The Cells of Transition* are those which, according to the known laws of development, are destined to be transformed into more permanent tissues, in the manner to be hereafter spoken of, and comprehend,—*1st*, Numerous embryonic cells observable in the ovum of plants and animals. *2d*, Fibre cells; *3d*, Epithelial cells; *4th*, Cartilage cells. The great end of these cells is to be transformed into the tissues formed in various organs, such as blood-vessels, nerve tubes, fibres, membranes, bone, &c.

8. *Pathological Cells.*—In the various morbid growths which so frequently occur, forming hypertrophies, strictures, tumours, &c., we constantly find an increased number of the same cells we discover in the healthy textures. At other times we find cells which are peculiar to different structural diseases and such as do not occur in health. These may be denominated pathological cells. Among these may be enumerated:—*1st*, *Pus cells*, the formation of which in a fluid constitutes the morbid substances so long known as pus, or purulent matter. *2d*, *Granule cells*, so called from their containing a number of fatty granules. These may be formed in every kind of normal cell, but occasionally in new cells, as in certain softenings of the cerebral hemispheres. *3d*, *Cancer cells*, so called from their frequency in cancerous growths. *4th*, A variety of indefinite corpuscles, the title of which to the denomination of cells is disputed, such as peculiar diaphanous bodies found in various morbid products—tubercle corpuscles, &c.

The Cell Theory of Organization.

A study of the minute bodies to which we have just alluded in plants and animals has led to a generalization or theory, which, although slightly modified since it was originally put forth by Schleiden and Schwann, still remains one of the most important doctrines in biological science. This theory we shall now give as shortly as possible.

All cells originate in a fluid substance, a so-called *blastema* (βλαστος, *germ*), or germ-substance, which, at one time clear, becomes opaque, from the formation or deposition of numerous molecules and granules. Several of these melt together to form a larger body, upon which there is gradually produced a delicate membrane that gradually separates from it, in consequence of the interposition of fluid. After a time, such a corpuscle, or cell, as it is now called, consists of an external envelope or vesicle (*the cell-wall*), the included body upon which it was formed (*the nucleus*), and a fluid between the two (*the cell fluid*). In the nucleus may frequently be observed one or more included granules (*nucleoli*). The changes which subsequently take place in cells thus formed are as follows:—*1st*, Having reached their full development as cells, they gradually dissolve and perish, or the cell-wall bursts, liberating the fluid contents, which constitute a secretion. *2d*, Various matters may be deposited on the interior of the cell-wall, or in the cell fluid. Thus, albuminous or mineral matter may be deposited which give to certain tissues unusual firmness, as in the fleshy leaves of plants, in the stones of fruit, and in bone; or the fluid may become loaded with albuminous, fatty, pigmentary, or mineral matter, communicating important properties and striking appearances to various tissues. *3d*, The cell-walls undergo remarkable changes, and by their union with neighbouring cells form complex tissues. Thus, by becoming elongated, and subsequently splitting up, fibres are produced; by becoming elongated and uniting endways to similarly changed cells while the partitions between them disappear, tubes are formed; by throwing out radiating branches, which in like manner unite with others proceeding from neighbouring cells, a net-work or plexus of tubes is produced; and by becoming flattened while their edges adhere together, membranes are developed. In this manner all the elementary textures of a living being may be derived from cells. *4th*, Many cells have the power of reproduction, or of forming other cells, and this may be accomplished in four different ways,—(1.) By the cell-wall bursting and liberating included germs, each of which gives rise to a cell. (2.) By the nucleus enlarging and dividing into two, each of these into other two, and so multiplying to a certain extent within the original cell-wall; (3.) By the cells themselves dividing into two or more divisions; and (4.) By processes or buds which are thrown out from one part of the cell, and subsequently separate. These four kinds of reproduction from cells may be called the exogenous, the endogenous, the fissiparous, and the gemmiparous modes of re-development.

A careful study of the transformations which occur in different cells must convince us that they possess a life peculiar to themselves, and perform special functions. They are born and nourished, and they grow, reach maturity, decline, and die. They are the organs of secretion, as it is in their interior that all the different fluid and solid secretions are elaborated. They are the organs of growth, as they constitute the germs out of which all the tissues are produced. They are the organs of reproduction, not only in causing new growth of tissues, but in multiplying the countless species of plants and animals that we find on the surface of the globe.

In order that cells may carry out these different purposes, they must possess different endowments; whilst some possess the property of storing up in their interior and elaborating various substances to form the secretions, others absorb matters which enable them to build up the different tissues of the organism itself, so as to give it support, ductility, and firmness. A third kind store up pigment, which gives colour to the tissues, or accumulate fat for the purposes of evolution, disintegration, or chemical combustion; and a fourth kind, by a modification of nutritive power, are especially charged with the important office of perpetuating and multiplying new living beings to take the place of those which are worn out and die. So long as all these processes go on harmoniously together, health is preserved. But the excess or diminution of these cells in particular parts of the economy occasion various kinds of disorders in secretion, nutrition, and reproduction. Lastly, the fluid part of the blood is not unfrequently drawn out of the vessels, and then a new set of cells spring up in it, which, like pus cells, may serve the purpose of getting rid of the morbid products, or, like cancer cells, propagate it in various directions to the destruction of the economy.

The conditions or laws which regulate cell life appear, so far as we are acquainted with them, to be as follows:—*1st*, They must be in a certain relation to a nutritive fluid or *blastema*, from which they can attract and select the various substances necessary to enable them to carry on their respective functions. The most active growing cells are those that swim in such a fluid. In the higher plants and animals the nutritive fluid (sap or blood) is distributed throughout the economy by a series of canals. *2d*, A certain temperature is necessary to cell life, as it will not proceed below zero or above 145° Fahr. As a general rule, a low temperature checks, whilst an elevated one is favourable to cell growth. *3d*, Room for expansion is necessary to perfect cell formation. Hence they grow most rapidly and perfectly in fluids or very moist substances; and when they begin to press upon one another, or upon unyielding tissues, their development is checked or destroyed. *4th*, An appropriate locality has evidently a great influence over cell formation, and this independent of mere temperature and the other circumstances referred to. This is well observed in the reproduction of tissues, the new matter thrown out originating cells, which, as to their ultimate development, are more or less governed by the neighbouring structures. *5th*, Besides these conditions of a general nature, there is another important one connected with the structure of the cell itself. Thus, if the cell-wall becomes so impregnated with mineral matter that liquids cannot pass through it,—if the cell fluid becomes loaded with albuminous, fatty, or mineral substances, or if the nucleus disappear,—the growth and function of the cell is at once destroyed. Hence the conjoined integrity of the three essential parts of the cell,—viz., cell-wall, cell-fluid, and nucleus, each of which may operate on one another, and on the surrounding blastema, by endosmose and exosmose,—is essential to its activity.

A knowledge of the cell theory as now explained must convince us that the most important vital processes in the economy are essentially connected with the development of the minute corpuscles, which the microscope now enables us to demonstrate and study with the greatest ease. Modern investigation, by its means, has thus completely revolutionized all our previous notions, and proved to us that the cell structures of which we have been speaking are in truth the real agents by which nutrition, secretion, and reproduction are carried on; and by means of which, indirectly, all the animal functions are supported, including even locomotion, sensation, and mental acts. A plant or an animal is in fact a living creature composed of millions of corpuscles, the sum total of the lives of which make up its own. Fat and bone are living tissues, which, in like manner, are composed of as many lives as

there are fat and bone cells aggregated together. Pus, that fluid which surgeons have considered as a deposit or secretion foreign to the body, and which ought to be let out as soon as possible, is, like the blood, a living fluid, crowded with multitudes of animal existences, which are born, live, and die, as man himself does. Views of this kind must not only materially modify the notions hitherto attached to the idea of life, but must satisfy us that in all attempts to support, restrain, or prolong it, we can only do so scientifically through our acquaintance with the structures, on the integrity of which it depends. Hence a knowledge of the minute cells in the various organs and tissues of the animal body, the transformations they undergo in health and disease, and the conditions necessary for their existence, and the performance of their functions, is of essential importance to the medical practitioner.

THE FIBRE TISSUES.

A fibre is a solid elongated body, like a thread, and in living beings exists of various degrees of thickness, varying from $\frac{1}{16000}$th to the $\frac{1}{1400}$th of an inch. What appear to be fibres to the naked eye are in truth bundles of the true fibres, which can only be made visible by means of the microscope. The different kinds of fibres which enter into the tissues are the following:—

1. *Molecular Fibres.*—These are best seen in the decolorized clot of blood, whence they may frequently be observed to form in the field of the microscope by the deposition of minute molecules, which assume a linear arrangement, and subsequently melt together to produce a solid fibre. They vary in thickness from the $\frac{1}{1200}$th to the $\frac{1}{1600}$th of an inch.

2. *White or Areolar Fibres.*—These constitute the areolar or connective textures of the body. They may run in wavy bundles, leaving spaces or areolæ between them, as in the so-called cellular tissue of descriptive anatomists. They may be closer together, and more or less crossed, as in a fibrous aponeurosis, or greatly condensed and running in parallel lines, as in tendon and ligament. Their course may be various and more or less mingled with cells, as in fibro-cartilage, or fibrous morbid growths. This kind of fibre is formed by the elongation and splitting up of cells. They vary in thickness from the $\frac{1}{3000}$th to the $\frac{1}{1200}$th of an inch

3. *Yellow or Elastic Fibres.*—This kind of fibre is yellow in colour and highly elastic; hence the names it has received. It is best seen in the *ligamentum nuchæ* of quadrupeds, or in the *ligamenta subflava* of man, extending between the laminæ of the vertebræ. They form the principal bulk of the large arteries, and present under the microscope a curled appearance at their extremities. The fibres may often be seen to anastomose; and are apparently formed from elongation of the nuclei of cells. They vary in thickness from the $\frac{1}{8000}$th to $\frac{1}{4000}$th of an inch.

4. *Epidermic Fibres.*—This kind of fibre is formed from the splitting up of epidermic cells in various ways, and constitutes the fibrous structure of hair, nail, hoof, horn, feather, quill, and a variety of epidermic appendages. They vary greatly in thickness.

5. *Non-voluntary Contractile Fibres.*—These constitute the so-called muscular coat of hollow viscera, and exist in considerable quantity in the blood-vessels, skin, and iris. Their form is that of ribbon-shaped flattened bands, which are made up of an aggregation of spindle-shaped nucleated cells. They vary greatly in thickness in different textures.

6. *Voluntary Contractile Fibres.*—These constitute the substance of muscle or flesh, the fibrous matter of which may be first divided into solid bundles of fibres, surrounded by a delicate membrane (*sarcolemma*) called the *fasciculus*. The fasiculi are polygonal, and characterized by transverse lines or striæ, which run across them, consisting of alternate dark and light spaces. Each fasciculus, on being broken up, may be shown to consist of numerous minute fibres or fibrillæ, on each of which the same dark and light markings may be seen. The greatest pains have been taken by microscopic observers to determine the ultimate structure of voluntary muscle; but beyond arriving at the fact, that the transverse striæ of the fasciculus are owing to the aggregation of the dark and light markings visible on the minutest fibrillæ, they have not been able to go.

The function of the fibrous tissues is manifold. The white fibrous or connective tissue unites together various structures, especially in the form of tendon, ligament, and aponeurosis. It also offers an elastic medium and support to the frame generally, protecting the blood-vessels and nerves. The yellow elastic tissue performs similar functions; and in addition, in consequence of its great elasticity, serves to restore parts after they have been moved by muscular action; and hence in various places it supplies an antagonist force to muscles. The epidermic fibres are useful as a covering and protection externally, besides forming resisting parts to pressure, and means of offence and defence in numerous animals. The most important property of the fibrous tissues, however, is that of contractility. This exists in different textures, which possess various degrees of power in having it called into activity. Thus, it may be stimulated by cold in the fibres of the bulbs of the hair, but cannot be excited by mechanical irritation or galvanism. In the veins and arteries, on the other hand, cold and mechanical irritation operate, but not galvanism; whereas this agent, with the others, excites contractility in the iris. Lastly, the capillary vessels, in addition to the other stimuli, are influenced by mental emotions, whilst the fibres of flesh are also brought into contraction by the mental act of volition.

Theory of Contractility.

The property of contractility in the fibres of a living being, on the application of a stimulus, is one peculiarly vital, and unlike anything known in physics. It was supposed that the shortening of the fibre was owing to its being thrown into a zig-zag, but it is now known to depend upon its swelling out laterally, and being shortened longitudinally. The property of contractility, however, is not only exerted in such a manner that, by shortening fibres as in muscles, and acting upon the bones and joints, it may induce locomotion. Certain molecular fibres may assume independent motion, as in vibriones, or in the disintegrated molecules of putrid animal or vegetable substances. These bodies, consisting of a fibre more or less long, possess spontaneous movement of a trembling or serpentine character, by which they are propelled through a fluid. Another remarkable movement is seen in the lashing of hair-like processes, shaped like a sabre, which are called cilia, and which cover the mucous surfaces in many parts of the animal body. The peculiar movements of a spermatozoid, in the spermatic fluid, is another example of contractile fibrous motions. In the attached stalk of the vorticellæ, the filament may be seen to assume a spiral form when called into action. Many cells, also, may be seen to enlarge and contract suddenly or slowly, while others contract irregularly, throwing out processes, and thereby continually changing their form, as in the *Amœba*.

The view originally put forth by Haller as to the explanation of contractility was, that it was a vital power inherent in the tissues which possess it; in short, an ultimate fact in physiology; a view which is supported by all that is now known of the subject. It has been maintained, however, by others, that muscular contractility is not so

much inherent in muscle as it is dependent on the nervous system. But this opinion is negatived—1*st*, By many ingenious experiments, and especially some by Dr John Reid, who, having removed a portion of the sciatic nerve in a frog, and then exhausted the contractility of the muscles of the limb by powerful repeated galvanic shocks, found that contractility returned after a period of repose; 2*d*, By the observations of isolated fasciculi of muscle under a microscope, which have been seen to contract when entirely separated from nerve; and, 3*d*, By the fact, that individual cells, and even some parts of plants, contract, which have no nerves. The true agency of nerves in muscular parts is not to give them the property of contractility, but to subject it in various ways to the dominion of the acts and feelings of the mind.

THE TUBE TISSUES.

The tubular tissues are distinguished from hollow viscera by their simple structure, and from fibres by their being composed of distinct walls with contents. The principle forms are as follows:—

1. *Air Tubes.*—In plants, and many of the inferior tribes of animals, their structure contains tubes for the transmission of air which are characterized by a deposition in their interior that assumes the form of a spiral; of bars like a ladder (*scalariform*); or of a reticulated or dotted structure. They are formed by the apposition of cells end to end, the partitions disappearing after the deposition of the spiral or reticulated substance on the inner wall of the cell has been produced. In the higher animals the air tubes are larger and more complex, terminating in blind expansions or air vesicles.

2. *Blood Tubes.*—In this system we may comprehend the chyle and lymphatic as well as the capillary vessels, which, with the more complex substance of the arteries and veins, constitute the circulatory apparatus in animals. Simple ducts and tubes perform a similar office in plants. The arterial, venous, and lymphatic vessels resemble hollow viscera in having several coats, composed of areolar, elastic, and non-voluntary contractile tissues. The two former are most abundant in the larger vessels, the latter in the smaller arteries. The capillary or minutest blood-vessels are just large enough to enable the blood globules to pass through them in single file. They are composed of a delicate membrane, with nuclei scattered here and there through them, and are formed originally from cells which coalesce with one another by processes or branching prolongations. The smaller arteries and veins are highly contractile; and though it has been much disputed whether the capillaries are so, we have little doubt, from careful observations and measurements, that such is the case.

3. *Dental Tubes.*—These are found in the ivory or dentine, such as occur at an early period in the enamel being filled up by mineral matter to communicate increased density and hardness to that tissue.

4. *Nerve Tubes.*—Nervous matter is principally composed of tubes, which are largest and most symmetrical in the cerebro-spinal nerves, smaller but ampullated in the spinal cord, and smallest of all in the brain, where they gradually diminish in calibre towards the convolutions of the cerebral hemispheres. The tube itself consists of an extremely delicate membrane externally, inside which is an albuminous layer, constituting the wall of the tube, called the white substance of Schwann, and this contains an oleo-albuminous fluid; in this there may sometimes be seen a slightly fibrous structure, called the band of Remak, or the axis-cylinder of Purkinje. The wall of the tube is characterized optically by possessing a double line, with a clear space in the centre; and on breaking it up, it unites so as to form globules of various sizes, also distinguished by the double outline. The cause of the swellings or ampullæ in the spinal and cerebral tubes has been ascribed to the greater weakness of the investing membrane, and has been supposed to be a *post-mortem* phenomenon. Towards the circumference of the body these tubes terminate in loops. Throughout the body they form numerous connections, through the medium of the nerve cells, with one another, or with various parts of the nervous system. Their mode of termination in the gray matter of the brain has not yet been traced.

The general function of all the tubular tissues may be said to be that of conduction: the air tubes convey air, the blood tubes distribute the nutritive fluid to all parts of the economy, the dental tubes serve also as nutritive channels, and the nerve tubes conduct the nervous influence.

Theory of Nervous Conduction.

The nerve tubes possess a vital property, named sensibility or excitability, by virtue of which, when irritated, an influence is generated in the irritated or excited part of the nerve tube, and transmitted in certain directions with electric-like velocity. The rapidity with which this is effected negatives the idea that nervous influence travels in the interior of the tube with the contained fluid. It has been supposed that some vibration may be communicated to such fluid; but in fact we are as ignorant of the mode in which the nervous influence travels along a nerve tube as we are of the manner in which galvanism is conducted by a metallic wire. Some nerve tubes only conduct the influence of impressions from the circumference to the nervous centres; others only from the centres towards the circumference. From the circumstance, that some nerves only consist of the former, which, by communicating with the brain, give rise to sensations, they have been called nerves of sensation; whilst such nerves as only consist of the latter, and terminate externally in the muscular system, have been called nerves of motion. Most of the cerebro-spinal nerves, however, are composed of both sets. On tracing a nerve into a ganglion, or a mass of nerve cells, its component tubes separate and pass through it in different directions, in consequence of which an interlacement of them takes place in different directions, and the nerves which emerge from it result from a new combination of tubes, different from those which enter it. The result of this arrangement is, that the impression may be conducted in various ways from one centre or more to another, producing those endless combinations of mental, emotional, sensitive, and motor effects which are produced in the animal frame. These we shall describe more particularly hereafter. In the meantime we may say, that a nerve tube may be excited by psychical or physical causes, the former originating probably in the nerve cells of the brain, the latter from direct pressure or other mechanical causes. As a result of this excitation, a something is generated which, for want of a better term, we call an influence. This influence is then transmitted in various directions, according to the peculiar endowment and anatomical distribution of the tubes excited, occasioning, if they reach the brain, sensation; if the muscles, motion; if the various glands, an increase or diminution of their secretions; and if the blood-vessels, contraction or enlargement of their calibres.

Such are the four great elementary textures of living beings, on the integrity of which are dependent the important vital endowments of growth, contractility, and sensibility. If among these we search for a primary element out of which all the others are evolved, we may place it in some primitive cell, although this, so far as we can determine histologically, is derived from molecular matter, and this in its turn from an organic fluid. An extensive knowledge of the tissues must convince us that the molecule is the primary, as it is the most simple form, and that an aggregation of molecules may even form fibres and membranes

without the agency of cells at all. Again, they may combine so as to form nuclei; that is, simple closed vesicles containing a fluid, as in the bi-concave blood-disks of the mammal, which never proceed further in development. Upon nuclei so produced, however, cell-walls may be formed; and as a result of these, the various secretions and textures, as previously explained. Still, the molecule, and not the cell, seems to us to be the primary form; and it would appear, as we shall afterwards see in speaking of reproduction, that the successive elaborations which matter undergoes takes places by successive formations (*histogenetic*) and disintegrations (*histolytic*) of elementary molecules.

But before we can rightly comprehend the philosophy of the formative process, we must attend not only to the form, but to the chemical changes which organic matter undergoes during the successive transformations that take place during the growth and decay of living beings. This leads us to a short discussion of what is known with regard to organic chemistry.

PHYSIOLOGICAL CHEMISTRY.

Of the sixty-two elementary substances known in nature, only twenty are found in organized beings, of which eleven are non-metallic, and nine metallic. The non-metallic elements are oxygen, hydrogen, carbon, nitrogen, phosphorus, sulphur, chlorine, fluorine, iodine, bromine, and silicon. The metallic elements are potassium, sodium, calcium, magnesium, aluminum, iron, manganese, copper, and lead. Of all these, oxygen, hydrogen, carbon, and nitrogen may be regarded as the most essential, and as the basis of all organic matter. Phosphorus enters into the composition of albumen and fibrine, is solidified in the bones in the form of phosphate, and is also found in cerebral substance. Sulphur is necessary to the constitution of albumen, fibrine, and of caseine, and has been found largely in bile. Iron enters into the constitution of the blood. Calcium, in the form of lime, is united with phosphoric and carbonic acids in the skeleton, and in the covering of cretaceous animals. Sodium, in the condition of soda or of common salt, gives alkalinity to the humours and fluidity to the blood. Potassium has similar properties. Chlorine, existing in hydrochloric acid, forms part of the gastric juice; and fluorine has been found in milk and blood. The other substances are only occasional or accidental, and appear to depend upon peculiarities in the kind of food in animals, or soil in vegetables.

According to a beautiful generalization of M. Dumas, an animal should be regarded, in a chemical point of view, as an apparatus of combustion, which incessantly returns to the atmosphere carbonaceous matters in the shape of carbonic acid, hydrogen as a constituent of water, and free azote in the form of oxide of ammonium. In short, from the animal kingdom as a whole there is continually given off carbonic acid, watery vapour, and azote. Vegetables, on the other hand, absorb and fix these substances, retaining the carbon and hydrogen, and setting free the oxygen. They also abstract azote directly from the air, or indirectly from oxide of ammonium or nitric acid. Vegetables for the most part form organic matter under the influence of solar light. They pass ready formed as food into the bodies of animals, which, during their life or after their death, restore them to the atmosphere from which they were originally derived. Thus the animal kingdom is an apparatus of combustion, the vegetable kingdom an apparatus of reduction; the one produces the elements which the other consumes; so that, in the language of Dumas, they are the "offspring of the air." They come from the atmosphere, and return to it again.

The various mineral matters which enter into the constitution of living beings exhibit the same dependence which animals have upon vegetables, and these, again, upon inorganic matter. They simply pass through living beings, as it were, to serve certain important purposes in the scheme of life. Let us take lime and sulphur as examples. Rain water, loaded with the carbonic acid of the air, falls upon calcareous hills, and carbonate of lime, in a state of solution, enters rivers, and is by them carried to the ocean, where it is seized upon by millions of animals, and converted into their external skeletons or shells. The water of rivers and springs also is absorbed by plants and drank by animals; and so lime enters into their substance, and is converted into various salts of that basis, such as oxalates, tartrates, phosphates, &c. Phosphate of lime is the principal element of the bones, besides entering more or less into the constitution of the other tissues of the superior animals, which are continually excreting as well as assimilating it. Lastly, on their death, the lime is dispersed in various ways; even the bones crumble to pieces; and so the mineral returns to the soil from whence it came. Sulphur passes from one region to another in a similar manner, from the sea, which contains sulphur in large quantities, to the atmosphere, thence to the soil, and thence to plants and animals, from whence it again returns to the bosom of the ocean.

These incessant exchanges between the soil or atmosphere, plants and animals, have been laboriously worked out by M. Dumas, and constitute the theory now known as "the chemical balance of organic nature." Liebig, however, has shown that an animal is not the mere consumer of the organic principles elaborated by vegetables. There can be little doubt that, whilst this is done to a great extent, an animal may also produce them; for instance, it can transform, by a vital chemistry of its own, one principle into another, such as albumen into fat, sugar into oil or dextrine, and so on. It is only by a knowledge of this fact we could understand those remarkable degenerations which recent researches have shown us constitute so large a proportion of the organic diseases of man and animals.

The chemical proximate principles which are of such paramount importance in constituting the substance of living beings may be divided into four groups,—namely, 1*st*, The albuminous; 2*d*, The fatty; 3*d*, The pigmentary; and 4*th*, The mineral principles. All these are more or less associated together in every texture and fluid, but some abound in one, and others in another, giving to each peculiar characters.

Albuminous Principles.—These consist of albumen, fibrine, and caseine. Gelatine and chondrine are also allied to this group, although chemically they exhibit some marked differences from the others. Albumen, fibrine, and caseine also contain sulphur, and the two former a minute quantity of phosphorus; otherwise, their relative proportions of carbon, hydrogen, nitrogen, and oxygen are the same. *Albumen* forms the white of eggs, and occurs in large quantity in all the animal fluids that contribute to the nutrition of the organism. It is also found in most of the animal solids, and in nearly every morbid product. *Fibrine* forms nearly the whole substance of the muscles, but exists in small quantity in the blood. *Caseine* constitutes the chief ingredient in the milk of Mammalia. *Gelatine* is obtained by boiling animal membranes, skin, tendon, and bones, which yield a substance that on cooling becomes semi-solid, and if dried, hard and brittle. Common glue and isinglass represent this substance in different degrees of purity. It is apparently formed from the albuminous tissues by the action of boiling. The various albuminous principles now spoken of constitute the basis of the animal frame. They form, when coagulated, the walls of cells and the substance of fibres, tubes, and membranes. In solution, they are for the most part precipitated by acids and by oil, especially albumen; and when recently solidified, are again

partially dissolved by acids. The partial solubility of albuminous cell-walls and fibres enables the histologist to detect them with great ease under the microscope.

Fatty Principles.—Fatty matter may exist in living bodies under four conditions,—namely, free, saponified, non-saponifiable, and as a fatty acid. Chemically these consist of carbon, hydrogen, and oxygen, in various proportions; and hence have been called non-nitrogenous substances. In this respect they are analogous to starch, gum, and sugar, from which, apparently, they may be readily formed by a process of deoxidation. There can be no doubt, also, that fat may be produced from albuminous substances by a chemical process of a like nature; for muscles, if rendered inactive in the living body, become fatty, and if after death they be exposed to a stream of running water under certain conditions, they are converted into adipocere.

The healthy growth of the living tissues depends essentially on the union of the albuminous and fatty principles, and the constant chemical exchanges which are apparently taking place between them. The development of a young animal from an egg is a good illustration of this fact. It contains only albumen and a yellow fat with some traces of iron. Yet we see in the process of incubation, during which no foreign matter except atmospheric air can be introduced, that feathers, claws, blood-corpuscles, fibrine, cellular tissue, and vessels are produced. Moreover, the mere union of albumen and oil, under certain conditions, is apparently sufficient to produce those elementary molecules out of which all cells, as well as the molecular constitution of the chyle, are formed. The importance of this fact in nutrition and alimentation will be pointed out hereafter.

Pigmentary Principles.—The various tints communicated to the textures of plants and animals are dependent on two causes. First, the formation of a coloured secretion in the interior of cells, which may present a fluid or granular form, and the exact chemical constitution of which has hitherto been little studied. Secondly, refraction of the rays of light, in consequence of a grooved structure more or less covered with fatty particles, as in the brilliant refracting wing-cases of insects, feathers of birds, and in the tapetum of the choroid membrane. The pigment secretions are evidently allied to the oily constituents in living beings, are more or less dependent on light, heat, and exposure to the atmosphere, and are also influenced by the nature of the soil in vegetables and of food in animals.

Mineral Principles.—These are carried into the body of men and animals, combined with acids, partly in their food and partly in their drink. There they are acted upon in various ways, either by chemical changes induced in them by contact with other salts, but more especially by the oxygen of the atmosphere, which, entering the blood and coming in contact with all the tissues and fluids, is continually forming new affinities and combinations. The most important salts which enter the body are those of lime. Phosphate of lime forms the bulk of the bones and of teeth. Carbonate of lime is more abundant in the fluids and bones of graminivorous than of carnivorous animals. It also constitutes the principal part of the skeleton in the Invertebrata. Both salts enter the economy in the way referred to, become dissolved, and find their way into the blood, and from it are deposited in the organic matrix of bone or cartilage to give it firmness. Indeed, bones may be regarded as cartilage loaded with phosphate and carbonate of lime. In plants, and some of the lower forms of animals, silicious salts are deposited in like manner, to form skeleton of the texture. In every case the mineral solution infiltrates in the first place a cell structure; so that, on afterwards becoming solid in consequence of the disappearance of the water, an organized form is communicated to mineral matter, as in the silicious epidermis of the grasses, the shells of the Mollusca and Crustacea, and the bones of mammals. During life, the mineral, like the animal constituents, are continually undergoing changes, new particles being deposited from the blood, while the old ones are absorbed and excreted. Hence the mineral substances necessary for the textures must not only exist in aliment, but are constantly found more or less changed in all the secretions and excretions.

GENERAL PROPERTIES OF LIVING BEINGS.

Having now described the elementary forms and chemical constitution of the textures of living beings, and seen that they possess peculiar endowments, we may next inquire into the general properties which they present. On considering the nature of these, we may at once divide them into two classes,—viz., 1*st*, Those which are reducible to the laws of physics; and 2*d*, Those which, in the actual state of science, cannot be so reduced, and which *therefore* we call vital. The history of physiology exhibits a long series of struggles between the physicists and the vitalists, and we must confess that, in proportion as the vital functions have been encroached upon, so science has advanced. Thus the production of animal heat, and the processes of digestion and respiration, though formerly considered to be vital phenomena, are now known for the most part to be chemical. It is of the utmost importance, therefore, to ascertain what are physical and what are vital phenomena in a living body, not only that we may avoid confounding one with the other, but in order that we may know in what manner the vital functions may be best investigated.

Physical Phenomena of Living Beings.—We observe in the various kinds of living beings phenomena altogether physical, but which are essential to its existence: among these may be mentioned elasticity; gravity; hydraulic, optical, acoustic, and chemical phenomena; imbibition; and endosmose. The importance of this last, in a structure composed of membranes through which fluids are continually passing, must be evident. The cells out of which, as we have seen, most of the tissues are formed, present a membrane admirably adapted for the phenomenon of endosmose, and there can be little doubt that it is constantly operating in these bodies. Again, the absorption of fluid from the stomach and intestinal canal through the mucous membrane, and the processes of absorption and exhalation generally, must be connected with endosmose. Living beings are also subjected to the physical influences of caloric, electricity, and light from without, which operate upon them much in the same manner as they act upon matter in general.

Vital Phenomena of Living Beings.—Although many functions in vegetables and animals could not be explained without physics, there are scarcely any which can wholly be accounted for by mechanical or chemical principles, and thus to the most physical act there are peculiarities superadded in living beings which our present knowledge does not enable us to fathom. The properties of growth, of reproduction, of contractility, and of sensibility are so broadly distinct from anything as yet known to be mechanical, electrical, or hydraulic, as at once to evince the existence of something in connection with living beings alone, which we call vital. When, therefore, we employ this term we only mean that it characterizes certain phenomena which in the present state of our knowledge cannot be accounted for by physical science, and which, being found only in living beings, are consequently vital.

In studying the different phenomena, whether physical or vital, physiologists are in the habit of using the term force much in the same manner that it is used by the general cultivators of science: mechanics has its forces, such as that of the lever; chemistry has its forces, like that of affinity; and physical science has its forces, like

that of attraction. Physiology has also its forces. It has been supposed that in the same manner as we have physical attractions and repulsions, so we have vital attractions and repulsions. Then we have contractile, nervous, and germinative forces. The idea of force, whether in physics or physiology, as explanatory of phenomena, must be regarded only as theory, as a mental creation, which we employ as a convenient term to satisfy that intense desire of arriving at definite causes which is instinctive in man. On the other hand, it is often employed to express action, which may be demonstrated and often measured. In this sense it is as applicable to the action of a stomach or of a liver as it is to that of an electric telegraph or a steam-engine.

According to Mr Grove, the physical forces are "correlative," or have a relation of mutual dependence, each being capable of producing any one of the rest, either directly or through the medium of some other. Thus, the motion of a body retarded by friction gives rise to heat; and, conversely, heat applied to any form of matter produces its expansion,—that is, motion. The friction of two dissimilar bodies produces not merely heat, but electricity; and heat itself, when made to act on certain combinations of metals, also produces electricity; whilst on the other hand, the electric current may produce heat, light, magnetism, or motion, according to the nature of the substances through which it is transmitted. Light, heat, and electricity, again, are closely related to chemical affinity, which is often specially excited by them, and which can in its turn generate these forces; a material *substratum* being required in both cases. In the same way, as pointed out by Dr Carpenter, there may be a correlation of the vital forces. Thus, as we have seen, the most universal agents of growth are cells. But some of these produce one tissue, and some another, having different vital endowments. Thus, cells converted into muscular tissue, exhibit contractility; those converted into nerve, excitability. Here also a certain substratum or material substance is requisite for the conversion of one force into another. Then, as we have seen, there is a certain relation between the nervous and muscular force: one can call the other into action in a degree proportional to its own excitement; and, again, nervous agency is capable of influencing cell-formation in such a manner as to give rise to the idea that it may be re-converted into the forms of vital force necessary to evolve cells. Again, heat, light, and electricity have long been recognised as exciters or stimuli of the vital forces, and these, operating through a peculiar organized structure, may in fact become vital forces themselves, just as heat becomes electricity when it passes through a certain combination of metals. Thus, vital force may be converted into physical force, and *vice versa*, as when we see one set of cells directed to chemical action, another to mechanical movement, and a third to produce electricity, as in the case of the torpedo, or *Gymnotus electricus*.

It results that the physical and vital forces and properties are intimately united in a living body, and that the activity or life which it exhibits is the sum of those phenomena which we observe in it. When therefore we use the term life, we simply mean that an organized substance is possessed of certain properties partly peculiar or vital, and partly physical, which, when acted upon by appropriate stimuli, are competent to give rise to that series of actions in which life consists. We are as ignorant of the true nature of physical as we are of vital properties. It is from the effects alone that we infer their existence. Hence, if one substance exhibits the property of combustibility, it burns; if another, on being stretched, returns to its original size, it is elastic; and if a third presents growth, involving assimilation and excretion, it lives.

PART II.—NORMAL OR HEALTHY PHYSIOLOGY.

Having now ascertained the vital properties and chemical constitution of the elementary textures of the animal body, we have next to describe what is known of the functions of its more complex organs. These have been variously divided by physiologists; but I shall speak of them under three heads,—viz., 1*st*, Function of Nutrition; 2*d*, Function of Innervation; and, 3*d*, Function of Reproduction. The first of these comprehends all those processes called digestion, assimilation, circulation, respiration, absorption, secretion, excretion, &c., which are directed to building up, supporting, and removing the various textures of the body. The function of innervation comprehends those processes connected with locomotion, sensation, and thought or intellect; the third-named function, such as are necessary to the reproduction and development of the animal. The three functions are in the higher animals so intimately mingled together that they are with difficulty separated from one another. But in the lower we find that innervation gradually disappears as we descend in the scale. At first, mind, then voluntary motion, and then sensibility, is not present, until at length, when we arrive at the simplest condition of animal life, as in the infusorial animalcules, we find only an absorbing membrane with the power of reproduction. Although, therefore, the three functions may be intimately united and dependent on one another, we must study in the first place the laws by which each seems to be governed.

FUNCTION OF NUTRITION.

Instead of treating of nutrition as one of many functions, and especially as only comprehending what refers to the reception and assimilation of alimentary matter, we prefer regarding it as a great compound process, for which many acts are necessary, and all of which combine to keep up the nutrition of the economy. We may consider it as consisting of five stages,—viz., 1*st*, The introduction into the stomach and intestinal canal of appropriate alimentary matters; 2*d*, The formation from these of a nutritive fluid, the blood; and the changes it undergoes in the lungs; 3*d*, Passage of fluid from the blood to be transformed into the tissues; 4*th*, The disappearance of the transformed tissues, and their re-absorption into the blood; 5*th*, The excretion of these effete matters from the body in various forms and by different channels. We believe that it is only by understanding nutrition in this enlarged sense that we can obtain a correct explanation of the dependence of one process upon another, as well as of those important affections which may appropriately be called diseases of nutrition. We shall therefore treat of these stages separately, the whole of which will be more readily comprehended by a study of the diagram (p. 657), representing the different parts concerned in the nutritive function of a dog.

STAGE I.—*Introduction into the Stomach and Intestinal Canal of Appropriate Alimentary Matters.*

Aliment.—Food of every variety, when analysed, is resolvable into four elements,—viz., carbon, hydrogen, oxygen, and nitrogen, combined with certain minerals; and we have previously seen that in the great balance of organic nature, whether in the atmosphere, in water, in plants, or in animals, they play the chief part. The chemical constitution of plants and animals is exactly the same; and hence the

Physiology necessity which modern science has elicited for the food derived from one kingdom of nature being composed of

View of the Nutritive System of a Dog.

A. Œsophagus or Gullet, which conveys the food from the mouth to the stomach—B. Lungs—C Vena Cava, through which the blood from the system generally is returned to the heart—D. Liver—E Stomach—F. Spleen—G. Receptaculum Chyli—H. Pancreas—I. Duodenum—J. Entrance of Biliary and Hepatic Ducts—K. Jejunum—L Ileum—M. Cæcum—N. Colon—O Rectum—P. Kidneys, with the Supra-Renal Capsules above—R. Urinary Bladder—S. Thoracic Duct, through which the chyle passes to join the blood—1. Parotid Gland—2. Salivary Gland of Nuck—3 Submaxillary and other Salivary Glands—4 Jugular and Subclavian Veins—5. Situation of Thymus and Thyroid Glands—6. Entrance of the Thoracic Duct into the left subclavian vein, near the jugular—7. Left Auricle—8. Right Auricle—9. Left Ventricle—10. Right Ventricle—11. Gall Bladder—12. Vena Portæ, which conveys blood from the intestines to the liver—13. Mesenteric glands—14. Lymphatic Vessels—15. Lacteal Vessels—16. Branches of the Portal Vein 17. Lacteals.

those elementary substances of which the bodies to be nourished in the other kingdom are themselves made up. The proximate principles, however, which contain these may vary under different circumstances, such as a hot or cold climate, or a peculiar constitution of body,—carnivorous or herbivorous, for example. In all cases, however, the demand for food is regulated by the waste of the tissues; hence the processes of growth require constant supply, and this is increased or diminished by the state of the respiration and the amount of bodily or mental exertion,—circumstances which induce loss of force and of texture.

In endeavouring to ascertain what are the best kinds of Physiology food requisite for meeting the demands of supply, attention must be paid to the following circumstances:—1*st*, The chemical principles which enter into the constitution of the living being to be nourished; 2*d*, The mode in which these are combined to form tissues and organs; 3*d*, The atmosphere which surrounds it; and, 4*th*, The amount of waste produced, as, for instance, amongst men variously employed.

1. With regard to the first point, we have seen that the chemical principles which enter into the constitution of a living being are the albuminous, the fatty, the pigmentary, and the mineral. The pigmentary may here be excluded from consideration, or regarded as a modification of the fatty; so that we may consider, in reference to dietetics, that the essential constituents of the animal frame are the albuminous, the fatty, and the mineral principles. No one of these groups alone will serve to keep up nutrition in an animal body. They must be all united; a fact which has been clearly demonstrated by numerous experiments of Magendie. He fed dogs upon sugar, oil, gum, or butter alone, and found that for one or two weeks they did very well, but after that, became weak, and died on the thirty-second or thirty-sixth day. When they were fed on white bread and water, they lived fifty days; when on cheese and white of egg, they lived longer, but became feeble, emaciated, and lost their hair. More recent experiments by Edwards and Balzac have shown that a diet of bread and gelatine is insufficient, producing death after emaciation, without appreciable lesion. A little addition of brown soup, however, renders bread and gelatine highly nutritious. Hence it is always necessary to associate a proper mixture of albuminous and fatty principles, in which the mineral enters as a constituent part. Of all the articles of food, human milk appears to be that which contains the three essential substances in the best proportions. A like result may be obtained by mixing other articles together, such as fat pork with veal, potatoes with beef, and rice with mutton or fowl. Again, stuffing is generally added to ham and veal, bacon to beans, ham to fowls, and so on. The addition of butter to bread is the almost universal food of the nursery. Mankind have for the most part adopted these rules instinctively. Persons who feed principally on flesh prefer it fat; and those who live largely on vegetables, as potatoes and rice, take considerable quantities of milk. The same result is obtained by the use of fermented liquors. Hence bread and wine constitute a diet resembling milk in chemical constitution. It is not mere nitrogenous or non-nitrogenous kinds of food, however, that will serve for nourishment, as is theoretically supposed by chemists. To form tissue, these chemical constituents must be converted into albumen and oil, so as to produce those elementary molecules found in the chyle, and which constitute the formative substance out of which nuclei and cells are developed. An unacquaintance with this histological truth has been the cause of much error in dietetics. The mineral elements necessary for nutrition, especially the salts of lime, potash, soda, and iron, constitute the ashes obtained by incineration from all articles of food, and are, as we have previously explained, as essential to the animal frame as the fatty and albuminous constituents.

2. With regard to the manner in which the essential constituents of food are combined to form tissues and organs, we have seen that the three groups of principles are necessary to every texture. There are some, however, which abound in one, and some in another. Thus the fibrous tissues abound in albumen, the glandular organs in fat, and the bones in mineral matter. Whenever fluid albumen and fat are brought in contact with one another, the former is precipitated in a membranous form, and if the two are mingled together by trituration, they assume to the naked eye the

appearance of milk or of an emulsion. This is owing to the formation of multitudes of particles such as are found in milk, composed of a delicate vesicle of albumen, containing a minute portion of oil. Such, also, is the invariable structure of all blastemata, or nutritious fluids; and hence the necessity of bringing fluid albumen and oil in contact,—a function performed by the stomach,—so as by their mixture together a properly constituted molecular basis be produced, out of which texture may be formed.

3. The atmosphere which an individual breathes evidently exercises an important influence on the nature and quantity of the diet. If cold and condensed, there is more oxygen, which will unite with the tissues during respiration, and produce more waste, while greater evaporation will take place from the surface; a larger supply is therefore necessary, and principally of matter which will rapidly give rise to carbonic acid. Hence the amount of animal and fatty food used by northern nations. In them, also, it will be found that alcohol in all its various forms is used with the greatest freedom; that is, a non-nitrogenized drink, useful, according to Liebig, as fuel for combustion. In warm countries, on the other hand, where the air is more rarified, a vegetable diet, abounding in sugar and starch, is employed; also non-nitrogenized substances, which, however, being more slow of digestion, are not so readily converted into matter for combustion. Thus, the non-nitrogenous kinds of food, as fat, starch, and sugar, by combination with oxygen, protect the tissues, and produce animal heat. The amount of oxygen in the atmosphere also explains how, with an equal expenditure of force in work, a man requires in summer a less supply of non-nitrogenous food than in winter.

4. The degree of bodily or mental exercise influencing the muscular and nervous textures influences the kind and amount of food. Those who spend their time in either kind of labour require more food than those who pass idle lives. This has been proved experimentally in a variety of ways, and is observable by paying attention to the dietaries of able-bodied men, such as sailors, as compared with those of prisoners and of the sick in hospitals. An able-bodied man requires from 31 to 36 oz. of dry nutritious food daily, of which 26 oz. may be vegetable. In prisons, somewhat less is required, although even there it is not safe to reduce the quantity below 30 oz. daily, as it occasions scurvy.

We can now comprehend some of the more striking phenomena of the modes of life and of respiration in man and animals. Nations of hunters, as well as the carnivorous animals, require a large quantity of fleshy nourishment. In violent corporeal activity they decompose their nitrogenous food into the constituents which serve to be transformed into the tissues on the one hand, and into carbon and hydrogen, to supply respiration, on the other. Hence the unquiet and restlessly active habits of the hunter and of rapacious animals, as well as the extended area for their existence; circumstances which require a scanty population. We meet with the other extreme among the nations which—as in the East Indian races, the Negroes—live wholly on rice, bananas, or similar vegetable substances, in which little nitrogenous matter exists. Hence the enormous quantity which these nations are forced to take in order to extract the necessary amount of actual nourishment for the tissues and for respiration. In this respect they resemble the herbivorous animals who pass most of their lives in a state of nature in feeding and sleeping. In the polar regions, again, we find an immoderate consumption of fat. Here man must produce a greater quantity of heat in order to live, and requires thereto a larger amount of combustible matter or fuel. For this purpose there could be scarcely any substance so applicable as the fat of animals, which principally consists of carbon and hydrogen. Finally, where the breeding of cattle is carried on, we have a transitional state, since man here makes use of the domestic animals to provide himself, in addition to meat, with the substances devoid of nitrogen, in the constituents of milk and the rich fat of the domestic animals, which is almost wholly absent in the wild ones. In this manner a skilful agricultural people leads the most judicious life, mingling nutritious substances in the same proportion as nature has mixed it for the suckling in milk, and deriving them from both the vegetable and animal kingdoms. For these generalizations we are indebted to Liebig.

Want of solid aliment produces a peculiar sensation called *hunger*, while want of liquid causes another called *thirst*. These are not so much dependent on a peculiar condition of the stomach or œsophagus as they are upon the general wants of the system. Voyagers in the arctic regions have related numerous instances among the Esquimaux of men who could devour enormous quantities of animal food with impunity; and other cases are known where, from habit, other persons have survived on surprisingly small quantities of nourishment. Certain animals, when they are large and fat, fall into a torpid state on the approach of winter, and continue so until the warmth of spring returns. During this period they take no food; their respiration is exceedingly slow; the blood has rather a gentle undulation than a circulation, and the trivial losses which take place are repaired by the gradual absorption of fat. Hence, at the end of the hybernating season, the emaciation of animals subject to its influence is very considerable. Some authentic cases are known of Indian fakirs who have sustained a complete fast, when in a state of trance, for from four to six weeks. Under ordinary circumstances, however, abstinence from food cannot be supported beyond the fourth or fifth day without danger. Young animals generally sink more rapidly than old ones. Of the 150 individuals wrecked in the Medusa, only 15 survived after 13 days of starvation; and some of these had assisted in eating parts of the dead bodies of their companions. One of the most important effects of starvation to attend to is, that after some days it destroys the power of digestion itself to a great extent. Hence the extreme caution necessary in treating such a case. At first only fluids should be given containing little nutriment, the amount of which must be gradually increased.

Mastication.—The food must be properly prepared for the changes it is destined to undergo in the stomach, and to this end it must be broken down by the action of the teeth, jaws, and tongue.

For a description of the teeth, the article ODONTOLOGY may be referred to. All that need be said here is, that they are organs admirably adapted, in man and the inferior animals, for seizing, lacerating, and grinding various kinds of food. They are fixed in the jaws, which move about in various directions by the action of the muscles. Man having a variety of movements, possesses a very complicated apparatus for this purpose. The tongue continually gathers together the aliment from below the dental arches, and when it is of soft material, assists in crushing it against the palate. To fulfil this function, it not only possesses great mobility, but is endowed with tactile sensibility, whereby we are enabled to judge of the physical qualities and situation of aliment in the mouth, as well as to push it about continually, and appreciate the degree of trituration it undergoes. The lips also being closed, they, with the muscular walls of the cheeks, assist mastication, in keeping the food into the cavity of the mouth, and preventing its accumulation outside the dental arches. As the result of these combined actions, the food is broken down, the utility of which must be obvious. All chemical processes, and the action of solvents, is favoured by division of the matter to be operated on. Too rapid eating is a common cause of indigestion; and considerable masses of food, if not broken

by the teeth, pass through the digestive canal unaltered, and deficient nourishment is the result, and this especially if they be principally vegetable, or contain the skins of fruits and husks of grain.

Insalivation.—The next process the food is subjected to is a mixture with a peculiar fluid, the saliva. This is a slightly viscid, transparent liquid, which, on standing, deposits a little flocculent sediment, composed principally of the scaly epithelium of the mouth and of the nucleated cells of the salivary glands. (See diagram, 1, 2, and 3.) It contains an organic chemical substance called ptyaline or salivine, on which its peculiar properties are supposed to depend. The food in the mouth constitutes the stimulus for the flow of saliva; and the common expression of the idea of a feast making a man's mouth water shows that the secretion may be excited by mental emotions. Its uses are,—1*st*, By keeping the mouth moist, to favour articulation; 2*d*, To assist in mastication, it being much more difficult to break down dry than moist substances; 3*d*, To facilitate deglutition, as it is impossible to swallow dry matters; 4*th*, To operate upon certain constituents of the food chemically, and although there is great difference of opinion as to how this is accomplished, it is supposed to affect more especially the starchy constituents, readily converting them into glucose or grape sugar; 5*th*, Liebig supposes that, owing to the viscidity of the saliva, air, in the form of froth, is carried to the stomach, and then yields up its oxygen to unite with the tissues.

Deglutition.—The food, reduced to a minute pulp by means of mastication and insalivation, is now carried from the mouth, through the œsophagus or gullet to the stomach (diagram, A). This is accomplished by a rapid contraction of numerous muscular parts, which unite together to produce the desired effect by the agency of a certain series of nerves acting through the spinal cord; hence called *diastaltic* (δια, *through*, στελλω, *to contract*). So long as the bolus of food is contained in the anterior part of the mouth it is under the control of the will, but once pushed back by the pressure of the tongue against the hard palate, to the posterior third of the tongue, it is involuntarily conveyed into the stomach. For this purpose, the lips are closed, to prevent escape of the morsel anteriorly; the soft palate is elevated to prevent its passage into the nasal cavities above; the contraction and backward action of the tongue presses the epiglottis over the larynx, which prevents its going into the windpipe inferiorly; and thus, no other mode of escape being left open, the pressure of the various muscles of the mouth, pharynx, and œsophagus, carry it by a continuous wave-like motion from above downwards towards the stomach. The cardiac orifice of the stomach then opens, and it slips through into that viscus.

Digestion in the Stomach.—The stomach is a bag (diagram, E) in which further mechanical and chemical processes are made to operate upon the food, in order to fit it for assimilation or conversion into blood and tissues. The substance of this bag is composed of a serous membrane externally, a muscular coat in its centre, and a mucous layer internally. The muscular coat is composed of three layers of contractile non-voluntary fibre, which closes upon the food, and subjects it to trituration or kneading, whereby the whole of it is intimately mingled together, and mixed with the gastric juice. It is also pushed about in a certain direction, moving along the great curvature from left to right, and then along the lesser curvature from right to left. These motions continue until the entire mass of food is broken down into a fine pulp, called chyme, and passes out of the stomach through the pyloric orifice. The stomach seems to be more irritable during the period of digestion, and its contractility more energetic; so that a stimulus will operate then which will produce no effect in the interval, or when fasting. Hence is explained why, during digestion, the outward orifice is so firmly closed that nothing but the finest pulp passes through it; but this process once over, undigested masses, and even large bodies, such as coins, have been known to go through.

The different motions of the stomach now spoken of have actually been seen to take place in the living human body, in a remarkable case, the study of which has so improved our knowledge of this function, that it deserves especial notice. It was that of a young man named St Martin, a Canadian, eighteen years of age, who, when in perfectly good health, was accidentally wounded by the discharge of a musket, on the 6th of June 1822. "The charge," says Dr Beaumont, who describes the case, "consisting of powder and duck-shot, was received in the left side, at the distance of one yard from the muzzle of the gun. The contents entered posteriorly, and in an oblique direction, forward and inward, literally blowing off the integuments and muscles to the size of a man's hand, fracturing and carrying away the anterior half of the sixth rib, fracturing the fifth, lacerating the lower portion of the left lobe of the lung, the diaphragm, and perforating the stomach." From this injury he gradually recovered, but the orifice never closed. When healed, twelve months after the accident, the perforation was two-and-a-half inches in diameter. Subsequently a small fold of the mucous coat of the stomach appeared, which gradually increased till it filled the aperture, and acted as a valve, so as completely to prevent any efflux from within, but to admit of being pushed back by the finger from without. Dr Beaumont, who had carried this difficult case to a successful termination, took the man into his service, and commenced a series of careful observations, which he has embodied in one of the most instructive works extant on the subject of digestion. On placing a solid substance through the opening into the stomach of St Martin, it was seen by Dr Beaumont to be subjected to the movements described.

These movements, however, though useful in perfecting and facilitating digestion, do not constitute the essential part of the process, as was shown by the experiments of Spallanzani, who caused metallic balls to be swallowed, filled with food, which, notwithstanding, was perfectly digested in the stomach. The mucous coat of the organ contains a multitude of follicular glands, that secrete an acid fluid, the gastric juice, which acts as a chemical solvent on the food subjected to it. This is not merely owing to acidity, but to the presence of a peculiar organic substance called pepsine, which is so powerful that one part dissolved in sixty thousand parts of water will digest meat and other alimentary substances. It is poured forth when food reaches the stomach, and is secreted in the tubular glands in the intervals of repose.

The conditions favourable for good digestion in the stomach are,—1*st*, A temperature of about 100° Fahrenheit; 2*d*, Constant movement of the walls of the stomach, which brings in succession every part of the food in contact with the mucous membrane and gastric juice; 3*d*, The removal of such portions as have been fully digested, so that what remains undigested may be brought more completely into contact with the solvent fluid; and 4*th*, A state of softness and minute division of the aliment. Numerous experiments have shown that digestion will go on in gastric juice out of the stomach, but takes a three or four times longer period than when performed by the stomach itself.

According to the experiments of Dr Beaumont upon St Martin's stomach, the rapidity of digestion varies according as the food is more minutely divided, whereby the extent of surface with which the gastric fluid can come in contact with it is proportionally increased. Liquid substances are for the most part absorbed by the vessels of the stomach at once, and any solid matter suspended in them, as in soup, are concentrated into a thicker material before the gastric

juice operates upon them. Solid matters are affected so rapidly during health that a full meal, consisting of animal and vegetable substances, may be converted into chyme in about an hour, and the stomach left empty in two hours and a half. Dr Beaumont found that among the substances most quickly digested were rice and tripe, both of which were digested in one hour. Eggs, salmon, trout, apples, and venison were digested in one hour and a half. Tapioca, barley, milk, liver, and fish, in two hours. Turkey, lamb, and pork, in two hours and a half. Beef, mutton, and fowls required from three to three and a half hours, and these were more digestible than veal. These facts were different from what was anticipated, and show that prevailing notions as to the digestibility of different kinds of food are very erroneous. It must be remembered, however, that easy digestibility does not imply high nutritive power. A substance may be nutritious, though so hard as not to be readily broken down; and many soft, easily digested materials may contain a comparatively small amount of nutriment.

Other circumstances besides those referred to affect digestion in the stomach. Among these are,—1*st*, The quantity of food taken: the stomach should be moderately filled, but not distended; 2*d*, The time which has elapsed since the last meal, which should always be long enough for the food of one meal to have completely left the stomach before more is introduced; 3*d*, The amount of exercise previous to and subsequent to a meal; gentle exercise being favourable, and over-exertion injurious to digestion; 4*th*, The state of mind; tranquillity of temper being apparently essential to a quick and due digestion; 5*th*, The bodily health; 6*th*, The state of the weather; 7*th*, Period of life; digestion being more active in the young than in the old.

Digestion in the Intestines.—The intestines have been divided into small and large, and each of these subdivided into three portions. Thus the small intestine is divided into duodenum (see diagram, I), jejunum (K), and ileum (L); and the larger intestine into cæcum (M), colon (N), and rectum (O). The whole constitutes a hollow tube with serous, contractile, and mucous coats, similar, but not identical with those of the stomach. The food operated on in the manner described enters the upper part of this tube, the duodenum, in the form of a thick, grumous fluid called chyme, of a strong, disagreeable acid odour and taste, and containing undigested portions of the food. This is now propelled from above downwards by the action of the contractile fibres of the intestine. As it descends, it is subjected to two kinds of operations,—1*st*, The influence of various fluids with which it is mixed; and 2*d*, The gradual absorption of its nutritive substance through the intestinal walls into the system.

Shortly after the chyme has passed out of the stomach it becomes mixed with the bile and the pancreatic juice,—two fluids secreted by the liver and the pancreas, which in man enter the duodenum by a common opening. The exact influence exerted by the bile on the chyme is not known, but it is supposed so to operate as to render the nutritive and excrementitious matter more easily separable. The bile serves other purposes, which will be dwelt on subsequently. The pancreatic juice is a clear alkaline fluid, which has the property, when mingled with a drop of oil, of emulsionizing it with the greatest readiness. Numerous observations and experiments by M. Bernard have shown that it operates with the greatest readiness on the fatty constituents of the food; and that in such animals as have the pancreatic separated from the biliary duct for some distance, as in the rabbit, milky chyle is only formed in the lymphatics after the food has passed the former. Hence there can be little doubt it does emulsionize the fluid fat of the food, and fit it for assimilation. At the same time, recent observations show that this is not its exclusive action, but that it also assists in digesting the other constituents which have escaped the operations of the mouth and stomach. The chyme is also mingled with the fluid of the Brunonian glands of the duodenum, and of the glands of Peyer and Lieberkuhn, scattered over the small intestine generally, but the particular changes these induce in it are not known.

As the chyme passes along the intestinal canal from above downwards, it is squeezed by successive contractions of the tube forcibly against the mucous coat of the intestine. This is covered over with prominences of various forms and lengths, denominated *villi*, which are pendulous folds or projections of the mucous coat itself, so as to afford a great extent of surface, over which the chyme passes. The more fluid parts, containing such portions of the food as have been reduced to excessive fineness, now pass through the membrane, and enter a series of ducts provided for that purpose. As the chyme, therefore, descends the alimentary tube, it is constantly losing its more fluid and nutritive portions, while other portions of it are being still farther digested and prepared for a like absorption. On reaching the cæcum, or commencement of the large intestine, it assumes a fœcal odour, and has now lost nearly the whole of its nutritive matters. Such as remain, however, are absorbed by the large intestine, whilst the useless matter becomes more and more solid, until it is expelled through the rectum. Supposing that thirty ounces of solid nutriment have been taken in the course of twenty-four hours by a healthy individual, only five of these are expelled as fœces. So that twenty-five ounces have been prepared, elaborated, and finally passed into the body to form blood, and through it into the various tissues and secretions, to supply the wants of the economy.

Stage II.—*The Formation from the Alimentary Matters of a Nutritive Fluid, the Blood; and the Changes it undergoes in the Lungs.*

Chylification.—The nutritive matters of the food, in a state of the minutest division, pass through the cell-walls of the epithelium covering the intestinal villi, probably by endosmose, although it has been supposed that there are minute pores which permit their entrance. From the interior of these cells they pass into the extremities of ducts, called lacteals, in a way that has hitherto eluded all research. What, however, *has* been seen is, that, when digestion in the intestines is active, the epithelial cells of the villi are filled with the fatty molecules and granules of an emulsion, the extremities of the villi themselves appear turgid, and the lacteals within them, where they are visible, are filled with a milky fluid. The continuation of these lacteals on the peritoneal coat of the intestines are also filled with this milky fluid or chyle, which flows in a continuous stream through the numerous lymphatic glands towards the thoracic duct. The chyle, when it is first examined on leaving the intestine, presents a milky appearance, and consists of a multitude of minute molecules, or a molecular basis when examined microscopically. After passing through the lymphatic glands, however, these molecules may be seen to be mingled with larger corpuscles, which are the lymph and chyle corpuscles previously described, and which are subsequently transformed into those of the blood.

Function of the Blood-Glands.—There are a series of glands, widely disseminated through the body, characterized by being very vascular, forming in their interior a multitude of colourless nuclei and cells, having no ducts, but richly furnished with lymphatics. To this group of organs not only belong the lymphatic glands, but the spleen the supra-renal capsules, the thymus, and thyroid glands. In infancy and early childhood the thymus and supra-renal capsules are large and active; they then decline and almost

disappear in man. The others are permanently active throughout life. The lymphatic glands evidently exercise a great influence over the fluid which passes through them, the exact nature of which is unknown, but which serves to elaborate or fit it more perfectly for the function it is to undergo. The fluid derived from the intestines in the manner described, passes through the mesenteric lymphatic glands, is of a milky appearance, and called chyle; that which goes through the other lymphatic glands is limpid, and denominated lymph. They also pour their contents into the thoracic duct, which in man enters the angle formed by the left jugular and axillary veins (diagram, 6); so that the whole joins the blood at that point. The thoracic duct further receives the lymphatics coming from the other blood glands, each of which contributes numerous corpuscles, in various stages of development, destined to become blood corpuscles.

Sanguification.—The blood, therefore, is formed and kept up not only by the nutritive matter derived directly from alimentary matters digested in the intestines, but by the constant secretion of fluids abounding in corpuscles derived from the blood-glands on the one hand, and lymph and matters absorbed into the circulation from the tissues of the economy on the other. Of this latter process, however, we shall speak subsequently. The formation of blood is undoubtedly connected with the reception of chyle and the function of the blood-glands. The former furnishes the proximate nutritive principles—albuminous, fatty, and mineral—reduced to a fine emulsion. In the blood-glands are produced the corpuscles according to the laws of cell growth, which, floating in the fluid, become more and more developed as they flow along the lacteals, and through the lymphatic glands towards the blood, on reaching which they are immediately transmitted through the right side of the heart to the lungs, and become blood corpuscles. Whether all the corpuscles formed in the blood-glands, and more especially in the spleen, reach the circulation through the thoracic duct, is doubtful. It is probable that the Malpighian glands of the latter organ may have some direct connection with the veins, although this has not been clearly demonstrated anatomically. The blood of the splenic vein, however, is always more rich in colourless cells than any other kind of blood; and in certain morbid conditions, where the spleen and other blood-glands are enlarged, that fluid is crowded throughout with colourless cells, constituting a morbid condition Dr Bennett first discovered and described, denominated Leucocythemia, or white cell-blood. That the corpuscles formed in these glands, therefore, do get into the blood is certain, although the channel by which they do so has not yet been clearly demonstrated. In the lungs most of the corpuscles in a state of health become coloured, and the blood itself undergoes important alterations.

Circulation of the Blood.—Having seen how the nutritive elements of the food are converted into blood, the method by which it is distributed or circulated throughout the organism should next be described. This circulation is carried on through the heart, the arteries, the capillaries or intermediary vessels and veins, back to the heart again. In the higher animals, there may be said to be two circulations, one connected with the body generally—the systemic or greater circulation—the other with the lungs—the pulmonary or lesser circulation. Let us suppose that it commences with the left ventricle of the heart (see diagram, 9). The blood passes from thence by the aorta through the systemic arteries into the capillaries, and back by the veins to the right auricle of the heart. From thence it goes into the right ventricle of the same organ through the pulmonary artery to the capillaries of the lung, in which it is exposed to the atmosphere, and then back through the pulmonary veins to the left auricle and left ventricle, where we saw that it commenced. In this constant round it is subject,—1*st*, To various forces which serve to propel it; and 2*d*, To different changes, the result of the respiratory and nutritive processes.

1. The most important force which propels the blood is induced by the contractions of the muscular walls of the heart, an organ so constructed that, by the union of contractile cavities and valves, the fluid is constantly sent through it only in certain directions. (For a description of the heart, see ANATOMY.) The action of this apparatus is accompanied by certain noises, caused by the combined contraction of the muscular walls, the rushing of the fluid, and the flapping together of the valves, an exact appreciation of which is the method by which the modern physician is enabled, with wonderful accuracy, to determine the diseases or derangements of the organ. The apex of the heart also is at each ventricular contraction tilted upwards and forwards, so as to strike the chest anteriorly between the fifth and sixth ribs, a little below and to the inside of the left nipple. This is caused by the peculiar spiral arrangement of its contractile fibres. The inner surface of the heart is considerably more irritable than the outer, and the right auricle retains the power of contractility longer than any other part of the body, and has consequently been called *ultimum moriens*. The blood is the natural stimulus to this contractility, and hence why, the more blood is forced into it as the result of exercise and increased respiration, the more rapid its actions become. The heart, however, will continue to contract regularly when cut out of the body of an animal recently killed, and when deprived of blood, but then the stimulus is supplied by the air, or by the table on which it lies. Under any circumstances, the rhythmical action of its various parts is owing to the distribution of ganglionic nerves in its substance, constituting one of the excito-motory actions which will be subsequently described. The heart is also readily excited by various emotions of the mind, though not by volition; hence in ancient times it was considered the peculiar seat of the affections and passions, an opinion which may be still traced in numerous expressions common to the phraseology of all languages even in the present day.

The force with which the left ventricle of the heart contracts is about double that exerted by the contraction of the right, which results from the greater thickness of its walls, and the greater resistance it has to overcome. It has been calculated that the static force with which the blood is impelled in the human aorta from the ventricle is equal to that of 4 lb. 4 oz., and in that of a mare is equal to 11 lb. 9 oz. The frequency of the heart's action is modified by a variety of circumstances, which we shall allude to immediately when speaking of the pulse. The arteries are tubes composed of elastic and contractile fibrous tissues, the former being most abundant in the largest vessels, where the pressure is greatest, while the latter exists almost alone, where the impulse of the heart is scarcely felt. Their functions are,—1*st*, The conveyance and distribution of blood to several parts of the body; 2*d*, The gradual conversion of the pulsatile or wave-like movements into a uniform flow.

The blood nowhere passes through an artery so rapidly as it is forced into it by the left ventricle of the heart, on account of the resistance offered by all the tubes against which it is forced. The consequence is, that when it receives the wave of blood, both the diameter and length of the vessel is increased, and this is followed by a recoil and recovery of its previous position, owing to the elasticity of the tube. These operations constitute the pulse, which is felt when the finger slightly compresses an artery. The pulse differs after violent exercise, according to the time of the day and position of the body. Exercise raises the pulse. It is quicker in the morning than in the evening; and hence, it has been

supposed, why a glass of wine is more stimulating early in the day than at night. In health, the pulse reaches its maximum about noon, and its minimum towards midnight. It is more frequent in the erect than in the sitting position, and quicker then than in the recumbent posture. The difference between standing and sitting is about 10 pulsations; between sitting and lying, 5; and between standing and lying, 15 pulsations; much, however, depends on the muscular effort employed. The natural pulse in the adult male may be stated as varying between 60 and 70 pulsations in the minute; that of the female being, on an average, about 10 beats more. In a newly-born infant, it is from 130 to 140; in old age, from 50 to 60. In diseases, the deviation from the healthy standard as to frequency is very remarkable. It has been known in profound coma to be only 17, and in cases of water in the brain in children it has been counted 200 in the minute. The volume or force of the pulse may also vary; hence the terms strong or weak, full or small, hard or soft, rigid, tense, wiry, thready, &c. As regards rhythm, it may be regular, irregular, unequal, intermittent, jerking, &c.

The capillaries, as was previously remarked, consist of delicate membranous contractile tubes, and their functions seem to be,—1*st*, To subdivide the blood, so that it may be brought within the attractive influence of the tissues; and, 2*d*, To act as fine filters, permitting an exchange of matter to be constantly carried on between the blood and the textures. In the transparent webs of certain animals, the blood may be seen passing through these tubes in a state of health with a uniform flow. There is no evidence that they exercise any influence in propelling the blood by contracting their walls, but there is every reason to suppose that the constant attraction exerted by the tissues in drawing nutritive matter from the blood must exercise a considerable power in drawing the blood onwards. We observe this in plants and animals which have no hearts or contractile vessels to propel the nutritive fluid, and we see it strongly manifested where, in consequence of increased local growth, the blood increases in a part, as in the scalp during the annual growth of the stag's horns, in the breast during lactation, in the gums during dentition, and so on. In all such cases the vessels of the part are enlarged and turgid with blood, a phenomenon formerly ascribed vaguely to a "determination of blood to the part," but now known to result from the increased attractive force exercised by the tissues on the blood in places which are the seat of excessive local growth. The same theory serves to explain, as we shall subsequently see, the phenomenon of the morbid process known as inflammation.

The veins arise from the capillaries, and are similar in structure to the arteries, with the exception that the elastic tissue is not so thick. It has been supposed that the forces propelling the blood through the arteries and capillaries are sufficient to cause its return to the heart through the veins, but this is assisted by internal valves and by the respiratory movements of the chest. The former are numerous, and so arranged that the blood can never return towards the capillaries. Every motion of the body and contraction of the muscles through which veins pass must, by compressing them, and thereby squeezing the blood towards the heart, assist its transit. Expiration favours the flow of blood in the arteries, and inspiration favours it in the veins, but does not operate in vessels distant from the thorax, and even in them to no great extent.

It is very difficult to determine the rapidity of the blood in different parts of the circulation. The most satisfactory results have been arrived at from watching the period occupied by poisons in passing from one part of the body to another, as in the experiments of Blake. From them it would appear that a portion of blood can traverse the entire circulation in the horse in half a minute.

The circulation presents peculiarities—1*st*, In different parts of the body; 2*d*, In the fœtus; 3*d*, In various animals, to particularize which here would lead us too far. One of the most important of these peculiarities occurs in the cranium, which being an unyielding osseous case, its contents are pressed upon by the atmosphere from below, like an inverted jar in a pneumatic trough. The result is, that so long as the cranial walls are uninjured, it must always hold the same amount of fluid. Hence the notion, that by general or local bleeding you can draw blood from the brain, is erroneous, although, by weakening the action of the heart, it is of course possible to diminish the pressure it exercises on the cerebral vessels.

2. The changes which the circulating fluid undergoes during its transit through the body are, the conversion of arterial into venous blood in the systemic capillaries, and its re-conversion into arterial blood in the pulmonary capillaries. This leads us to discuss in the next place the function of

Respiration.—This is carried on by means of lungs, the structure of which organs is so arranged as to expose a large surface, covered with capillary blood-vessels, to the action of the atmosphere. The dilation of the chest during ordinary inspiration is principally owing to the contraction and descent of the diaphragm muscle. But when a deep breath is taken, the cavity of the chest is further dilated by the intercostal, scaleni, serrati, and other muscles. Expiration ordinarily is owing to the elasticity of the lungs and walls of the chest, aided by the contractions of the abdominal muscles. During forced expiration the *longissimus Dorsi, Sacro lumbales,* and other muscles, cooperate.

The number of respirations which occur in the minute during health are from fourteen to eighteen, but in disease they have been known to be so low as seven, and so high as a hundred. The amount of air inspired also varies; in health ranging from 20 to 25 cubic inches (Coathupe). A man's average breathing capacity is best tested by a forcible expiration, which yields, according to Hutchinson, 225 cubic inches, as measured by the spirometer.

The great change which the atmospheric air undergoes in going into and coming out of the lungs is the removal of a portion of the oxygen and the substitution of a quantity of carbonic acid gas. For a long time it was supposed that the loss of the one was exactly equal to the production of the other, but it is now known that the volume of oxygen which is absorbed is far greater than that of the carbonic acid given off; and hence we must conclude that the former gas serves not only for the oxidation of carbon, but also of hydrogen in the animal organism. If the air be already charged in some degree with carbonic acid gas, the quantity exhaled is much less, a circumstance which strongly points out the necessity of ventilation. It is not sufficient for health that a room should contain the quantity of air requisite for the respiration of its inhabitants during a given time, since long before its exhaustion it will contain a quantity of carbonic acid sufficient to interfere with the necessary excretion from the blood. Hence the headache and other symptoms often experienced in breathing confined air. The manner in which oxygen is absorbed and carbonic acid given off, seems owing to the physical law described by Professor Graham with respect to diffusion of gases; and the quantity of the former which enters will be much greater than that of the latter, which passes out in the proportion of 1174 to 1000. The one-sixth of oxygen which thus enters the body, and is not converted into carbonic acid, is supposed to combine with hydrogen, furnished by the food and by the disintegration of the tissues, to produce water. Part of the water so formed is again exhaled in the form of vapour from the lungs, whilst another part is used in oxidizing the sulphur and phos-

phorus taken in with the food, and excreted chiefly in the condition of sulphuric and phosphoric acids. The absolute quantity of solid carbon given off by the lungs is about 160 grains per hour, or 8 oz. troy in the twenty-four hours. The amount of watery vapour given off varies from 6 to 27 oz., according to the nature of the diet, amount of exercise, temperature, humidity of the atmosphere, &c., &c. As regards the effects of respiration on the blood, the most striking is the change of colour of the claret-like venous into the bright scarlet of arterial blood. The temperature of arterial blood is one or two degrees higher than venous blood. (Davy.) The specific gravity and number of corpuscles also are said to be somewhat greater, and it contains a larger amount of oxygen and less carbonic acid.

Numerous chemical theories have been advanced to explain the manner in which oxygen is removed from the inspired air, and a quantity of carbonic acid gas added to expired air. To describe and criticise them in this article would be impossible with the limits prescribed us. Besides, whether the oxygen, after forming an acid, unites with the alkalies, whether it attaches itself to the corpuscles or to the fibrin, or unites with phosphorus and fatty matter, are points not yet finally determined.

If respiration be embarrassed or difficult, it constitutes *dyspnœa*; if arrested, from exclusion of atmospheric air, *asphyxia* is produced. As a general rule, if the air be cut off from the lungs of a warm-blooded animal by strangulation or immersion in water, all external muscular movements will cease in a period varying from three to five minutes, and the circulation comes to a stop in two minutes. Some individuals, by force of habit, seem to have acquired the power of retaining their consciousness for a considerable time under water, as in the divers of Ceylon, some of whom have been known to remain immersed and actively picking up oysters from three to five minutes. This period, under ordinary circumstances, is sufficient to induce death, for few persons recover who have been under water four minutes. Exceptional instances indeed are on record where persons have revived after a submersion of half an hour. It is supposed, however, that in these a state of syncope was occasioned at the moment of immersion, from fear, mental emotion, or concussion of the brain, so that in them respiration did not exist in its full activity. To restore asphyxiated persons no time should be lost. The individual should be immediately placed on the abdomen, with one of the arms below the forehead, to prevent the possibility of the nose and mouth being compressed by the ground. The body should then be alternately rolled on the side, and again placed on the abdomen, so as to imitate the compression and expansion of the chest in respiration. The extremities should be assiduously rubbed, especially pressing upwards, and warmth applied.

STAGE III.—*Passage of Fluid from the Blood to be transformed into the Tissues.*

We have now seen how nutritive matter enters the body, and the changes it undergoes to be transformed into blood. We have also seen how the blood is carried to all parts of the organism. We have next to trace how that organism is built up and maintained by substances derived from that blood.

We have previously shown that the tissues have a vital property of attraction and selection, whereby the necessary materials are drawn through the delicate membranous walls of the capillaries, and transformed chemically and structurally into the textures. We are forced to adopt this theory, for it can easily be shown that all the tissues depend on one fluid, the blood, for their nourishment; whilst it is also clear that this same fluid in different tissues and organs gives rise to different chemical and structural results. In this manner an animal is maintained for a series of years with the same physical characters, the different proportions between the supply and loss causing the rapid growth of the young, the stationary period of adult life, and the decline of age. Of the ultimate causes of the different variations in growth we know nothing. All that science can accomplish is to obtain a knowledge of the conditions on which it depends. Some of these we have spoken of when describing the cell theory, but there are four others to which we shall allude in this place.

1. *A healthy quality of the blood* is necessary for a healthy formation of texture, and this implies that all the processes of nutrition should be properly performed, including digestion, assimilation, respiration, secretion, excretion, and so on. Any one of these being disturbed, growth of the body, in whole or in part, may be faulty from want of appropriate material. The blood, however, enjoys to a certain extent the power of spontaneously correcting its own deteriorations, and if these be not excessive or too long continued, it rapidly separates, or gets rid of them by means of some apparatus, and its normal characters are restored. We are continually meeting with these occurrences during our observation of disease; and in this way we account for and see the use of occasional diaphoresis, diarrhœa, epistaxis, loaded urine, and so on. It is also possible that the excretion of one substance is more or less connected with the formation of another, as in the instances of what Mr Paget calls *complemental* nutrition, of which the growth of the beard in man, and of the mammæ in females at the period of puberty, are illustrations.

2. *A proper quantity of blood in a part* is also essential for growth, as is proved by the effects of those occurrences which, by destroying or injuring the principal vessel leading to it, causes its wasting or death. It is also observable that whenever parts are actively growing, they attract more blood to them than usual, showing that there is an intimate relation between activity of formation and the quantity of blood in the textures.

3. *A certain influence of the nervous system* is so blended and mingled with nutrition of parts in the higher animals that the improvement of the one materially interferes with the advancement of the other. Thus there is scarcely an organ in the body the functions of which may not be more or less deranged by various conditions of the mind. Hope and confidence are highly favourable to the resolution of numerous diseases; while fear and a foreboding of evil seldom fail to aggravate the most simple maladies, and in dangerous ones often render them fatal. Destruction of a nerve leading to a part, not only may cause wasting of the tissue, but often ulceration and destruction of it. The same occurs when disease attacks the spinal cord.

4. *A healthy state of the part to be nourished* is as necessary for growth as the other conditions mentioned. If the property of attracting and selecting materials from the blood be inherent in the textures themselves, as we have seen is probable, it follows that, if these textures be seriously altered or destroyed, the property will also be altered or destroyed. Now, this is what really takes place, and hence why so many diseases of texture, once occasioned, are kept up in spite of all the interference of art. Such is the reason, also, that blows and other injuries, by exciting or diminishing the vital properties of the textures, give rise to what are called inflammations, tumours, and other forms of so-called morbid growths.

Such are the conditions which serve to regulate growth in the animal economy. The process may be in excess or diminution, constituting what is called *hypertrophy* and *atrophy*. There is one modification of growth, however, which we must refer to especially, and which has long been known under the name of *secretion.*

Secretion.—This process was for a long time considered as one opposed to growth; that is, as a function having for its object to separate matters from, while growth was directed to storing up or adding them to, the organism. We now know that secretion is simply a form of growth, and is carried on under the influence of the same laws which regulate the development, maturation, and decline of nucleated cells in general, and of the conditions just referred to in particular. Under the head of "Cell Tissues" we have alluded to the peculiar properties of secreting cells. They are generally formed on one side of a basement membrane, while on the other side blood-vessels are distributed, from which their contents are derived. The variations in glands simply result from the convolutions and greater or less complexity of these universal gland elements. No relation apparently exists between the structure of the glandular apparatus, or the nerves supplying it, and the secretion it pours forth. Thus the pancreas, the lacrymal and mammary glands, are very much alike in their anatomical elements, although the pancreatic and lacrymal fluids and milk are widely different. This fact is sufficient to convince us that a property of a peculiar kind, essentially vital, must reside in the cells themselves, which occasions these results.

STAGE IV.—*Disappearance of the Transformed Tissues, and their Re-absorption into the Blood.*

While, on the one hand, matters are always passing from the blood to build up the tissues, on the other, matters are continually passing into the blood from those tissues which have fulfilled their appointed functions. The new material takes exactly the place and form of the old; so that the general configuration of the body is preserved, while continually and imperceptibly undergoing a change. Although in adult animals we cannot see the tissues forming, in the embryo we can, and are consequently enabled to infer the steps of the process. But we cannot see the healthy tissues disintegrating and absorbing, even in the embryo; and this source of information is therefore cut off from us. Almost all that we know of this process, from actual observation, is derived from the study of morbid anatomy. From this we learn that new formations, such as pus and cancer cells, break down and are reduced to a fluid state in the inverse order to that in which they were developed. Thus a fluid exudation is poured out from the vessels. It coagulates in the form of molecules and granules. These unite to form nuclei, around which cell-walls are produced. If this be their ultimate point of development, they are again reduced to the fluid state, first by the solution of the cell-wall, and subsequently by that of the nucleus. The whole now again presents a molecular and granular aspect, whilst the more fluid portions again pass through the walls of the blood-vessels, and enter the circulation. We do not see this process in health, but doubtless particle after particle of solid matter is reduced to fluid, and disappears, in order to give place to new particles, which for a time become solid, assume form, fulfil their function and allotted period of life, and then dissolve, are absorbed and excreted as their predecessors were before them.

Function of the Blood.—The blood, therefore, is a wonderfully complex fluid, partly made up of organic materials derived from the alimentary canal and blood-glands (*primary digestion*), partly derived from organic materials derived from the tissues and gaseous fluids received from the atmosphere through the lungs (*secondary digestion*). The constituents thus obtained from such various sources are modelled and changed during the circulation, so that they may readily pass off by other channels, and so escape from the economy. The stream of blood carries them to the various excretory organs, where they are separated; and thus the vast importance of a continued circulation of fluid is made manifest, not only in carrying materials of growth to build up the frame, but in removing the effete or worn-out particles which have fulfilled their office. In this manner the circulation of the blood may be compared to a river flowing through a populous city, which not only supplies the wants of its inhabitants, but conveys from them all the impurities which, through numerous channels, find their way into its stream. The general properties of this fluid now demand attention.

The blood corpuscles of which we have previously spoken float in a straw-coloured transparent fluid, the *liquor sanguinis*, which, when it ceases to circulate in the vessels, has the property of coagulating. This may be seen under the microscope to take place, in consequence of the deposition of the fibrin held in solution, in the form of molecular fibres, whereby a fibrous mesh-work is produced, entangling the corpuscles. The clot of the blood, therefore, is composed of the fibrin and corpuscles, while the serum is set free. When the blood coagulates slowly, or is unusually viscous from an increase of its fibrin, the corpuscles sink to the bottom, leaving a colourless layer on the surface of the clot, which was formerly supposed erroneously to be a distinctive sign of inflammation. In addition to fibrin, the *liquor sanguinis* holds in solution albumen, fat, and salts, and all those substances which are necessary, directly or indirectly, for the formation of the tissues and secretions. It may be regarded as the most elaborated portion of the blood, inasmuch as the corpuscles are dissolved in it; and, as previously stated, it receives the results both of the primary and secondary digestions. So prepared, it is the essential material or nourishing fluid, which, attracted through the capillaries by the tissues, is the foundation for all the formative processes of the economy.

Chemical Composition of the Blood.—The chemical constitution of the blood has been investigated by numerous distinguished chemists. We give the results arrived at, from a large number of data, by Becquerel and Rodier:—

Table, showing the Maxima, Minima, and Average Numbers of the Different Constituents in 1000 *parts of the Blood of Man:—*

	Mean.	Maxima.	Minima.
Density of defibrinated blood	1060 2	1062 0	1058·0
Density of serum	1028·0	1030·0	1027·0
Water	779·0	800·0	760·0
Blood corpuscles	141·1	152·0	131·0
Albumen	69·4	73·0	62·0
Fibrin	2·2	3 5	1·5
Extractive matters and free salts	6·8	8·0	5 0
Fatty matters	1·600	3·255	1·000
Serolin	·020	·080	impond.
Phosphorized fat	·488	1·000	·270
Cholesterin	·088	·175	·030
Saponified fat	1·004	2·000	·700

From 1000 parts of blood, after calcination, they obtained—

Chloride of sodium	3 1	4·2	2·3
Other soluble salts	2·5	3·2	2·0
Phosphates	·334	·7	·225
Iron	·565	·633	·508

We may say that the chemical composition of the blood in a general way is as follows:—1*st*, The great bulk of the blood is made up of water, varying in a healthy state from 760 to 800 parts in 1000; 2*d*, The fibrin is small in quantity, varying from ½ to 3 parts; 3*d*, The amount of albumen ranges between 60 and 70 parts; 4*th*, The blood corpuscles vary from 130 to 150 parts; 5*th*, The extractive matters and fat range from 1 to 4 parts; and 6*th*, The saline matters range from 5 to 10 parts. These are not the exact proportions, but approximative results which are more easily retained by the mind. The mean amount of this fluid in the human adult male is 34½ lb.; in the female, 26 lb. (Valentin.) These various results differ in diseased conditions of the body, con-

cerning which the following conclusions were formed by Becquerel and Rodier:—1*st*, That the simple fact of the development of a disease almost always modifies in a notable manner the composition of that fluid. 2*d*, That venesection exercises a remarkable influence on the composition of the blood; the more marked, the oftener it is repeated. Under these circumstances, the blood is impoverished and rendered more watery; the albumen is slightly diminished; the fibrin, extractive matters, and free salts are not influenced, but there is a decided diminution of the corpuscles. 3*d*, That in a plethoric condition of the system there is no relative increase in the number of the corpuscles, or in fact in any other change in the composition of the blood; it is simply the mass of the blood that is increased. 4*th*, That anæmia is characterized by a diminution in the amount of the corpuscles. 5*th*, That inflammation induces an increase of the fibrin and of the cholesterine; the former varying from 4 to 10, and the latter being almost doubled. The albumen is diminished. 6*th*, That the amount of fibrin is diminished, and possibly its physical conditions altered, under two conditions. The first embraces fevers, exanthematous diseases, and intoxication; the second, starvation and *purpura hæmorrhagica*. 7*th*, That when any of the secretions are checked, their essential principles are contained in the blood in excess. For instance, when secretion of the urine is suppressed, urea is found in the blood; when the bile is not excreted, it abounds in the blood, &c. And, 8*th*, That there are three diseases in which the albumen of the blood is notably diminished,—viz., in Bright's disease, in certain affections of the heart accompanied by dropsy, and in severe cases of puerperal fever.

Animal Heat.—Many of the processes we have described are accompanied by an exchange of chemical elements, which, in the act of forming new combinations, evolve heat. Thus the union of oxygen with the blood in the lungs, and the formation of carbonic acid gas in the capillaries make up together the amount of animal heat found in the body. The average temperature, as estimated by placing a thermometer in those internal parts which are most easily accessible, is from 98° to 100° Fahrenheit. In children it is about 2° higher. In febrile diseases it has been observed to rise to the height of 108°·5 in children, and to 107° in adults. In Asiatic cholera it may sink to 77°, or even lower, and the breath itself feels cool to the naked hand. The natural temperature of the body, though slightly affected by temperature, food, and exercise, is on the whole pretty stationary; a circumstance which for the most part is owing to the power of evaporation possessed by the skin. Hence the danger of suddenly checking perspiration, in exposing the surface to cold. The temperature of the various tribes of animals differs considerably, birds having a higher, and reptiles and fishes a much lower temperature than mammals, according to the medium they live in. They cannot, however, endure severe changes in external heat and cold. Man alone, by his power over food and the supply of artificial clothing and exercise, is enabled to bear without injury extremes of atmospheric temperature that no other animal could endure.

We have seen that more oxygen is taken in by the lungs than escapes from them in the form of carbonic acid gas. This excess, by uniting in the tissues with the carbon and hydrogen received into the system as food, produces heat; and the carbon in its conversion into carbonic acid, and the hydrogen in its change into water, gives off exactly the same amount of heat as if these processes had been carried on out of the body. Hence the quantity of heat generated bears a direct relation to the activity of respiration and the supply of food. Thus the respiratory process is most active in birds, and they possess the highest animal temperature; and in reptiles, in whom respiration is slow, the heat evolved is much less. Even in man all the circumstances which induce rapid breathing, such as exercise, occasion increased heat. As regards the influence of food, we observe that in northern climes, where the oxygen in the air is more abundant, the quantity of food taken is greater than among the inhabitants of tropical countries. The nature of the food, also, in the one, abounding in fatty and oily substances rich in carbon and hydrogen, is better adapted to combine rapidly with the excess of oxygen than the vegetable and starchy compounds used in others. The effects of alcohol, a highly carbonaceous substance, in keeping up animal heat, is in like manner thus explained; a substance which, rapidly entering the blood, combines with the excess of oxygen, and thus supports the temperature of the body when exhaustion from want of food, or from exercise too long continued, has been occasioned. Thus, in the words of Liebig, to whom we are indebted for establishing this theory of animal heat, "The animal body acts as a furnace, which we supply with fuel. It signifies nothing what intermediate forms food may assume, or what changes it may undergo in the body; the last change is uniformly the conversion of its carbon into carbonic acid, and of its hydrogen into water; the unassimilated nitrogen of the food, along with the unburned or unoxidized carbon, is expelled in the urine or in the solid excrements. In order to keep up in the furnace a constant temperature, we must vary the supply of fuel according to the external temperature, that is, according to the supply of oxygen. Hence, in the animal organism two processes of oxidation are going on; one in the lungs, the other in the capillaries. By means of the former, in spite of the degree of cooling, and of the increased evaporation which takes place there, the constant temperature of the lungs is kept up, while the heat of the rest of the body is supplied by the latter."

Stage V.—*Discharge of Effete Matters from the Body in Various Forms and by Different Channels.*

We have already seen that the textures of the body, while they are continually assimilating new particles of matter from the blood, are constantly giving up to that fluid the particles which have lived and are worn out. These in a fluid form, but more or less chemically changed, constitute the fibrin, and a portion of the fat, extractive matters, and salts which circulate in that fluid. They are the results of the disintegration of the tissues,—that is, of the secondary digestion of organic matter which takes place in the body,—and being useless, are now separated from the economy in the following ways, as—

1. *Excretion from the Lungs.*—A large amount of watery vapour and of carbonic acid are, as we have seen, continually passing off from the lungs. The water thus exhaled daily varies from 6 to 27 oz., and the carbon, in the form of carbonic acid, separated in the same space of time, amounts to 8 oz. troy. In addition, then, to considering the lungs as organs which supply oxygen to the blood, and as supporters of animal heat, they must be regarded as an apparatus of excretion, whereby oxygen, hydrogen, and carbon are continually separated from the body in a given form. Under the heads of Respiration and Animal Heat we have sufficiently dwelt on these points.

2. *Excretion from the Liver.*—Bile, as we have previously seen, is a secretion, but as it is one of those secretions which are produced in order to be excreted, and as the principal function of the liver is the separation from the blood of matters which, if retained, would be injurious to it, we must speak of it in this place.

The blood which supplies the liver is, like that which goes to the lungs, venous, and the portal vein which carries it there originates for the most part from the intestines (diagram, 12). Hence it differs from other blood in more

frequently containing principles derived from the primary digestion, more especially fat, dextrine, and sugar; whilst it does not possess so much fibrin, a substance principally formed from the secondary digestion; so that the clot it forms is deficient in firmness. The food, in traversing the alimentary canal, not only parts with substances which enter the systemic circulation to form blood, but also with portions of its material which enter the blood-vessels, and are at once directed through the portal vein to the liver, in order to form bile. We can easily understand, therefore, how rich eating and little exercise favour the production of those symptoms which are denominated bilious.

When the blood arrives by the portal vein at the liver, it breaks up into a multitude of minute capillaries, which, with a mass of secreting cells filling up the interspaces between them, are arranged in small masses or lobules. The vital property of the cells is to attract and select from the blood materials which they fashion into bile in their interior, and this is subsequently discharged into ducts, and accumulated in a gall-bladder until it joins the food in the duodenum, as previously described. The bile thus formed is a viscous yellow or greenish fluid, and of strong bitter taste, the amount of which formed daily has been estimated at 17 or 24 oz., but varies under a great variety of circumstances. It is composed of water holding salts in solution, with about 80 in 1000 parts of mucus, colouring matter, and fat. The salts are those of soda, potash, and ammonia, in combination with acids, one of which contains sulphur as a constituent. The colouring matter is called *biliphin*, and the fatty matter is composed principally of cholesterine, mingled with a small proportion of fatty acids.

Bile is excreted in two ways. A portion of it, including the colouring matter, passes through the whole alimentary canal. The greater portion, however, is absorbed into the blood, and is ultimately carried off by the respiratory process in the form of carbonic acid. The amount of the excretion in these two ways varies greatly, one being to a certain extent increased if the other be diminished. It is absolutely necessary for the bile to be conducted out of the system, and if, through any obstruction in the duct, it be prevented from being discharged, the bile enters the blood, producing jaundice, and acts as a poison. Although, therefore, the bile is useful as a secretion in operating on the chyme, there can be no doubt that its principal function is that of purifying the blood of hydrogen and carbon, and acting as an excretion.

The liver also secretes a large quantity of free fat, which, accumulating in the cells of the organ, often causes its enlargement, or so-called fatty liver. It has further been shown by Bernard constantly to secrete a substance which, when separated, presents all the physical and chemical properties of hydrated starch. The moment this comes in contact with the blood of the hepatic vein, it is converted into sugar, which in its turn is decomposed by the oxygen of the air in the lungs, and there disappears. If the pulmonary action be insufficient to accomplish this, the sugar becomes in excess in the blood generally, and is excreted by the kidneys, forming the disease known as diabetes. Hence also why a section of the pneumo-gastric nerves, injuring the fourth ventricle of the brain, and occasionally blows on the head, may occasion diabetes. The liver, whether giving off bile, fat, or starch, is thus evidently a great excretor of hydro-carbon, which is converted into water and carbonic acid, and given off by the lungs.

That the lungs and liver are to a certain extent associated for the purpose of a common function, is further shown by the circumstance, that in those cases where the lungs imperfectly separate carbonic acid gas, the action of the liver is particularly apt to be disturbed. Thus, if more non-nitrogenized food be taken than can be got rid of by the lungs in the form of carbonic acid, the liver pours a greater quantity of bile into the duodenum, causing those symptoms known as *bilious*. This is what happens frequently to Europeans in tropical climates. The rarity of the atmosphere, and the little exercise which is taken, throws increased work upon the liver. The appetite is stimulated by drugs and spices, which increase the disturbance, rendering a return to Europe necessary. All such persons, therefore, should carefully adapt a certain diet to the amount of exercise they take and the vigour of the respiration, avoiding carbonaceous, especially oily food, and alcoholic drinks, and living according to the simple habits of the natives.

Excretion from the Kidneys.—The two kidneys contain in their cortical substance globular convolutions of capillary vessels, which hang in the blind extremities of the tubular glands. This arrangement permits the ready passage of a large amount of water from the blood, which, as it flows out through the duct, receives the secretion formed by the cells which line them. The whole accumulates in the urinary bladder in the form of urine, and is expelled from time to time voluntarily (diagram, P and R). The daily amount of urine discharged in a healthy person is about 35 fluid ounces, of a wine-yellow colour, and is slightly acid in its re-action on vegetable colours. Its composition, according to Becquerel, is as follows:—

Water	967·
Urea	14·230
Uric acid	·468
Colouring matter; Mucus and animal extractive matter — inseparable	10·167
Salts: Sulphates (Soda, Potash); Bi-phosphates (Lime, Soda, Magnesia, Ammonia); Chlorides (Sodium, Potassium); Hippurate of soda; Fluate of soda	8·135
Silica	traces
	1000·000

The proportion of these constituents varies greatly, even in health, according to the amount and quality of the food and drink, the occupation, period of life, sex, and other circumstances. In disease the variations are still greater. The quantity, as a whole, may be increased or diminished, and the saline constituents may be so augmented as to be deposited on cooling, causing the formation of various salts. The urine may also be loaded with foreign substances, as blood, albumen, pus, sugar, &c. Hence why a careful examination of this fluid is so important to the physician, as indicating a variety of morbid conditions, not only of the urinary organs themselves, but of the constitution generally.

The kidneys, therefore, separate,—1*st*, A large quantity of the water which enters the body as drink; 2*d*, Certain materials derived from the primary digestion; and, 3*d*, Matters the result of the secondary digestion, or disintegration of the tissues. The principal object of the kidney is to separate two substances rich in nitrogen; so that, while the liver may be considered as an organ excreting hydro-carbon, the kidneys must be regarded as organs which separate nitrogenous substances. The forms these assume are two, viz., urea and uric acid. Of the former, 270 grains, or more than half an ounce, are excreted by a healthy man daily, and of the latter, somewhat more than 8 grains. According to Liebig, when the vital force in the albuminous tissues is no longer able to resist the chemical action of the oxygen which is conveyed to them in the arterial blood, it combines with their elements, and forms products, among which uric acid is the most important. But if sufficient oxygen and water be conveyed into the arterial blood, the greater part of the uric acid, or more insoluble salts, is converted into urea and carbonic acid; so

that the effete nitrogenized elements of the tissues reach the emunctories in a soluble form, a condition necessary for their ready secretion. Hence the more oxygen enters a tissue during its disintegration, the more complete will be the conversion of the insoluble uric acid into the soluble urea, and the more easy its elimination from the body.

In this manner is explained how the urine of the boa-constrictor is semi-solid, consisting almost entirely of bi-urate of ammonia, as the animal eats an enormous meal of nitrogenous food; but being a cold-blooded, slowly-respiring animal, it takes in too little oxygen to convert the uric acid into urea. On the other hand, the lion and the tiger, equally carnivorous with the serpent, are rapidly-respiring, warm-blooded animals; and although, from their violent muscular exertions, rapid and great destruction must occur, scarcely a trace of uric acid is found in their urine, as it is all converted into urea at the moment of its formation, in consequence of the abundant supply of oxygen. The non-nitrogenized elements of our food, however, considerably interfere with the conversion of uric acid into urea, because they also combine with oxygen. Hence, according to Liebig, man, being an omnivorous animal, partakes of a sufficient amount of food rich in carbon to prevent the complete conversion of insoluble uric acid into soluble urea; consequently, the former substance appears in the urine, its proportion to urea being as 1 to 32.

In addition to urea and uric acid, which are the excretory products of the nitrogenous compounds, the kidney is continually separating from the blood a large quantity of earthy salts. These are separated daily, to the amount of 138 grains, and they consist of combinations of chlorine, sulphuric, and phosphoric acids, with soda, lime, magnesia, and potass. Of these, the phosphatic salts are by far the most important. It has been calculated that about 6¼ grains of phosphoric acid are thrown off by the kidneys in twenty-four hours, which are united to the four bases,—soda, ammonia, lime, and magnesia,—forming two double and one simple salt,—viz., the ammoniaco-phosphate of soda; the ammoniaco-magnesian, or triple phosphate; and the phosphate of lime.

Both the organic and mineral products may undergo excess or diminution, resulting from derangements in the primary or secondary digestive processes. Excess of uric acid in the blood may arise in two ways, constituting a tendency to gout or rheumatism,—the first from indulgence in eating, the second from hard labour and wasting of the tissues. Or the mineral salts may form in abundance from eating substances they contain; or from disintegration of the textures, the result of severe study; or, as occurs in old age, from their natural decay.

Excretion from the Skin.—The skin not only serves as a most efficient protective covering to the body, but is a most important organ, constantly excreting watery and fatty matters. The epidermis, hair, and various appendages which are constantly growing from the surface, may, in addition to the special purposes they are fitted for, also be regarded as excretory.

The water separated from the blood by tubular glands—the so-called sudoriparous or sweat glands—is for the most part carried off from the surface in the form of vapour as fast as it is separated. When, from increased exertion or other cause, the perspiration is augmented in quantity, or when, from a greater degree of moisture in the atmosphere, it is not readily evaporated, it becomes visible in the form of minute drops, which distil from the surface. The fluid consists principally of water, holding in solution a small quantity of the salts of soda, potash, and lime, with a trace of oxide of iron. The amount given off daily varies greatly—the maximum, according to Séguin, being 5 lb., and the minimum, 1 lb. 11 oz. 4 dr. The average quantity, according to Valentin, is 2¼ lb. There is an intimate relation between the functions of the skin and those of the lungs and kidneys,—the one being more active when the other is depressed. Animals, on being covered with an impermeable varnish die, with all the symptoms of asphyxia, while the temperature of the body rapidly sinks 36 degrees. Again, skin diseases, and especially febrile eruptions, materially affect the kidney, and thereby give rise to secondary dropsies.

An oily fluid is constantly poured out on the skin from another series of follicular or sebaceous glands, preventing it from being dried and cracked by the action of the sun and air. Hence it is more abundant in the races which inhabit warm climates. In these, and many of the lower animals, the sebaceous matter possesses a distinctive odour, whereby they can readily be traced by quick-scented dogs. Generally speaking, the oily matter excreted from the skin is conveyed directly to the hairs or other epidermic appendages in those parts of the surface which are supplied by them.

The hair and nails grow from the base of a follicle or gland, and are developed from the cells formed in the base of such follicle so as to form a fibrous structure. A hair, if allowed to grow, tapers towards a point, and then splits up like a painter's brush, becomes brittle, and breaks off. There can be no doubt that the oily or sebaceous matter which Nature has provided to lubricate such structures keeps them soft, and prevents their breaking off too suddenly. The colour of the hair depends upon the presence of pigment secreted within the cells of the follicle. Well-authenticated instances of hair turning white in a short period, from excessive grief or anxiety, are known. According to Vauquelin, this is owing to the secretion of an acid fluid, which percolates the hair, and chemically destroys the colouring matter. In the various classes of animals the epidermic appendages serve the purposes of warmth, of defence, or as aids to the sense of touch; and the modifications they undergo,—as seen in horn, the quills of the porcupine, the feathers of birds, the scales of fishes, the wing-cases and spines of insects, &c.,—embrace a singular variety of form, constituted of the same structure.

The colour of the skin was formerly supposed to exist in a distinct membrane called the *rete mucosum*, situated between the epidermis and chorion. It is now known to depend on the deposition of pigment in the lower cells of the epidermis, or those nearest the blood-vessels, and to be influenced by the general laws which regulate the formation of pigment in the animal and vegetable worlds.

Excretion from the Intestines.—We have seen that the solid nutritive matter received as food daily ought to amount to 30 oz.; of these, 25 oz. are absorbed, and only 5 oz. rejected daily from the intestines. These consist of certain parts of the food which have escaped the digestive process, and of various secretions which have been poured into the alimentary canal during its passage. Among the latter are numerous crystals of triple phosphate, showing that earthy matters are excreted in large quantities by this channel. In the large intestine, and especially in the cæcum, a further chemical change is effected. In the latter situation the peculiar fœcal odour is first produced, owing, it is supposed, to the secretion of an acrid liquid there, causing another kind of digestion.

Such is a general sketch of the function of nutrition, from which we observe, from an extended point of view, that it is a continuous round, which in the natural world may be said to commence with the reception and terminate with the preparation of aliment, vegetable or animal. This is observable not only in the "chemical balance of organic nature," so beautifully described by Dumas, but in the incessant chemical compositions and decompositions, as well as structural formations and disintegrations, which are

peculiar to all vital entities. If so, it must be apparent that our knowledge of the animal economy, and of the diseases to which it is liable, can only be elucidated by investigating the nature of such chemical and structural changes, together with the necessary relations that each one bears to the others, and that it is on such kind of knowledge alone that medicine as a scientific art can ever repose in security.

We can, for instance, now readily understand how derangement in one stage of the nutritive process more or less affects the others. Thus, if alimentary matters are not furnished in sufficient quantity, and of a proper quality, the blood is rendered abnormal, and it necessarily follows that the matters it gives off will be abnormal also, and its subsequent transformations more or less modified. Again, if secretion be checked, the blood is not drained of its effete matter; and if excretion be prevented, the secretions themselves may enter the blood, and act upon it as a poison.

A diseased or morbid state of the blood, therefore, may arise from either of the stages of nutrition we have described being rendered irregular, or otherwise abnormal. In whatever part of the circle interruption takes place, it will, if long continued, affect the whole. Thus, a bad assimilation of food produces through the blood bad secretions and excretions, whilst an accidental arrest of one of the latter reacts through the blood on the assimilating powers. The forms of disease thus arising may be endless; but as regards nutrition, they may all be traced to the following causes:—

1. An improper quantity or quality of the food.
2. Circumstances preventing assimilation or impeding respiration.
3. Altered quantity or quality of nutritive matters passing out of the blood.
4. The accumulation of effete matters in the blood.
5. Obstacles to the excretion of these from the body.

Examples in which each of these causes, separately or combined, have occasioned disease, are of frequent occurrence. It is true that all general diseases are accompanied by certain changes in the blood, but these changes are to be removed, not by operating on that fluid directly, but by obviating or removing those circumstances which have deranged the stage of nutrition primarily affected. For instance, a very intense form of disease may be produced in infants from improper lactation. The remedy is obvious, and we procure a healthy nurse. Ischuria is followed by coma, from the accumulation of urea. We give diuretics to increase the flow of urine, and the symptoms subside. In the one case we furnish the elementary principles necessary for nutrition; in the other, we remove the residue of the process. In both cases the blood is diseased, but its restoration to health is produced by acting on a knowledge of the causes which led to its derangement.

In the same manner we might illustrate the indications for correct practice in the other classes of causes tending to derange the blood, which we have enumerated. Thus, although there be a proper quantity or quality of the food, there may be circumstances which impede its assimilation; for instance, a too great acidity or irritability of the stomach, the use of alcoholic drinks, inflammation or cancer of the organ. It is the discovery and removal of these that constitute the chief indications of the scientific practitioner. Again, the capillary vessels become over-distended with blood, and the exudation of *liquor sanguinis* to an unusual amount takes place, constituting inflammation. How is this to be treated? In the early stage, topical bleeding, if directly applied to the part, may diminish the congestion, and the application of cold will check the amount of exudation. But the exudation having once coagulated outside the vessels, acts as a foreign body, and the treatment must then be directed to furthering the transformations which take place in it, and facilitating the absorption and excretion of effete matter. This is accomplished by the local application of heat and moisture, the internal use of neutral salts to dissolve the increase of fibrin in the blood, and the employment of diuretics and purgatives to assist its excretion by the kidneys or intestines.

The general principle we are anxious to establish from this general sketch of the nutritive functions is—that diseases of nutrition and of the blood are only to be combated by an endeavour to restore the deranged processes to their healthy state, in the order in which they were impaired; that for this purpose, a knowledge of the process of nutrition is a preliminary step to the proper treatment of these affections; that the theory of acting directly on the blood is incorrect; and that an expectant system is as bad as a purely empirical one.

FUNCTION OF INNERVATION.

The function of innervation, like that of nutrition, consists in the performance of various actions, widely different from each other, although associated together. These actions lead to the manifestation of intelligence, sensation, and combined motion, and are dependent on the vitality of complex organs,—viz., the brain, spinal cord, and nerves. But as the connection between these cannot be shown to exhibit such an order of functional sequence as has been made apparent among the nutritive processes, it will be necessary to describe them in a different manner.

General Arrangement of the Nervous System.

To the eye, the nervous system appears to be composed of two structures—the gray or ganglionic, and the white or fibrous. The ganglionic, when examined under high powers, may be seen to be composed of nucleated cells, varying greatly in size and shape, mingled with a greater or less number of nerve-tubes, also varying in calibre. The fibres, as we have previously seen, consist of minute tubes. There are also bundles of gelatinous or flat fibres, the nature of which is much disputed, very common in the olfactory nerve and sympathetic system of nerves. There can be no doubt that some nerve-tubes run into the ganglionic corpuscles, whilst others originate from them. It is also now rendered certain that the same ganglionic cell may receive and give off nerve-tubes, each having distinct properties, the one of conveying the influence of impressions to, and the other of conveying influences from, the nervous centres.

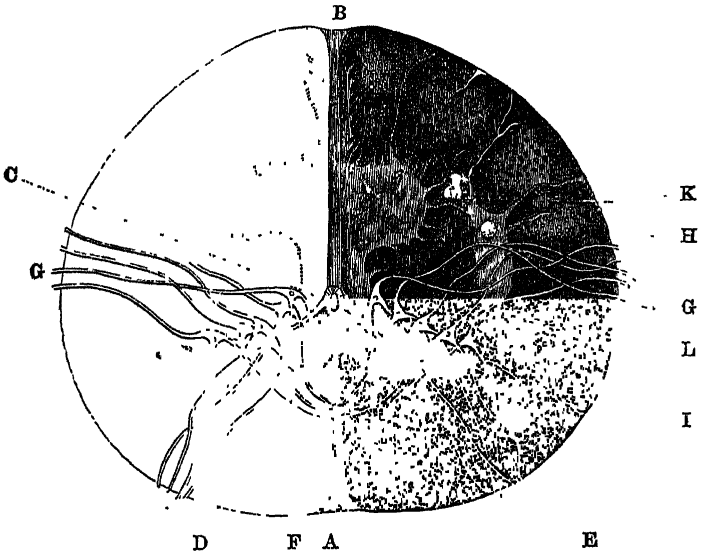
The general arrangement of the two kinds of structures should be known. By cerebrum, or brain proper, ought to be understood that part of the encephalon constituting the cerebral lobes, situated above and outside the *corpus callosum;* by the spinal cord, all the parts situated below this great commissure, consisting of *corpora striata, optic thalami, corpora quadrigemina, cerebellum, pons Varolii, medulla oblongata,* and *medulla spinalis.* In this way, we have a cranial and a vertebral portion of the spinal cord.

In the cerebrum, or brain proper, the ganglionic or corpuscular structure is external to the fibrous or tubular. It presents on the surface numerous anfractuosities, whereby a large quantity of matter is capable of being contained in a small space. This crumpled-up sheet of gray substance has been appropriately called the hemispherical ganglion. (Solly.) In the cranial portion of the spinal cord, the gray matter exists in masses, constituting a chain of ganglia at the base of the encephalon, more or less connected with each other and with the white matter of the brain proper above, and the vertebral portion of the cord below. In this last part of the nervous system the gray matter is internal to the white, and assumes the form of the letter X, having two posterior and two anterior cornua,—an arrangement which allows the latter to be distributed in the form of nerve-tubes to all parts of the frame.

The white tubular structure of the vertebral portion of the cord is divided by the anterior and posterior horns of gray matter, together with the anterior and posterior sulci, into three divisions or columns on each side. On tracing these upwards into the *medulla oblongata*, the anterior and middle ones may be seen to decussate there with each other, whilst the posterior columns do not decussate. On tracing the columns up into the cerebral lobes, we observe that the anterior or pyramidal tracts send off a bundle of fibres, which passes below the olivary body, and is lost in the cerebellum—(*Arciform band* of Solly). The principal portion of the tract passes through the *corpus striatum*, and anterior portion of the optic thalamus, and is ultimately lost in the white substance of the cerebral hemispheres. The middle column, or olivary tract, may be traced through the substance of the optic thalamus and *corpora quadrigemina*, to be in like manner lost in the cerebral hemispheres. The posterior column, or restiform tract, passes almost entirely to the cerebellum.

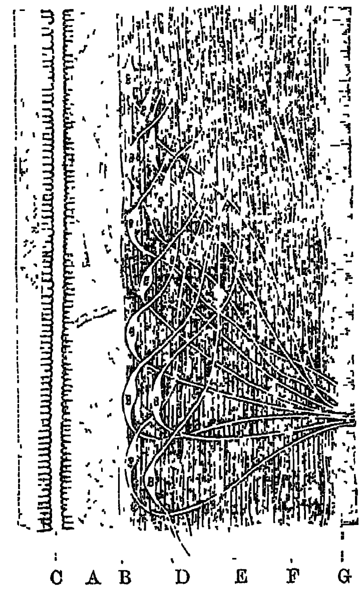
In addition to the diverging fibres in the cerebral hemispheres which may be traced from below upwards, connecting the hemispherical ganglion with the structures below, the brain proper also possesses bands of transverse fibres, constituting the commissures connecting the two hemispheres of the brain together, as well as longitudinal fibres connecting the anterior with the posterior lobes. In the spinal cord it results, from the investigations of Lockhart Clarke, that there is a decussation of various bundles of fibres throughout its whole extent. It is now also determined that many of the fibres in the nerves may be traced directly into the gray substance of the cord—a fact originally stated by Grainger, but confirmed by Budge and Kölliker. Further, it has recently been shown that, by means of these fibres, an anastomosis is kept up between the various columns, even those on both sides of the cord, through the medium of nerve-cells in the gray matter; an important fact, principally demonstrated by the labours of Stilling, Remak, Van der Kolk, Schilling, Kupffer, and Owsjannikow.

These later observations, indeed, open up to us the probability that the numerous actions hitherto called reflex are truly direct, and are carried on by a series of nervous filaments running in different directions, which have yet to be described. There can be no doubt that they pass and operate through the cord; and hence the term *diastaltic* proposed by Marshall Hall instead of reflex, is in every



Transverse section of the Spinal Cord of the Salmo salar, *about two inches from the Brain, magnified* 100 *diameters linear.*

A. Anterior—B. Posterior Groove—C. Central Canal lined with Epithelium—D Areolar Tissue surrounding the central canal, continuous with the anterior and posterior grooves—E. Anterior Root—F. Commissural Fibres—G. Posterior Root—H. Areolar Tissue—I. Vertical Fibres of the white substance cut across in the transverse section—K. Openings of Blood-Vessels cut across—L. Ganglionic Cells.



Longitudinal section of the Spinal Cord of the Salmo salar, *cut obliquely from before inwards, in the course of the fibres of the anterior root.*

A. Blood-vessels filled with Blood Corpuscles—B Areolar Texture—C Central Canal—D. Ganglionic Cells—E. Fibres of the White Substance originating in the cells and going to the brain—F. Fibres of the Anterior Root which pass through the white substance, and pass into the cells—G. Pia Mater.

way more appropriate. The importance of this view appears to us so great, that we refer to the accompanying figures from the Thesis of Owsjannikow,[1] showing the connection of the nerves and ganglionic cells in the spinal cord of the salmon, as indicative of probable similar relations yet to be discovered in man.

General Functions of the Nervous System.

The great difference in structure existing between the gray and white matter of the nervous system would, *à priori*, lead to the supposition that they performed separate functions. The theory at present entertained on this point is, that while the gray matter eliminates or evolves nervous power, the white matter simply conducts to and from this ganglionic structure the influences which are sent or originate there.

The brain proper furnishes the conditions necessary for the manifestation of the intellectual faculties properly so called, of the emotions and passions, of volition, and is essential to sensation. That the evolution of the power especially connected with mind is dependent on the hemispherical ganglion, is rendered probable by the following facts:—1. In the animal kingdom generally, a correspondence is observed between the quantity of gray matter, depth of convolutions, and the sagacity of the animal. 2. At birth, the gray matter of the cerebrum is very defective; so much so, indeed, that the convolutions are, as it were, in the first stage of their formation, being only marked out by superficial fissures almost confined to the surface of the brain. As the cineritious substance increases, the intelligence becomes developed. 3. The results of experiments by Flourens, Rolando, Hertwig, and others, have shown that, on slicing away the brain, the animal becomes more

[1] *Disquisitiones Microscopicæ de Medullæ Spinalis Textura*, 1854.

dull and stupid in proportion to the quantity of cortical substance removed. 4. Clinical observation points out, that in those cases in which the disease has been afterwards found to commence at the circumference of the brain, and proceed towards the centre, the mental faculties are affected *first;* whereas in those diseases which commence at the central parts of the organ, and proceed towards the circumference, they are affected *last.*

The white tubular matter of the brain proper serves, by means of the diverging fibres, to conduct the influences originating in the hemispherical ganglion to the nerves of the head and trunk, whilst they also conduct the influence of impressions made on the trunk, in an inverse manner, up to the cerebral convolutions. The other transverse and longitudinal fibres which connect together the two hemispheres, and various parts of the hemispherical ganglion, are probably subservient to that combination of the mental faculties which characterizes thought.

The spinal cord, both in its cranial and vertebral portions, furnishes the conditions necessary for combined movements; and that the nervous power necessary for this purpose depends upon the gray matter, is rendered probable by the following facts:—1*st,* Its universal connection with all motor nerves. 2*d,* Its increased quantity in those portions of the spinal cord from whence issue large nervous trunks. 3*d,* Its collection in masses at the origin of such nerves in the lower animals as furnish peculiar organs requiring a large quantity of nervous power, as in the *Triglia volitans, Raia torpedo, Silurus,* &c. 4*th,* Clinical observation points out that, in cases where the central portion of the cord is affected previous to the external portion, an individual retains the sensibility of, and power of moving, the limbs, but wants the power to stand, walk, or keep himself erect, when the eyes are shut; whereas, when diseases commence in the meninges of the cord or externally, pain, twitchings, spasms, numbness, or paralysis, are the first symptoms present, dependent on lesion of the white conducting matter.

The white matter of the cord acts as a conductor, in the same manner that it does in the brain proper, and there can be no doubt that the influence arising from impressions is carried not only along the fibres, formerly noticed, which connect the brain and two portions of the spinal cord together, but along those more recently discovered, which decussate or anastomose in the cord itself (Brown-Sequard), and are connected with the ganglionic cells of the gray matter.

The various nerves of the body consist for the most part of nerve-tubes running in parallel lines. Yet some contain ganglionic corpuscles, as the olfactory and the ultimate expansion of the optic and auditory nerves; whilst the sympathetic nerve contains in various places not only ganglia, but gelatinous flat fibres. The posterior roots of the spinal nerves possess a ganglion, the function of which is quite unknown. These roots are connected with the posterior horn of gray matter in the cord, while the anterior roots are connected with the anterior horns. As regards function, the nerves may be considered as—1*st,* Nerves of special sensation, such as the olfactory, optic, auditory, part of the glosso-pharyngeal and lingual branch of the fifth. 2*d,* Nerves of common sensation, such as the greater portion of the fifth, and part of the glosso-pharyngeal. 3*d,* Nerves of motion, such as the third, fourth, lesser division of the fifth, sixth, facial, or *portio dura* of the seventh, and the hypo-glossal. 4*th,* Senso-motory or mixed nerves, such as the pneumo-gastric, third division of the fifth, and the spinal nerves. 5*th,* Sympathetic nerves, including the numerous ganglionic nerves of the head, thorax, and abdomen,—the exact function of which has not yet been fully investigated, although they seem to influence the excito-motory and excito-nutrient acts of the internal viscera and organs of sense.

All nerves are endowed with a peculiar vital property called *sensibility,* inherent in their structure, by virtue of which they may be excited on the application of appropriate stimuli, so as to transmit the influence of the impressions they receive to or from the brain, spinal cord, or certain ganglia, that may be considered as nervous centres. The nerves of special sensation convey *to* their nervous centres the influence of impressions caused by odoriferous bodies, by light, sound, and by sapid substances. The nerves of common sensation convey the influence of impressions *to* their nervous centres, caused by mechanical or chemical substances. The nerves of motion carry *from* the nervous centres the influence of impressions, whether psychical or physical. (Todd.) The mixed nerves carry the influence of stimuli both to and from, combining in themselves the functions of common sensation and of motion. Although the sympathetic nerves also undoubtedly carry the influences of impressions, the direction of these cannot be ascertained, from their numerous anastomoses, as well as from the ganglia scattered over them, all of which act as minute nervous centres. But there *are* cases where certain psychical stimuli (as the emotions) act on organs through these nerves, and where certain diseases (as colic, gallstones, &c.) excite through them sensations of pain.

Sensation may be defined to be *the consciousness of an impression;* and that it may take place, it is necessary,—1*st,* That a stimulus should be applied to a sensitive nerve, which produces an impression; 2*d,* That, in consequence of this impression, a something should be generated, we designate an influence, which influence is conducted along the nerve to the hemispherical ganglion; 3*d,* On arriving there, it calls into action that faculty of the mind called consciousness or perception, and sensation is the result. It follows that sensation may be lost by any circumstance which destroys the sensibility of the nerve to impressions; which impedes the process of conducting the influence generated by these impressions; or, lastly, which renders the mind unconscious of them. Illustrations of how sensation may be affected in all these ways must be familiar to every one, from circumstances influencing the ultimate extremity of a nerve, as on exposing the foot to cold; from injury to the spinal cord, by which the communication with the brain is cut off; or from the mind being inattentive, excited, or suspended.

The independent endowment of nerves is remarkably well illustrated by the fact, that whatever be the stimulus which calls their sensibility into action, the same result is occasioned. Mechanical, chemical, galvanic, or other *physical* stimuli, when applied to the course or the extremities of a nerve, cause the very same results as may originate from suggestive ideas, perverted imagination, or other *psychical* stimuli. Thus a chemical irritant, galvanism, or pricking and pinching a nerve of motion, will cause convulsion or spasms of the muscles to which it is distributed. The same stimuli applied to a nerve of common sensation will cause pain, to the optic nerve flashes of light, to the auditory nerve ringing sounds, and to the tip of the tongue peculiar tastes. Again, we have lately had abundant opportunities of witnessing suggestive ideas, or stimuli originating in the mind, induce peculiar effects on the muscles, give rise to pain or insensibility, and cause perversion of all the special senses. (See "Mono-ideism," in a subsequent section of this article.)

Motion is accomplished through the agency of muscles, which are endowed with a peculiar vital property called contractility, in the same way that nerve is endowed with the property of sensibility. Contractility may be called into action altogether independent of the nerves (Haller), as by stimulating an isolated muscular fasciculus directly. (Weber.) It may also be excited by physical or psychical stimuli, operating through the nerves. *Physical* stimuli

(as pricking, pinching, galvanism, &c.), applied to the extremities or course of a nerve, may cause convulsions of the parts to which the motor filaments are distributed directly, or they may induce combined movements in other parts of the body *diastaltically* (Marshall Hall),—that is, through the spinal cord. In this latter case the following series of actions take place :—1*st*, The influence of the impression is conducted to the spinal cord by the afferent or *esodic* filaments which enter the gray matter. 2*d*, A motor influence is transmitted outwards by one or more efferent or *exodic* nerves. 3*d*, This stimulates the contractility of the muscles to which the latter are distributed, and motion is the result. *Lastly*, Contractility may be called into action by *psychical* stimuli or mental acts,—such as by the will and by certain emotions. Integrity of the muscles alone is necessary for contractile movements; but also of the spinal cord for diastaltic or reflex movements, and of the brain proper for voluntary or emotional movements.

Thus, then, we may consider that the brain acting alone furnishes the conditions necessary for intelligence; the spinal cord acting alone furnishes the conditions essential for the co-operative movements necessary to the vital functions; and the brain and spinal cord acting together furnish the conditions necessary for voluntary motion and sensation.

The following aphorisms will be found useful, in endeavouring to reason correctly on the functions of the nervous system :—

1. The brain proper is that portion of the encephalon situated above the *corpus callosum*.

2. The spinal cord is divided into a cranial and a vertebral portion.

3. The gray matter evolves, and the white conducts, nervous power.

4. *Contractility* is the property peculiar to fibrous texture, whereby it is capable of shortening its fibres. Motion is of three kinds—*contractile*, dependent on muscle; *diastaltic*, dependent on muscle and spinal cord; *voluntary*, dependent on muscle, spinal cord, and brain.

5. *Sensibility* is the property peculiar to nervous texture, whereby it is capable of receiving impressions. *Sensation* is the consciousness of receiving such impressions.

Senso-Motory Electrical Phenomena.—The manner in which the nervous force is generated and conducted along the nerves to distant parts of the body has given rise to the idea that it resembles electricity. But that there is any identity between them is disproved by the following facts:—1. The firm application of a ligature to a nerve stops the propagation of the nervous influence below the point of application, but not of electricity. Indeed, the nervous trunk is as good a conductor of electricity after as it was before the application of the ligature. 2. If a small piece of a nervous trunk be cut out, and replaced by an electric conductor, electricity will still pass along the nerve; but no nervous force, excited by the strongest irritation above the section will be propagated through the conductor to the parts below. 3. A nerve is not so good a conductor of electricity as some other tissues. Matteuci assigns to muscles a conducting power four times greater than that of nerve or cerebral matter; and from the results of some experiments by Dr Todd, with the most delicate instruments, he concludes that both nerve and muscle are infinitely worse conductors than copper. In fact, their power of conduction does not rank above that of water holding in solution a small quantity of saline matter. 4. That in all those animals which undoubtedly evolve electricity, a peculiar apparatus, resembling a series of galvanic piles, is superadded, proving that other conditions are required than those ordinarily existing in the nervous system to produce the electric force. In the present state of science, therefore, facts are opposed to the idea of nervous power being identical with electricity. It is very possible, however, that future observations may prove one to be a modification of the other. It should not be forgotten that it is only lately that the relations have been discovered which exist between electricity, galvanism, and magnetism; and, as Mr Faraday remarks, "If there be reason for supposing that magnetism is a higher relation of force than electricity, so it may well be imagined that the nervous power may be still more of an exalted character, and yet within the reach of experiment."

Dr Todd considers that the change which takes place in nerve during its excitation is analogous to that which occurs in the particles of a piece of soft iron, in virtue of which the iron acquires the properties of a magnet so long as it is maintained in a certain relation to a galvanic current. The magnetic power being instantly communicated when the circuit is completed, and as rapidly removed when it is interrupted, he thus considers that a *state of polarity* of the particles of the nerve stimulated is induced. This polar state, he thinks, may be occasioned in tissues, either muscular or nervous, with which the nerve stimulated may be in organic connection; just as the polar state of the electrical apparatus is capable of being communicated to the piece of soft iron, which thereby acquires the well-known magnetic properties during the continuance of the excited polarity. This analogy may be admitted, although it has in noway been proved that what is here called *nervous polarity* is in any way identical with electrical or magnetic polarity. Some animals, as the glow-worm, fire-fly, and others, generate light, which, like the evolution of electricity, is connected with the presence of a peculiar organ or apparatus. It cannot be maintained that light and nervous influence are the same; and we are therefore compelled to conclude, that the generation both of electricity and light in animals is a vital property special to peculiar organs, which, like other vital properties, though connected with, and influenced by, the nervous system, is altogether distinct from it.

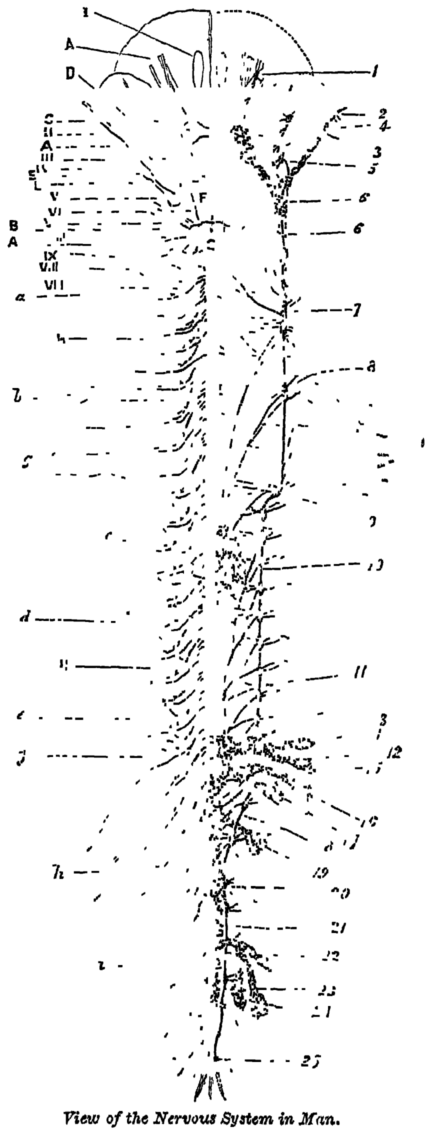
Several fishes, but more especially the genera Torpedo, Gymnotus, and Malapterurus, give out electrical shocks when touched or irritated, which gradually become weaker, and cease altogether from frequent repetition, but return after a certain period of repose. The agent producing these has been proved to be electricity, by being communicable to chains of individuals, by causing chemical decomposition, and a luminous spark on its sudden discharge. It is isolated by non-conductors, deflects the magnetic needle, and communicates magnetic properties to soft iron when transmitted through a coil of wire surrounding it. The discharge of the gymnotus has been estimated to be equal to that of a battery of Leyden jars of 3500 square inches, fully charged. We can have no doubt, therefore, that an animal can generate electricity, and discharge it at will, for the purpose of stupifying or killing other creatures, or as a result of reflex nervous action, whilst its own body is entirely free from the sensitive and motor consequences of the shocks which it produces. The electrical organ in these animals consist of piles of very numerous and closely-set thin membranous plates, among which numerous fine nerves are distributed. Between these plates are small cavities filled with an albuminous fluid, so that the apparatus closely resembles a number of moist galvanic piles or batteries closely aggregated together. This structure, though differently arranged in the various kinds of fish, is richly supplied by motor and sensitive nerves and by blood-vessels. The nerves are distributed on one surface only of the plates, whilst the blood-vessels go to another, on which nucleated cells are distributed. (Pacini.) There is also a special lobe of the brain situated on the *medulla oblongata*, close to the origin of the vagus nerve, which is called the electric lobe. It contains large ganglionic corpuscles from which nerve-tubes arise. When this lobe is destroyed, the power of ge-

nerating electricity is destroyed with it; whereas the whole brain above it may be removed without immediately impairing the function of the batteries. This fact has led some to suppose that the electricity is generated in the brain; but there can be little doubt that it is formed in the batteries, which, however, differ in different animals. Thus, in the torpedo the action resembles that of a thermo-electric pile,—the nerve and vascular surfaces corresponding to the bismuth and copper elements, whilst the nervous influence corresponds with heat. When, therefore, a shock is induced in the torpedo, either voluntarily or by reflex action, the nervous influence sent to one surface of the electrical plate throws the other into an opposite electrical condition, and a current is the consequence. In the gymnotus, on the other hand, the apparatus has been compared to the hollow cylinder of porous clay, which, in a Bunsen's or Grove's galvanic arrangement, separates the negative from the positive elements. (Pacini.)

Although in other animals little electricity seems to be generated, electric currents have been demonstrated in the muscles and in the nerves. Galvani first noticed the fact, that when the exposed muscles of a frog's limb are brought into contact with the sciatic nerve, the muscles are slightly contracted. Nobili found that when the circuit of the nerve and muscles was closed by a galvanometer, a deviation of the needle took place to the extent of 10°, 20°, or 30°, in consequence of a current which passed in the limb from the toes upwards, and which could be increased by inclosing in the circuit several frogs arranged as a battery. Matteuci showed that these currents were independent of the nervous texture; and Du Bois-Reymond that the longitudinal section of a muscle, natural or artificial, is invariably positive to the transverse one. According to him, the muscular substance during life, and in the intervals of contraction, is in a state of electric tension, which is much diminished, or disappears during its action. He succeeded in showing this experimentally in the human subject. The fore-fingers of a muscular individual being dipped in a saline solution, together with the electrodes of the galvanometer, no deflexion of the needle occurs. If all the muscles of one arm be now strongly and continuously contracted, a current is indicated passing from the finger to the shoulder in the contracted arm, and in the opposite direction in the relaxed one. Other experiments showed,—*1st*, That the current varies in different individual muscles, in some running from the head to the foot, in others in the opposite direction; *2d*, That the electro-motor power of a muscle is directly as its length and thickness; and *3d*, That if two muscles are opposed to one another in a circuit, the thicker or the longer overcomes the other. Hence the current in one entire organism represents the superior force of the currents of the stronger muscles. As regards nerve, Matteuci failed in detecting any electrical current in it; but Du Bois-Reymond has done so by employing a very delicate galvanometer. He has determined that the nervous electric current has the same relation to the longitudinal and transverse sections as is observed in muscle, and that in this respect all the nerves are alike. It would also appear from his observations, that when a nerve is completely excited or tetanized by electricity, its usual electromotor power is diminished, or in abeyance, and that a similar loss accompanies intense functional excitement from ordinary agents. No difference as to electrical relations exist between motor and sensory nerves, and in both kinds innervation advances in either direction with equal facility. The muscles, when they are caused to contract in consequence of electricity sent along a nerve, do so only at the opening and closing of the circuit. From these researches it would appear, that in an organized being electrical currents are induced by arrangements of its fluids, textures, and organs, although the physiological importance of these remains to be discovered. It must be clear, however, that such currents are intimately connected with the normal functions of the parts which exhibit them, a circumstance which indicates the advantage of applied electricity in various paralytic and spasmodic diseases. This subject is now being investigated on scientific rather than on empirical grounds, especially by Remak.

Special Functions of the Nervous System.

On proceeding to determine more closely what are the special functions of the individual parts of the nervous system,



View of the Nervous System in Man.

A, A, A. Cerebral Lobes—B. Cerebellum—C Corpus Striatum—D. Optic Thalamus—E. Corpora Quadrigemina—F. Pons Varolii—G. Medulla Oblongata—H, H. Spinal Cord.

Left Side.—*The Cerebro-Spinal System of Nerves.*—I. Olfactory or first pair of Nerves—II. Optic, or second pair of Nerves—III. Motor Nerves of Eyeball, or third pair of Nerves—IV. Pathetic, or fourth pair of Nerves.—V. Trifacial, or fifth pair of Nerves—VI. Abducent, or sixth pair of Nerves—VII. Facial and Auditory, or seventh pair of Nerves—VIII. (1.) Glosso-pharyngeal Nerve—VIII. (2.) Pneumo-gastric Nerve, or Vagus—VIII. (3.) Spinal Accessory Nerve—IX. Hypoglossal, or ninth pair of Nerves—From *a* to *f* Branches of the Vagus: *a*. Superior Laryngeal Nerve; *b*. Inferior Laryngeal Nerve; *c*. Cardiac and Pulmonary branches of the Vagus; *d*. Œsophageal branches of the Vagus; *e*. Gastric branches of the Vagus; *f*. Termination of the Vagus on the right side in the Solar Ganglion.

Right Side.—*The Sympathetic or Ganglionic System of Nerves.*—1 Ophthalmic Ganglion—2. Submaxillary Ganglion—3 Spheno-palatine Ganglion—4. Cavernous Plexus—5. Otic Ganglion—6, 6. Carotid Plexus, surrounding the carotid artery—7. Super-cervical Ganglion—8. Middle Cervical Ganglion—9. Inferior Cervical Ganglion—10. Cardiac and Pulmonary Plexuses—11, 11. Splanchnic Nerves—12. Solar Ganglion—13. Hepatic Plexus—14. Gastric Plexus—15. Splenic Plexus—16 Super-mesenteric Plexus—17. Renal Plexus—18 Aortic Plexus—19 Inferior Mesenteric Plexus—20 Hypogastric Plexus—21. Inferior Hypogastric Plexus—22. Ovarian Plexus—23. Uterine Plexus—24. Vesical Plexus—25. Ganglion Impar.

we should never forget that the various ways in which they have been investigated have led to opposing results, and that such is the excessive difficulty of the inquiry, that we should be especially on our guard against specious hypotheses and unfounded theories. Anatomy, human and comparative, has furnished us with many valuable facts; but it is not easy to determine what are the nervous ganglia or other parts in the lower animals which correspond with what exists in man; whilst erroneous interpretations as to the habits and motions of these creatures are too readily formed. Again, in making experiments on animals, it is often impossible to ascertain how far the shock of the operation, the flow of blood, or the destruction of other parts may vitiate the results. Lastly, an observation of the effects of disease often leaves us in doubt how far the organic mischief extends, and what phenomena may be rightly attributed to it, and what to the congestion of the blood-vessels which accompany it. This last, however, is by far the most important means of research open to us; and if to the result of pathological observation, a similar one is obtained from well-performed experiments, our views derived from either will be confirmed. If to this, anatomy reveals such connections as will warrant and bear out such conclusions, we may consider that every proof is given which conviction requires. It should be remembered, therefore, that such is the fallacy inherent in each individual method of research that little dependence can be placed upon it, and that at least two of these must be united to give probability to any given theory.

Functions of the Cerebral Lobes.—The cerebral lobes (diagram, A, A, A), as has been previously stated, are undoubtedly concerned in the evolution and manifestation of intellect. This result is supported by every known mode of investigation, which also indicates that the former depends on the cortical, and the latter on the conducting or tubular portion. Further than this we are not warranted in going, for the facts which establish these great conclusions entirely negative all those theories which have been advanced having for their object a localization of the different faculties into which the mind has been arbitrarily divided. When, indeed, we endeavour to analyse these, and separate the reasoning powers from instinctive actions, the difficulty of the inquiry seems at first to be overwhelming. To analyse the intricate combinations of our own minds is a difficult task; but how much more laborious is it to study the variations in the minds of others, and to investigate the habits of the countless tribes of animals with the view of distinguishing which depend on reason, and which on blind instinct! The attempts of metaphysicians in this direction are not satisfactory. According to them, however, the purely mental faculties are,—Consciousness, Perception, Attention, Conception, Abstraction, Association of Ideas, Memory, Imagination, and Judgment or Reasoning. To these may be added the Affections, Desires, Self-love, and the Moral Faculty. (Stewart.)

Gall and Spurzheim have divided mind into thirty-three faculties, to which Mr Combe added two more, making thirty-five in all. These are—1*st*, *Amativeness*; 2*d*, *Philoprogenitiveness*, or love of offspring; 3*d*, *Concentrativeness*, or the power of continuing impressions and ideas; 4*th*, *Adhesiveness*, or the desire to attach ourselves to persons or objects; 5*th*, *Combativeness*, or the inclination to fight and be embroiled in contentions; 6*th*, *Destructiveness*, or the desire of destroying life; 7*th*, *Constructiveness*, or a disposition to apply oneself to the mechanical arts; 8*th*, *Covetousness*, or the desire to covet, to amass, or acquire; 9*th*, *Secretiveness*, to conceal; 10*th*, *Self-Esteem*, or self-love; 11*th*, *Love of Approbation*, or the pleasure we derive from the commendations we receive from others; 12*th*, *Cautiousness*; 13*th*, *Benevolence*, or meekness and gentleness of disposition; 14*th*, *Veneration*, by which we worship the Deity and material objects; 15*th*, *Hope*; 16*th*, *Ideality*, or the poetical disposition; 17*th*, the faculty of *Conscientiousness*, or of justice and equality; 18*th*, *Determinativeness*, or firmness of character or purpose; 19*th*, *Individuality*, or the power we possess of knowing external things; 20*th*, *Form*, by which we take cognisance of the forms of external objects; 21*st*, *Size*, that power which seizes hold of dimensions; 22*d*, *Weight*, that faculty by which we estimate weight, density, resistance, &c.; 23*d*, *Colour*, the faculty of perceiving colours; 24*th*, *Space* or *Locality*, the power of local memory; 25*th*, *Order*, or a love of methodical arrangement; 26*th*, *Time*, or the faculty which enters into speculations on duration; 27*th*, *Number*, or the power of calculation; 28*th*, *Tune*, or the perception of musical tone; 29*th*, *Language*, the faculty by which we learn artificial signs; 30*th*, *Comparison*, by which we recognise differences, analogies, similitudes, &c.; 31*st*, *Causality*, that power which directs our attention to the causes of things; 32*d*, *Wit*, the faculty of jesting, raillery, mocking, &c.; 33*d*, *Imitation*, the power of imitating sounds, gestures, manners, &c. These are the several faculties of mind laid down by Drs Gall and Spurzheim; but to this catalogue Mr Combe has added two others,—34*th*, *Wonder*, or that which relates to the marvellous, supernatural, &c.; and 35*th*, *Eventuality*, or that which takes cognisance of changes, events, and active phenomena.

The objections to this division of the mental faculties are,—1*st*, Its complexity; and, according to the phrenological system, one faculty is considerably influenced by others; so that compound characters may be easily manufactured at will, and thus numerous sources of fallacy thrown open. 2*d*, It is redundant in some faculties, and deficient in others. It is redundant, for instance, in having two organs for Form and Size, for Combativeness and Destructiveness, for Causality and Concentrativeness. Each of these two, if not identical, are, at all events, closely allied. It is deficient in having no such faculties as Memory, Reasoning, and Judgment, which every man is conscious he possesses. But it is said every organ has a power of remembering, reasoning, and judging; so that there are other faculties which govern or attend upon all the thirty-five organs. There are also obvious deficiencies in the propensities or instincts; for mankind not only love, steal, fight, kill, secrete, and build, but run, swim, walk, talk, sing, learn, and so on, which have no place in the phrenological system. Perhaps there is no instinct so strong in man and animals as that of self-preservation, and yet this has no organ ascribed to it by the phrenologists. As a philosophical and metaphysical system of the mental faculties, therefore, the classifications of Stewart and Brown seem to us greatly superior, especially in all the higher properties of the intellect; although, so far as the instincts and passions are concerned, they are, perhaps, inferior.

If our knowledge of what the faculties of the mind really are, and how they should be divided, is so imperfect, it may appear unnecessary to attempt to determine in what part of the brain each is situated. As might be expected, all such efforts have failed. That the brain furnishes the conditions necessary for the evolution and manifestation of mind, we have seen is established; and that the gray matter originates, whilst the white matter conducts, the influences generated, we have also shown to be highly probable. But we have no facts which point out that Memory, Consciousness, Judgment, Reasoning, or similar faculties belong to one part of the cerebral convolutions more than to another. Gall and his followers have localized all the thirty-five faculties into which they have divided the mind. He observed that certain individuals who displayed mental powers, moral feelings, or particular propensities, had a fulness or prominence in a certain part of the anterior, middle, or posterior third of the cranium. By paying attention to the

principal characteristics of remarkable men, and the living habits of animals, he found that this fulness or prominence coincided in a number of cases; and he concluded from this that the function of brain which existed below the prominence was the organ giving rise to the characteristic faculty. He then sought to confirm his theory by anatomy, physiology, and pathology; and he and his disciples have accumulated an immense number of these coincidences, which they believe sufficient to establish the phrenological theory.

But, proceeding on the principles which the phrenologists themselves have laid down, it is easy to show that the exceptions are as numerous as the coincidences; whilst the other modes of inquiry to which we have alluded,—namely, anatomy, the results of experiments on living animals, and the observations of the symptoms of disease as compared with the appearances presented after death,—not only give no support, but are directly opposed to the views of Gall. Thus, some remarkable skulls in the museum of the university of Edinburgh are, on the principles of the phrenologists themselves, entirely opposed to their doctrines. Of these, among many, we would point to the skulls of Burke, Pepé, and Haggart,—the two former remarkable murderers, with Destructiveness small; and the latter a most dexterous thief, with Acquisitiveness small. Anatomy proves that, while the lower vertebrate animals possess the anterior and middle lobes of the brain well developed, which are said to be the seat of the intellectual faculties and moral sentiments, they are deficient in those parts where Love of Offspring, Adhesiveness, Destructiveness, and Combativeness are found,—facts wholly incompatible with the theory of Gall. In the same manner, the great majority of facts derived from physiological and pathological research give no support to phrenology. Although, therefore, this doctrine is unquestionably founded upon a large number of data, it cannot lay claim to a correct localization of the mental faculties in any way superior to other systems, which, like it, have been advanced by ingenious men, excited attention for a season, and ultimately abandoned as inconsistent with the present state of our knowledge. The names of Gall, Spurzheim, and Combe, notwithstanding, ought ever to be registered among those whose labours have greatly contributed to advance our knowledge of the physiology of the brain.

Function of the Cerebellum, Corpora Striata, Optic Thalami, and Corpora Quadrigemina.—These different parts of the encephalon contain masses of ganglionic matter differently arranged, connected with the spinal cord below and the cerebrum above. We have as yet no means of determining with certainty the functions of each ganglion, although it is probable that the cerebellum (diagram, B) is connected with the power of voluntary combined movements, and the *corpora quadrigemina* (diagram, E) with the sense of sight, but not exclusively so; for the *corpus striatum* (diagram, C) is also connected with the one, and the optic thalamus (diagram, D) with the other. The whole, perhaps, may be regarded as uniting together the diastaltic function in connection with the head and face; and hence, as being an extension in another form of the gray matter of the spinal cord into the encephalon.

Function of the Pons Varolii and Medulla Oblongata (Diagram, F, G).—These portions of the encephalon possess the same function as the spinal cord, with the addition of being more essential to life, on account of their being the centres (especially the latter) which furnish the necessary power for maintaining the co-ordinate movements of respiration and deglutition. It is by arresting respiration, and paralysing the functions of the important organs to which the vagi nerves are distributed, that sudden injury to the *medulla oblongata* proves so rapidly fatal.

Function of the Spinal Cord (Diagram, H, H).—This nervous centre receives and gives off the different nerves which go to all parts of the body, and is the organ necessary for combined motions, and conducting the sensitive influences essential to sensation. These influences are now known, principally from the experimental researches of Brown-Sequard, to be conducted through the gray matter by means of nerve-tubes connected with the ganglionic cells. If the influences reach the cerebral convolutions, and excite consciousness, sensation is the result. If the influences originating in these convolutions, by an act of volition, pass outwards to a special series of muscles, voluntary motion is produced. But numerous combined muscular actions may go on independent of volition or sensation, and even when the brain is removed. These depend on influences originating in physical irritations applied to an incident nerve, which are conducted through the spinal cord, and from it by excident nerves to the muscles, the contractility of which is thereby excited. The character of these movements gave rise to the idea that they were connected with sensation, and indicated pain. Thus, decapitated animals may be seen to struggle exactly as they would do were the brain entire. They endeavour to avoid the particular injury, push the irritating instrument away with their paws, and writhe as if in agony; so that it is exceedingly difficult for a spectator to convince himself that they are not suffering, and that such motions are not connected with sensation. But we have previously seen, and the slightest analysis of our own sensations and mental operations will soon convince us, that sensation is the *consciousness* of an impression. If then the same sensitive and motor phenomena are produced independent of brain as when it is present, we must either believe that consciousness resides in the spinal marrow, and that therefore they are connected with sensation, or that it resides in the brain, in which case they must be independent of sensation. The former was the notion of Whytt, Haller, Le Gallois, Prochaska, and others, who connected these spinal movements with a so-called *sensorium commune.* It was Dr Marshall Hall who first clearly separated these functions from cerebral or mental acts, and placed them altogether in the spinal cord. He pointed out that they were independent of mind, and *therefore* not connected with sensation. He classified them by themselves, under the name of reflex, excito-motory, or diastaltic actions; described the laws by which they are governed, and their universal application to the pathology and diagnosis of disease. We have previously seen that all such actions require a centre with incident and excident nerves communicating with it, although the exact relation of these, as explanatory of individual diastaltic movements, has not yet been determined.

As examples of diastaltic or purely spinal motions, may be enumerated,—1*st*, Those constantly going on in the eyelids when any object approaches them, in which case the incident nerve is the palpebral branch of the fifth, and the excident the orbicular branch of the seventh pair of nerves. 2*d*, The closure of the larynx in every act of deglutition, and in every effort to vomit, and as occurs on the contact of a drop of water or a crumb of bread, &c., when the incident nerve is the superior and the excident the inferior laryngeal. 3*d*, The various movements associated in the act of respiration, in which the incident nerves are the sensitive branches of the fifth pair, of the pneumogastric and spinal nerves, while the excident are the spinal accessory and motor portions of the intercostal, diaphragmatic, and lower spinal. 4*th*, The different actions associated in the act of swallowing, including those that occur in the pharynx, œsophagus, and the cardiac orifice of the stomach. The incident nerves are united with the excident in the pharyngeal, œsophageal, and cardiac branches of the pneumo-gastric. 5*th*, Numerous actions connected with the outlets of the body, as in defœcation and expulsion from the urinary and generative organs, in which the

incident and excident nerves are united in the branches of the spinal nerves. *6th*, The movements of the fœtus *in utero*. *7th*, Numerous complex actions, acquired at one period, and performed afterwards automatically, without exercise of mind, such as walking, playing certain pieces of music on various instruments, &c. *8th*, Instinctive actions of various animals, as the flying of migratory birds, building their nests, construction of the honey-comb, &c. *9th*, All the spasmodic and convulsive actions of the body, including vomiting, choking from the presence of a foreign body in the larynx or pharynx, nervous twitching of the limbs, convulsions of parts of the whole body in chorea, hysteria, epilepsy, and rigid spasms of tetanus, &c. &c. In these four last kinds of actions, the sensitive nerves of various parts of the body are the incident, and the motor the excident nerves.

These diastaltic actions, though spinal and independent of mind, may, to a certain extent, be controlled by the will. Thus the sudden contact of hot or cold bodies to the skin, the prick of a pin, &c., if unexpected, will cause starting; but if a resolution be formed not to do so, this effect may be prevented. This influence is exercised over different muscles in different degrees; and it varies in persons from constitutional and unknown causes. Other spinal actions apparently require the co-operation of the mind, such as coughing, sneezing, laughing, sobbing, yawning, and hiccough. In these cases it frequently happens that the most determined effort of the will fails to control them; whilst arresting or withdrawing the attention checks them at once. Hence we have one class of motions purely voluntary, and another partly voluntary and partly spinal, such as coughing, laughing, sneezing, &c., which it is difficult to conceive being produced without a certain mental effort. Then we have a class of motions altogether involuntary, wholly spinal, which may be carried on for a certain time in a decapitated animal.

Functions of the Cerebro-Spinal Nerves.—There are generally enumerated, after Willis, nine cerebral pairs and thirty-one spinal pairs of nerves. (See left side of diagram.) All the so-called cerebral nerves, with the exception of the first pair, which is in truth a ganglion, may be regarded as belonging to the cranial portion of the spinal cord. The first pair of nerves, called the *olfactory*, serve to receive and convey the influences excited by odours on the Schneiderean membrane of the nose, to which it is distributed, direct to the brain, to produce the sensation of smell. The second pair, or *optic* nerves, receive and convey to the brain the influences excited by light, so as to produce the sensation of sight. The third pair of nerves, or the motor nerves of the eyeball, are purely motor, and regulate all the movements of the eyeball, except those which depend on the external rectus and superior oblique muscles. The fourth pair of nerves, or *pathetic*, also called *trochlear*, are purely motor, and govern the movements of the trochlearis, or oblique muscle of the eye. The fifth pair of nerves, called *trifacial* or *trigeminal*, divide into three branches,—two of which are purely sensitive, and the third is senso-motory. The sensitive branches terminate in the face, and communicate sensibility to the skin, various organs of the head, and to the external parts of the organs of special sense. It is also the great exciter nerve of these parts. Its communications also with the ganglia of the sympathetic system render its integrity of the greatest importance to various excito-motory, excito-sensory, and excito-nutrient actions of the head and face. The non-ganglionic branch distributed to the muscles of the jaws is motor, and governs the movements of mastication. The sixth pair of nerves, called *abducent*, are motor, and govern the motions of the external rectus muscle of the eyeball. The seventh pair of nerves are composed of two parts, which are really separate nerves. The hard portion, or *facial nerve*, is motor, and governs the movements of all the muscles of the face. The soft portion, or *auditory nerve*, transmits the influences of sound through the internal ear to the brain, to produce the sensation of hearing. The eighth pair of nerves are divided into three branches,—*1st*, The *glosso-pharyngeal*, distributed to the root of the tongue and pharynx, is a nerve of sensibility, administering to taste and touch in the former situation, while it is the great exciter in the act of deglutition in the latter. The second branch is the *par vagum*, or *pneumo-gastric* nerve, and is distributed to numerous important parts, its branches having different functions. As a whole, it is a motor and sensitive nerve, and contains incident and excident filaments. The pharyngeal and inferior laryngeal branches are wholly motor; its superior laryngeal branch is the sensitive nerve of the larynx, but is mixed with a few motor filaments, which supply the crico-thyroid muscle; the cardiac, pulmonary, œsophageal, and gastric branches are senso-motory. It also forms most important connections with the sympathetic system of nerves; and, like the fifth, is instrumental to numerous excito-motory, excito-secretory, and excito-nutrient functions of the neck, chest, and abdomen. The third branch of the eighth pair, or spinal accessory, is a motor nerve, the external division supplying the external muscles of respiration; the sterno-mastoid and trapezius, and the internal division, adding motor filaments to the vagus. The ninth pair of nerves, or *hypo-glossal*, is the motor nerve of the tongue. There are thirty-one pairs of spinal nerves, all of which are senso-motory,—the posterior ganglionic root being sensory, and the anterior motor. These, united, form a corresponding nerve, containing sensitive and motor filaments necessary for sensation and combined motions, including incident and excident filaments in connection with distinct portions or arcs of the spinal cord as centres of diastaltic movements.

Functions of the Sympathetic Nerves.—This system of nerves has also been called *ganglionic*, *organic*, and *trisplanchnic*. It consists essentially of a number of ganglia containing numerous nerve-cells, communicating by one series of connecting nerve-tubes with each other, and by another series with the cerebro-spinal nerves. (See right side of diagram, p. 672.) The ganglia are arranged, according to their situation, into cephalic, cervical, thoracic, and abdominal; while the connecting filaments forming plexuses have received numerous names in different parts, such as carotid, cardiac, diaphragmatic, supra-renal, hepatic, splenic, superior and inferior mesenteric, &c. &c. The connection between the cerebro-spinal nerves and those of the sympathetic system is indirect through ganglia, which break the conducting power of the nerves or modify it,—probably both. Under ordinary circumstances, no act of volition or of the mind can induce movements in parts supplied by the sympathetic; but under peculiar circumstances, or under the influence of unusual stimuli, movements are induced. Thus the emotions and desires, shame or fear, influence the movements of the heart and the contractile power of the capillaries, which an effort of volition cannot do. Such results are only explicable by the connection of the sympathetic system with nerves coming direct from the brain. Direct irritation of the sympathetic ganglia will also cause movements in the non-voluntary muscular parts receiving filaments from them. In the same way, for the most part, the internal organs and surfaces supplied by these nerves are not endowed with ordinary sensibility, and the mind is unconscious of their action; but occasionally very severe pain is produced from their being the seat of disease, as in certain agonizing pains of the heart (*angina pectoris*), in the intestines (colic), in the stomach, liver, kidneys, &c. &c. Thus, although in health the sympathetic system so diffuses the influences conducted that they are not obedient to or excite mental acts, there is abundant proof that the cerebro-

spinal filaments passing through the ganglia are constantly operating, although insensibly, in subjection to the cerebro-spinal centres. The ganglia, however, not only diffuse the influence of impressions coming from and sent to the cerebral and spinal centres, but they are nervous centres themselves, and especially centres of numerous reflex acts in non-voluntary muscles.

In addition to this excito-motory function of the sympathetic system, there is another of great importance, recently denominated by Dr Campbell of the United States *excito-secretory*. We have previously seen, however, that secretion in glands is only a form of nutrition; and the influence of this system would appear not only to be exerted on glands, but on blood-vessels and nutrition generally. It is therefore also excito-nutrient, and carried on wholly independent of the cerebro-spinal system. Thus it has been shown by Sir B. Brodie that division of the crural and sciatic nerves neither retarded nor impaired wounds and fractures of the inferior extremities; while numerous modern experiments have proved that injury to the large sympathetic ganglia occasion the most destructive effects to the nutrition of the parts which receive nerves from them. The recent experiments of Brown-Sequard and Harley on the supra-renal capsules, have shown that it is difficult to preserve animals if the semilunar or solar ganglion be much injured in the operation; but if this be avoided, animals can live without the supra-renal capsules for a length of time. Again, as illustrative of the general influence of the sympathetic system over nutrition, is the fact that certain fœtuses have been born with well-developed textures, without a brain or spinal cord, in the same manner that many of the lower animals are destitute of these organs.

As local examples of this excito-secretory and excito-nutrient function of the sympathetic system of nerves, may be cited,—1*st*, The effusion of tears from the lacrymal gland on the application of an irritant. In this case the incident nerve is the palpebral branch of the fifth, and the excident or secretory the lacrymal branches from the carotid plexus. 2*d*, The secretion of saliva on irritation of the gums, or exciting the mouth by food and mastication. Here the incident nerves are the buccal branches of the fifth, and the excident or secretory the parotid branches derived from the carotid plexus. 3*d*, Dentition in infants and children give numerous examples of excito-secretory and excito-nutrient actions. Thus, from tender gums, and irritation of the dental branches of the fifth, the eye may become lacrymose and congested; the Schneiderean membrane congested, and its secretion increased; while diarrhœa is one of the most common symptoms. In these cases the excident nerves are derived from the ciliary and Meckel's ganglia, distributed to the conjunctiva and Schneiderean membranes, and through the splanchnic, with the intestines. 4*th*, The process of lactation exhibits the remarkable influence of excitation applied to the sensitive surface of the nipple. This, when grasped and suction made upon it by the infant, not only occasions increased flow of milk, but causes that peculiar feeling of the rush which mothers describe, and which is apparently owing to congestion of the blood-vessels. Keeping up the flow of milk by constant milking long after it is required for suckling, as is constantly done for domestic purposes among our cattle, is an excellent example of the power of exciting such secretions locally. 5*th*, The secretion of starch from the liver, and its ready transformation into sugar, is influenced by irritations of branches of the eighth pair in the lungs, and by direct injury of the pneumo-gastric nerves, through the sympathetic branches of the cœliac and solar plexuses going to the liver. 6*th*, The results of section or destruction of the cervical ganglia by Petit, Dupuy, Bernard, and others, and the effects of galvanism applied to the cut extremities of the ganglionic trunks by Brown-Sequard, exhibit how the former injuries cause redness and increased heat in the neighbouring parts, while the latter cause paleness and coldness. This is accomplished in the last experiment by producing contraction or spasm, and in the first by occasioning enlargement and paralysis of the extreme vessels, and thus influencing nutrition. Further examples may be sought in the influence of excitants on all secretions—in the growth of the fœtus *in utero*, the phenomena resulting from shock after injuries, and in numerous diseases, especially of fever, inflammation, cholera, cutaneous eruptions, &c. &c.

It follows that the great functions of the sympathetic system of nerves are,—1*st*, Excito-motory, thereby regulating the contractions of the non-voluntary muscular fibres; 2*d*, Excito-secretory, whereby the various secretions are governed; 3*d*, Excito-nutrient, operating more especially on the blood-vessels, and thereby regulating the circulation in the capillaries.

It is impossible to review our knowledge of the physiology of the nervous system without recognising three great epochs or eras in discovery, which are inseparably connected with the names of three distinguished men. The first of these epochs is characterized by the establishment of contractility and sensibility as inherent properties of the muscular and nervous tissues. Such was the great work of Haller. The second is indicated by the indication of motor and sensitive columns in the spinal cord, and by the existence of nerves of sensation, of nerves of motion, and of mixed nerves in connection with these columns. Such was the doctrine established by Charles Bell. The third epoch is marked by the separation of numerous combined actions, from sensation, volition, and contractile movements; the demonstration that the spinal cord was their centre, and the fact that it was endowed with a reflex function acting through a series of incident and excident nerves, which were named. Such were the views introduced and successfully maintained by Marshall Hall. Each of these great doctrines has given rise to an astonishing amount of discussion, mingled with no small degree of acrimony. The controversy between Haller and Whytt, on the doctrine of inherent irritability and sensibility may still be considered as one of the most important and famous to be found in the whole history of medicine. Sir Charles Bell's life was embittered by the necessity of combating the claims of Dr Walker, who first conceived the idea of distinct function in the anterior and posterior columns of the spinal cord, and of Magendie, who maintained he had first demonstrated it experimentally. Lastly, Dr Marshall Hall has been accused, first, of having merely given to the sympathetic actions of Whytt a new name; and, secondly, of having borrowed all his ideas from Unzer and Prochaska. It would occupy far too much space to enter into the history of these discussions. The two former have ceased to excite attention; while the merits of Marshall Hall, with regard to the important theory of reflex nervous actions, is now universally acknowledged.

The experiments illustrative of reflex action are in their nature the same as those performed by Le Gallois and Sir Gilbert Blane, and the same results were derived from them as were observed by Flourens, Rolando, Hertwig, and by many others, who found that after removing the brain from animals, they could walk or fly. It is the inference derived from these experiments which we regard as important, and the demonstration that such actions are independent of sensation and volition, and strictly connected with integrity of the spinal cord. Now, this was not clearly stated by Unzer or Prochaska, for whom priority in this matter has been claimed. The latter physiologist, after enumerating the different seats given to the common sensory by his predecessors, all of whom understood by it the seat of sensation, distinctly says,—" The *sensorium com-*

mune, properly so called, seems not improbably to extend through the *medulla oblongata*, the crura of the cerebrum and cerebellum, also part of the *thalami optici*, and the whole of the *medulla spinalis*; in a word, it is co-extensive with the origin of the nerves." It is true, he distinctly says, that reflexions of sensorial impressions may take place either with consciousness or without consciousness, but then he proceeds to confound together convulsions in apoplectics, and other motions truly spinal, with the movements of the heart, stomach, and intestines. Unzer taught that the ganglia reflected motions without going to the *sensorium commune*, and that they were special sensoria.

A careful analysis of the writings of Unzer and Prochaska should be made conjointly with a critical study of the works of Haller, and then we think it will be evident that great confusion has been thrown over the whole subject by the use of the term *sensorium commune*, which, since the days of Willis, has been considered as the seat of sensation. It is easy now, when the subject has been unravelled, and the nature of sensation understood—at all events in its relation to consciousness—to maintain that Prochaska meant something different by *sensorium commune* from what Haller did. We nowhere see any evidence of this; and the proof that so essential a point was not made clear in connection with reflex function is, that all his contemporaries, as well as physiologists since his day, never understood it in this sense until Marshall Hall wrote.

SPECIAL SENSES.

The nature of sensation has already been dwelt upon; and it has been shown to depend essentially on the existence of mind, or the consciousness of impressions made on the sensitive nerves. The impressions which result from the stimuli of odours, sapid bodies, contact of hard or irritating substances, of light and of sound, are different. For the reception of these also, nerves with peculiar endowments are provided; and to these are added a special structure or organ adapted for the purposes of smell, taste, touch, vision, and hearing. Much discussion has taken place as to whether a sixth sense exists, viz., a muscular sense, or a sense of weight. Two masses of matter apparently similar may be undetectable by sight or touch, but when balanced in the hand are at once recognised by their difference in weight. Whether this sensation is dependent on the muscles or joints is doubtful; but that it is distinctive and peculiar, cannot be questioned.

Smell.—The acuteness of scent varies in different animals, and bears a certain relation to the size of the nostrils and turbinated bones, being greater where these are large and extended. Odours which depend on substances suspended in the air, when in an extremely fine state of division, thereby obtain more ready access to the membrane on which the olfactory nerve is distributed. This in animals that live in air is accomplished by the act of inspiration. Hence suspension of respiration prevents the perception of odours; whilst repeated quick inspirations, as in the act of sniffing, renders it more intense and prolonged. It is necessary that the mucous surface covering the expansion of the olfactory nerves should be moderately moist; for if it be too dry on the one hand, or too moist on the other, the sense is impaired or lost. The situation of the sensitive surface high up in the nostrils secures it from the direct contact of air, so as to prevent rapid evaporation and dryness; while the convolutions of the turbinated bones, over which the currents of air pass before reaching the seat of special sense, communicate heat to them, and thus prevent the action of cold. The sense of smell may be exalted, perverted, or lost. It is apparently increased by education, of which the case of James Mitchell is an interesting example. This boy was born blind and deaf, and chiefly depended on smell for keeping up a connection with the external world. He employed it on all occasions, like a domestic dog, in distinguishing persons and things. In some cases smell is exceedingly acute for particular substances, so as to be intolerable and distracting to those who suffer from it. Certain flowers or particular odours have in this way caused fainting or other bodily disorder. In other cases the smell is perverted or diminished, and occasionally is lost, as when the Schneiderean membrane is inflamed, or very rarely from congenital absence of the olfactory nerve.

Taste.—This sense is dependent on the fifth and glosso-pharyngeal nerves,—the former distributed to the two anterior thirds, and the latter to the posterior third of the tongue. This organ is covered over with minute prominences, which, when magnified, present four principal forms, viz.,—*1st*, Simple papillæ; *2d*, Conical or filiform papillæ; *3d*, Fungiform papillæ; and *4th*, Circumvallate or calciform papillæ. It is supposed that the two former are more especially concerned in the sense of touch, with which the tongue is also highly endowed; whilst the two latter, but particularly the last, constitute more especially the apparatus of taste. Sapid bodies pressed against these papillæ give rise to impressions which, when transmitted to the brain, occasion the peculiar sensation. The sense is more acute in some persons than in others; may be rendered more so by education, as is remarkably well observed in wine tasters; and is diminished or lost in febrile or other disorders which alter the condition of the mucous surface of the tongue and mouth.

Touch.—This sense is dependent on the nerves of common sensibility distributed to all parts of the surface. But here also we observe that a distinct structure is necessary for the manifestation of the peculiar property. This consists in the papillæ of the true skin, which are variously modified in different parts of the body, in proportion to the acuteness of the sense. The experiments of Weber and Valentin have shown that the extremity of the third finger and the point of the tongue are the parts most sensitive, as in these places the difference of half a line between the points of a pair of compasses could be distinguished. Next in sensitiveness to these is the mucous surface of the lips, whilst the parts in which touch is least acute are the neck, the middle of the back, and the middle of the arm and thigh. In the papillæ of the fingers and a few other places minute indurated bodies of condensed fibrous tissue have been recently discovered, called the Touch Bodies of Wagner, which have been supposed capable of rendering this sense more acute. They are in immediate relation to a nerve; and the well-known effects of pressing such nerve against a hard body, as in the case of a corn, may well be supposed capable of exalting the sensibility.

Sight.—This sense is dependent on the optic nerve, and a very complex apparatus, consisting, in man,—*1st*, Of external protective parts; *2d*, Of a set of muscles destined to move the organ of vision in various directions; *3d*, Of the expansion of the nerves, and the addition of a ganglionic structure, whereby the rays of light are received, and the influence of the impressions they excite conveyed to the brain; and *4th*, Of an optical apparatus, consisting of transparent media, which refract the rays of light upon the retina. The eyeball itself consists of an external fibrous coat, a middle or vascular coat, an internal or nervous coat, and of contents composed of refractive media. (For a minute description of these anatomical parts, see the article ANATOMY.) All that need be referred to here is the uses,—*1st*, Of the individual parts; and, *2d*, Of the entire organ as subservient to the sense of sight.

1. The external protective parts, composed of the eyebrows, the eyelids, and eyelashes, serve to shade the eye from excess of light, to diffuse over the cornea the sebaceous matter and lacrymal fluid, whereby the surface is

kept ductile and moist; and, lastly, to prevent the access of dust floating in the atmosphere. These different actions are for the most part involuntary, and carried on partly by the cerebro-spinal, and partly by the ganglionic system of nerves performing excito-motory, excito-secretory, and excito-nutrient functions. The watery fluid secreted by the lacrymal gland, and which is diffused over the anterior surface of the eye by the motion of the lids, keeping it moist and translucent, is conducted by two openings in the inner corner of the eye through the lacrymal duct into the nose, from whence it is discharged. 2. The eye-ball has a remarkable amount of mobility, in consequence of six muscles, four straight and two oblique, which act upon it in various ways. They are supplied by the third, fourth, and sixth pairs of motor nerves, and by a sensitive branch of the fifth pair. The object of so many nerves being distributed to them seems to be the correction or prevention of the simultaneous action which would take place in the two eyes if all their muscles were supplied by branches of the same nerve. 3. The optic nerve, on entering the eyeball, is a little compressed, but on reaching the internal surface branches out to form a membrane. On the inside of this membrane, however, are placed several layers of ganglionic cells, and externally, a membrane (Jacob's membrane) composed of minute columns or rods, standing vertical to the retina, and composed of a structureless, transparent substance like glass. The whole retina is transparent, and it is now supposed that the rays of light pass through it backwards, and are reflected by these rods, or Jacob's membrane, forwards to the sensitive branches of the optic nerve, which conveys the influence of the impressions so excited to the brain, to produce the sense of vision. For this purpose, the rods appear to be connected with the filaments of nerve by means of connective fibres. 4. The optical apparatus consists of four lenses of different structures, densities, and curves, filling up the substance of the ball, and forming, with the strong external case, or sclerotica, a perfect achromatic camera obscura. The most anterior of these lenses is the cornea, composed of condensed epidermis resembling horn; and hence its name. The second lens, proceeding backwards, is composed of a watery fluid, or aqueous humour, principally accumulated between the cornea and the iris. The third lens is the crystalline,—one of the most remarkable bodies in nature,—composed of concentric laminæ, like those of an onion, united by serrated or notched surfaces, and increasing in density from the circumference to the centre. The fourth lens, or vitreous humour, is of gelatinous consistence, fills up the large proportion of the ball, and appears to be a watery fluid inclosed within fibrous meshes of the greatest tenuity and fineness. These horny, watery, glassy, and gelatinous lenses, united, fulfil all the conditions optically required to produce achromatism so perfectly as to set the optician's art at defiance. In addition to the lenses, the eyeball is lined by a black opaque membrane, the choroid, to absorb unnecessary rays of light, the entrance of which is further regulated by a moveable aperture in the contractile iris, called the *pupil*, which is operated upon by excito-motory influences, so as to produce its contraction or enlargement.

In regarding the entire eye as an organ of vision, there are various points which deserve consideration. Among these are,—1. The means by which the apparatus is so readily accommodated to various distances. On this subject numerous theories have been advanced, all of which answer the purpose, if the truth of certain data be granted. It has been supposed that the curvature of the cornea is changed; but this has not been demonstrated. It has been imagined that the curvature of the lens is changed; a view which has in recent times again been supported by the observations of Kramer. It has been thought that the lens is drawn forward by a contractile non-voluntary muscle—the ciliary muscle—or is pushed forwards from behind by the turgidity of the ciliary processes. Some have thought that the contractions of the iris have much to do with the focal adaptation of the eye; and others, that it is owing to the pressure on the eyeball of the external muscles which move it. The question is still undecided. 2. The natural power of adaptation is interfered with in myopia, or short-sightedness; in presbyopia, or long-sightedness; and in amblyopia, or a peculiar dimness of vision. The first is owing to too great curvature of the lenses, and is corrected by concave glasses in spectacles; the second is produced by too little curvature of the lenses, and is corrected by convex glasses in spectacles; the third is owing to altered shape or oblique position of the lens, and is corrected by the use of cylindrical glass lenses. 3. Another perversion of vision consists of what is called colour-blindness, or Daltonism. Some persons cannot distinguish colours at all, everything appearing shadowed or light, like an engraving. Others cannot see brown, gray, or neutral tints; whilst a third class confound red, blue, and yellow with green, purple, orange, and brown. Red, blue, and yellow are never confounded with each other; but red and green are most commonly so. This condition may be dependent on some fault in the nerves of vision, possibly in the retina, and more especially in the refractive rods; or it may be owing to some change in the refractive media or lenses. But the theory is not yet determined. 4. All objects refracted on the retina are inverted, and yet we see them in their natural position. To explain this fact, it has been supposed that during infancy this sense, with all the others, undergoes a slow education, and that one so corrects the aberrations of the others that gradually we learn to recognise things as we do. The case of Cheselden, who operated on a young man successfully who had been born blind, in consequence of congenital cataract, contains many facts in favour of this view. 5. The circumstance of our seeing one object, although we receive two images in the two eyes, is explained by the regular action of the muscles of the eyeball. When this is deranged, as in squinting, or from the use of narcotics, we see double. Sometimes only half or a part of an object is seen; a circumstance attributed to paralysis of a portion of the retina, or to some disorder of the brain connected with the terminations in that organ of the optic nerves. 7. The retina, at the point where the optic nerve enters it, is insensible; whereas the foramen of Sömerring, in the direct axis of the eye, perfectly transmits the rays of light. This aperture, however, is not deficient in Jacob's membrane; a circumstance which points out the great importance of that structure as a refracting medium. 8. An impression made on the retina remains a certain time. This is proved by looking at a dazzling light or bright colour, and observing that, on turning away the head suddenly, it continues for a longer or shorter period. 9. Some persons are subject to ocular spectra. Remarkable objects, inanimate or living, may appear before them, and have all the appearance of reality. They always depend on a state of nervous exhaustion, from ill health, depression, or the use of certain drugs, as alcohol, opium, or other narcotic substances.

Hearing.—It is necessary for hearing that certain oscillations in the air, water, or solid bodies should reach the expanded filaments of the auditory nerve, and that the influence of impressions so produced should be conveyed to the brain. This is accomplished through the medium of a very complicated organ or acoustic apparatus, the ear, for a description of which we must refer to the article ANATOMY. The most essential part of the organ is the vestibule, that exists in every class of animals in which an auditory apparatus is to be detected. There also the principal expansion of the auditory nerve takes place, and there it is brought into connection with the vibrations of sound from the exterior. In man, such is the complication of parts super-

added to the vestibule or central ear,—viz., the cochlea and semicircular canals,—that the whole is denominated the *labyrinth*. It consists of chambers and canals hollowed out in the solid part of the temporal bone, containing a fluid, in which various branches of the auditory nerve are ramified, and so arranged that the slightest vibration communicated to the fluid must affect the nerve. In man, sonorous vibrations reach the labyrinth in two ways:—1*st*, Through the external ear; and, 2*d*, Through the bones of the head. The ticking of a watch is heard as distinctly when placed between the teeth as when applied to the ear, and the note of a tuning-fork, when it can be no longer heard by the ear, again gives rise to sound when placed in contact with the teeth. It is by the direct vibration of the bones of the head also that we become cognisant of the sound of our own voices. It has been supposed that the cochlea is that part of the labyrinth more immediately connected with those direct vibrations; whilst the vestibule and semicircular canals is that portion of it which enables the nerve to receive vibrations from without, indirectly, through the air. These latter vibrations, however, are diminished or intensified by means of the external and middle portions of the ear. The former, or auricle, serves to collect the sounds, and convey it through the short channel, or meatus, to the membrane or drum of the ear, which closes it internally. In this passage a number of ceruminous glands pour out a waxy secretion of a bitter taste, which, with the hairs that grow from it, serve as a very sufficient protection from foreign bodies, and especially insects. The *membrana tympani*, or drum of the ear, is connected with one end of a chain of small bones (called the *malleus*, *incus*, and *stapes*), which pass across the middle ear, or cavity of the tympanum; the other being attached to a membrane which closes the oval opening into the cavity of the vestibule. These moveable bones render their membranes tense or lax according to the intensity of the sonorous vibrations impinged upon them. This is accomplished through the agency of minute muscles which contract according to the influences transmitted by a series of excito-motory nerves. Hence this part of the apparatus is admirably adapted to carry the nicest vibrations in such a manner as will enable them best to conduce to the production of impressions on the auditory nerve. The cavity of the tympanum or middle ear is filled with air, which passes through the Eustachian tube. This not only permits the free vibration of the chain of ossicles, but further serves to keep the air of a uniform temperature; a circumstance of the greatest importance to the continuance of good hearing.

There is much similarity between the laws which govern the reception and reflexion of nervous vibrations and of rays of light; and, looking at the means necessary to effect this, there is a close analogy between the ear and the eye as organs of hearing and vision. The intensity of light and of sound are both regulated by muscular parts, independent of the will, operating through a ganglion and excito-motory nerves; the ciliary resembles the cochlear muscle, and the reflecting-rods of Jacob's membrane have their analogue in certain vibratory rods attached to the acoustic nerve where it is expanded on the *lamina spiralis* of the cochlea. But not to carry the comparison further, it may be noticed, that impressions made on the auditory nerve, like those on the retina, remain a certain time, as is shown not only by interrupted vibrations producing continuous musical tones, but by the experiments of Savart, who found that the removal of one or more teeth from toothed wheels when in motion occasioned no appreciable difference of sound.

Voice and Speech.

Voice is a function of the larynx, while speech is performed by the tongue, lips, and cheeks, in conjunction with the larynx. (For the anatomical description of this organ, see the article ANATOMY.) All that need be said here is, that it is composed of a tube made up of cartilages, which are connected together by ligaments, and moved upon one another by muscles. In the interior of the tube is a narrow chink in the shape of the letter V, having the point forwards, formed by two folds of membrane called the *vocal cords*, and which, thrown into vibration by the air rushing from the lungs, gives rise to sound. Different degrees of tensity are given to these cords; and the chink, or *rima*, of the glottis is widened or narrowed by the various muscles of the larynx, and position of the cartilages; points that can only be understood by a careful study of the organ, which, in construction, resembles the mouthpiece of a clarionet or hautboy.

Voice.—Nearly all air-breathing animals possess a voice; in man and a few birds only can it be so modified as to be capable of producing articulation. The vocal cords are caused to vibrate by the currents of air coming from below, and at once lose this power by destruction of the laryngeal nerves, which, by paralysing the muscles that regulate their necessary tensity, prevents their vibration and the production of sound. These vocal cords, therefore, are the essential parts of the organ of voice. Their tensity is varied sometimes by muscular action, and sometimes by the column of air. Thus, to produce low notes they are relaxed, and even wrinkled when at rest, but obtain the necessary degree of stretching by the pressure of the column of air. High notes, on the other hand, are caused by producing great tensity of the cords, and narrowing of the glottis; and intermediate notes, by intermediate degrees of tensity, and narrowing. The quality as well as the compass of the voice varies in different persons. In the male the deepest is the bass, the highest the tenor, and the intermediate the baritone. The corresponding tones in the female are the contralto, the soprano, and the mezzo-soprano. In men, owing to the prominence of the thyroid cartilage, the vocal cords are longer than in the female, as 3 to 2; and his voice in consequence is deeper, and in the musical scale an octave lower. Boys have treble voices, like women; but as manhood approaches, the thyroid cartilage undergoes a change in its form, and while doing so the voice is cracked or broken. Afterwards it becomes manly and deep; so that the highest soprano of a boy may be converted into the deepest bass of the man. Male voices also possess two series of notes,—chest or true notes, and false or falsetto notes. How the latter are produced is unknown. The strength of the voice does not so much depend upon the current of air, as upon the strength and accuracy of the muscular movements regulating the vocal cords. Hence why practice, which gives accuracy and tone to the muscles, is of such importance in the schools of singing.

Speech.—The voice, so modified by the additional action of the tongue, cheeks, and lips, as to signify objects, actions, and the properties of things, constitutes language. Languages vary greatly as to the sounds which enter into them, and hence the difficulty persons who have been educated in one, experience in learning others. Words, however, may be produced by the mouth and fauces alone, without the voice. This is whispering. Hence there may be speech without voice, as there is voice without speech. Vocal language, however, can only be accomplished by the combined use of the laryngeal and oral apparatuses. Articulate sounds are divided into vowels and consonants. Vowels are formed in the larynx, whilst consonants are produced in the air-passages above it. Many of these last, however, cannot be uttered unless the elements of a vowel are pronounced with them consonantly; hence their name. Thus *g* and *k* are formed of the vowels *e* and *a*, modified by the oral aperture. It is by different degrees in the opening and contraction of the mouth and oral canal

that most continuous sounds are formed; others are sudden and momentary, cannot be sustained, and are called explosive sounds, such as *b*, *p*, *d*, and *g*. Hence they are difficult to pronounce well in singing; and this is why the Italian language, in which they are seldom heard, is so much better adapted to songs than English or German. When the laryngeal and oral parts of the organ of speech cannot be combined, some letters, especially the explosive ones, as *t* and *p*, are not consonant with the vowel; and stammering is the result. It is to be corrected by a careful study of the mode of pronouncing the various consonants, constant practice, and avoiding hurry and nervous agitation, which render all muscular action uncertain. Ventriloquism is speaking without giving external evidence of utterance, and keeping the oral aperture immoveable while the attention of the audience is directed as much as possible to the thing or place from which the voice is supposed to come.

SLEEP—DREAMS—SOMNAMBULISM—MONO-IDEISM.

Sleep is that temporary suspension of the cerebral functions which in animals alternates with their exercise for a certain time, which suspension, however, is capable of interruption on the application of stimuli to the sensory nerves. Unless this last condition could be carried out, the individual would labour under coma, syncope, or asphyxia,—states more or less allied to sleep. All action in the living economy produces waste of tissue; and hence the necessity of rest in order that substance may be added. The cerebral functions, especially, are governed by this law, and we are obliged to submit to their suspension for a certain period, which is natural sleep. On awakening, we feel refreshed; greater strength is imparted to the muscles, higher sensibility to the nerves, and greater power to the mind. Sleep is more or less profound according as the body is more or less fatigued, and according to the constitution of the individual; as in some persons it is naturally light, whilst in others it assumes a soporose character. Habit and temperament also exert a strong influence over sleep, some persons falling into or arousing from it at particular hours, independent of all other circumstances. Its invasion may be sudden or gradual. As a general rule the senses and reasoning faculties sleep first, whilst imagination and the lighter ones remain longer awake. We may also awake suddenly; but there is usually an intermediate condition between sleep and waking. It is in these intermediate conditions that the sleep is lightest, and that persons can be aroused with the greatest facility. The amount of sleep required by man varies according to age, temperament, habit, and previous fatigue. In infancy and extreme old age life is almost a continuous sleep. In adults there is no rule, some persons requiring more and some less. The average period spent by mankind in sleep is eight hours in the twenty-four, being one-third of human life.

Dreams.—Not unfrequently while some mental faculties are suspended others are still active, and are busy with numerous ideas, which succeed each other with more or less regularity. This is dreaming. There is an absence of consciousness regarding external things, and a want of control in regulating the current of thought; so that the principle of suggestion—that is, one thought calling up another in a certain sequence—has unlimited governance of the mind. In some rare cases the dreaming thoughts are very consistent and vivid, but generally speaking they are more or less confused or incongruous. Not unfrequently, when seemingly in danger, we are governed by an intense desire to escape from it, while we possess an agonizing consciousness that we have not the slightest power to do so. This is *incubus*, or nightmare. Another curious circumstance is the rapidity with which, when dreaming, trains of thought pass through the mind, the events of years being apparently compressed into moments. The most mentally agitating dreams need not occasion the slightest change of position or muscular movement, although sometimes they produce restlessness, various gestures, or emotional indications. But when the ideas of a dream govern the motions and conversation of an individual, while the memory and other faculties of the mind are still so suspended that on awakening he is quite unaware of what has occurred, the condition is called *somnambulism*.

Somnambulism.—The peculiarity of this state consists in the mind being wholly occupied with one idea or train of thought, to the exclusion of all other considerations. Thus there may be complete insensibility to bodily pain, to loud sounds, flashes of light, or other ordinary stimuli; although whatever is spoken or done in harmony with the subject thought of is heard and appreciated, often with unusual acuteness. We can frequently change the current of the ideas by audibly suggesting others, when all the feelings and emotions in connexion with the new subject are called into action, to the exclusion of those which previously existed. Thus if the attention be strongly fixed on a distant object, impressions made on the skin will not induce sensation; but if the attention be directed to the skin, its sensibility often becomes wonderfully excited, and pain is experienced from the contact of bodies that, under ordinary circumstances, would scarcely be felt. The same rule applies to all the other senses. In the same manner the reasoning power is often increased on a particular point, and a variety of things performed, or movements gone through, that the individual otherwise could never have accomplished. Some men perform all the acts which at the time are suggested to them, or describe the various scenes which in imagination are placed before them. In this way a somnambulist may be made not only to think and converse on any subject, but to go through any kind of action, however ridiculous or even fatiguing. He will place himself under every variety of condition presented to his mind, and perform the appropriate motions, as well as give utterance to the ideas which such conditions would naturally give rise to. Thus he may be made to hunt, swim, fight, appear intoxicated, visit distant cities or lands, &c. None of these acts and ideas are remembered in the ordinary waking condition, although when again thrown into a similar state, they may be taken up and continued. Such a person may be said to have two kinds of memory,—one when awake, and one when dreaming; or, as it has been called by some, a *double consciousness*. Somnambulism may come on involuntarily, at regular or irregular periods, or it may be excited artificially. In either case it may be accompanied by various nervous phenomena, denominated *catalepsy*, *trance*, *ecstacy*, and so on.

Mono-ideism.—Dreaming and the phenomena of somnambulism may be excited in some persons artificially, when the acts of the mind, sensation, and motion may be completely governed by means of suggestive ideas, even although the individual be conscious. This state has been called *monoideism*. (Braid.) The mode of effecting this is to cause a certain number of persons to fix their attention on a small object, as a coin, or submit to have monotonous passes made with the hands before their face. On an average, at least one person in twenty so treated feels in a shorter or longer time, first a mistiness of vision or stiffness in the eyelids, and occasionally deep-drawn sighs, hurried respiration, and signs of general excitement are visible. If now such persons are respectively told in a confident manner that they cannot open their eyes, it will be found that they cannot do so, especially if their attention be more strongly directed to the eyelids by touching or by pointing to them. But on receiving permission, or on being commanded to open them, this is done at once. Such persons may now, as in certain cases of somnambulism, have every kind of motion, sensa-

tion, or mental act produced, governed, or arrested, according to the endless train of suggestive ideas that may be communicated to the individual. Many of the lower animals also appear to be susceptible of being impressed by what strongly arrests their attention, in such a way that they are rendered incapable of voluntary motion, or irresistibly impelled towards the object. Hence the long glittering bodies of serpents, or the glaring eyes of other animals, *fascinate* birds and small quadrupeds, and render them an easy prey to their enemies. Similar effects are produced in individuals who look from heights and precipices, and experience an uncontrollable desire to leap down, although it be to certain destruction.

Like phenomena have occurred in all ages, produced in certain persons by predominant ideas, and variously modified according to the education, politics, or religion of the period. Thus the effects produced on many votaries during their initiation into the ancient mysteries; the ecstacies of the Pythian and other priestesses; the influence of religious enthusiasm; the dancing epidemics of St Vitus or of Tarantism in the middle ages; the hallucinations of the Convulsionaires at the tomb of St Medard, in Paris, &c. &c., are of a like character. Numerous perversions of the nervous functions, identical in their nature with those described, consisting of sensory illusions, muscular convulsions or rigidity, and peculiar trains of thought influencing acts and conversation, may be found in the histories of witchcraft or demonology, in the legends of the saints, the journal of Mr Wesley, and in the accounts given by travellers of the religious camp-meetings in the woods of America. They are perhaps more common now than formerly, and excite even more astonishment among the ignorant; the only difference being, that the same phenomena, which in a dark age were attributed to divination or incantation, now assume the garb of science, and are ascribed to magnetism or electricity.

It is unnecessary to enter into any lengthened argument to refute the numerous hypotheses which ascribe these effects to external influences. There is no series of well-ascertained facts capable of supporting such a doctrine; whereas it would be easy to prove that all the phenomena really occasioned depend on suggestive ideas communicated to the person affected. But while these theories scarcely merit attention, the facts themselves are highly important, and demand the careful consideration of the physiologist and medical practitioner. The effect of mind on the body has from the earliest periods been seized upon by individuals as a ground for veneration or astonishment. In ancient times the heathen priests were the physicians, and the temples were converted into so many dispensaries, at which the sick applied for relief. In Catholic countries, during the middle ages, the offices of priest and physician were frequently united in one person; so that the powerful effects of certain shrines, and the benefits of pilgrimages in cases not admitting of simple cure, met with every encouragement. From what has preceded, it must be allowed that, so far from its being improbable that real cures were so effected, all that we know of the effects of confident promises on the one hand, and belief on the other, render it very likely that many such occurred. The legends of the saints, the history of witchcraft, the journal of Mr Wesley, the accounts of celebrated pilgrimages, and of the virtues of particular shrines, and the writings of religious enthusiasts generally, abound in wonderful cures. Charms, amulets, and relics are stated to have at once banished all kinds of agony, and removed numerous nervous diseases. Many of these are certainly incredible, whilst others are perfectly conceivable. The benefits of the royal touch are confirmed by the observations of Richard Wiseman, and the cures performed by Greatrakes are warranted by Robert Boyle. In all these cases, there can be little doubt that any benefit which did occur may be attributed to a strong belief, on the part of the patient, in the efficacy of the means employed. There can be little doubt that the facts recently ascertained in connection with this subject open up a new field for investigation, not only in physiology and practical medicine, but in what relates to evidence as it is now received in courts of law.

As regards the nature of this condition, it seems analogous to that of sleep or dreaming, in which certain faculties of the mind are active, and may be even stimulated into excessive action, whilst others are suspended. All the phenomena produced are strictly analogous to what medical men are acquainted with in various morbid states; and it must now be considered as well established, that in certain conditions of the nervous system they may be induced at will. This conclusion, however, is something new, for it has but recently been received in physiology or pathology, that a condition of the cerebral functions may be occasioned in apparently healthy persons in which suggestive ideas are capable of producing those phenomena we have described, and which render them, for the time, as irresponsible as monomaniacs. Yet such is really the fact, and once admitted into physiology, must have an important influence on the theory and practice of medicine. Such a condition may probably be accounted for physiologically in the following manner:—

We have previously seen that the cerebral lobes contain white fibres, which run in three directions:—1*st*, Those which pass from below upwards, and connect the hemispherical ganglion with the spinal cord; 2*d*, Those which pass transversely, forming the commissures, and which unite the two hemispheres; and, 3*d*, Those which run from before backwards, uniting the anterior with the posterior lobes on each side. It has also been stated that these fibres are probably subservient to that combination of the mental faculties which characterizes thought. Now all metaphysicians and physiologists are agreed that the mind is composed of various faculties, and that different portions of the nervous mass are necessary for their manifestation. True, it is by no means determined what or how many faculties mind should be divided into; still less is it known which parts of the brain are necessary for the manifestation of each. But let the first proposition be granted, then there is no difficulty in supposing that one or more of these may be paralysed or suspended, whilst others are entire, any more than there is in knowing that sensation may be lost whilst motion remains intact, although the nerve fibres of both run side by side. It may be presumed, then, that certain mental faculties are, as the result of exhausted attention, temporarily paralysed or suspended, whilst others are rendered active in consequence of being stimulated by suggestive ideas; that the psychical stimuli of the former make no impressions on the cerebral conducting fibres, whilst those of the latter are increased in intensity; that the proper balance of the mind is thereby disturbed, and thus the individual for the time being acts and talks as if the predominant idea was a reality. The condition is analogous so far with ordinary somnambulism, certain forms of hypochondriasis, and monomania, but admits of infinite changes, from the nature of the idea suggested.

According to this theory, therefore, we suppose that a psychical stimulus is generated, which, uncontrolled by the other mental operations acting under ordinary circumstances, induces impressions on the peripheral extremities of the cerebral fibres, the influence of which only is conveyed outwards to the muscles moved. In the same manner, the remembrance of sensations can always be called up by the mind; but under ordinary circumstances we know they are *only* remembrances, from the exercise of judgment, comparison, and other mental faculties; but these being exhausted, in the condition under consideration, while

the suggested idea is predominant, leave the individual a believer in its reality.

In this manner we attribute to the faculties of the mind a certain power of correcting the fallacies which each is liable to fall into, in the same way that the illusions of one sense are capable of being detected by the healthy use of the other senses. We further believe that the apparatus necessary for the former operations consists of the nerve-fibres which unite different parts of the hemispherical ganglion, whilst that necessary for the latter are the nerve-fibres connecting together the organs of sense and the ganglia at the base of the encephalon. A healthy and sound mind is characterized by the proper balance of all the mental faculties, in the same manner that a healthy body is dependent on the proper action of all the nerves. There are mental and sensorial illusions, one caused by predominant ideas, and corrected by proper reasoning; the other caused by perversion of one sense, and corrected by the right application of the others. Both these conditions are intimately united, and operate on each other, inasmuch as voluntary and emotional movements and sensation are mental operations.

This theory, if further elaborated, appears to be consistent with all known facts, and capable of explaining them on physiological principles.

FUNCTION OF REPRODUCTION.

The process whereby the countless variety of organisms which constitute the vegetable and animal worlds is perpetuated on the surface of the globe has from the earliest periods attracted the attention of physiologists, naturalists, and philosophers. In recent times, the excellence of the achromatic microscope has enabled us to penetrate much further into the mysteries involved in it, and the whole subject is now one of vast extent. We shall speak of this function as consisting of three stages:—*1st*, The production and discharge of germs; *2d*, Of the fecundation of such germs; *3d*, The changes which follow fecundation.

THE PRODUCTION AND DISCHARGE OF GERMS.

We have seen that at the earliest period of development in all organized beings, without exception, there is formed a molecular blastema which originates a nucleated cell. Up to that point where sexes are manifest, the process of reproduction is identically the same with that of cell growth. The peculiarity of the function of generation in the higher organisms consists in the superaddition to this process of a particular act, whereby the further development of germ-cells is occasioned. There is a special apparatus in animals and in plants,—the ovary,—the function of which is to mature a germ, that from the time of its first formation is capable of becoming the rudiment or embryo of a new being, and which is often separated from its parent in a form altogether dissimilar to that which it is ultimately to assume. This sometimes takes place as a spore, at others as an egg; and hence the terms *sporuliferous* and *oviparous*, as distinguished from *viparous* reproduction. The more heterogeneous a structure becomes,—that is, the more difference is manifested in the structure and properties of its separate parts,—the less title has any one to be regarded as a separate individual, since it cannot maintain an independent existence, nor reproduce the entire structure. When an organism merely consists in a multiplication of similar parts, these parts may separate, and constitute independent existences, as in the Algæ among plants, and in the Polypes and Radiata among animals. This has been called *fissiparous* generation—a mode of reproduction that can never take place in the more highly organized beings. This manner of propagation is identical with that of multiplication by cells alone, with this difference, that at one period groups of cells are aggregated and united together, and afterwards separate.

Germ-cells are constantly forming and ripening in the ovaries of plants and animals, and are separated from them at particular times. In the separation of these oviparous cells, indeed, a tendency to periodicity is manifested. Thus plants flower at certain seasons,—some in spring, others in summer, and a third class in autumn or winter,—with great regularity. Throughout the whole range of animals the same thing is observable. They all present a breeding period, at which time only, ova are fully developed, and capable of being fecundated. The reproductive organs of plants and animals at this time become elevated in temperature. Among plants, this is most appreciable in the Arum tribe, where flowers are collected in great numbers within cases which act as non-conductors. On one occasion, Brogniart observed that in the *Colocasia odora* the temperature had been demonstrated to be 8° above that of the surrounding air. This was increased in the following day to 18°, and during the emission of pollen on the three succeeding days to 20°, after which it began to diminish with the fading of the flower. In animals, the same elevation of temperature has caused agriculturists to denominate this season as the period of heat. It originates in them from excessive congestion in the capillaries of the part, causing great local and more or less general disturbance of the system, the result of an augmented nutrition in the ovaries necessary for the development of the ova. This congestion causes rupture of the vessels and discharge of blood, which in the human female, and in a few of the monkey tribes, causes an external flow, known as the *menstrual fluid*, while the process in them has received the name of *menstruation*. The essential act, however, is not the discharge of a fluid externally, but the formation, ripening, and separation of ova from the ovaries. Multitudes of seeds and of ova are formed in this manner, at regular periods, in plants and animals, which prove abortive, and the history of which is identical with the formation, ripening, and disintegration of simple nucleated cells, which have no power of reproduction.

The manner in which ova are formed in the ovary has been well studied by Martin Barry, who informs us that molecules and granules are deposited in groups among the fibrous stroma of the organ. Around a large granule smaller ones are aggregated, and become surrounded by a membrane,—the *ovisac*,—so as to form a nucleated cell containing granular matter. This granular matter now separates into two portions. The inner forms a membrane that immediately surrounds the yolk, and from its transparent appearance has been called the *zona pellucida*. The outer divides into two layers, one of which, covering the *zona pellucida*, he called the *tunica granulosa;* and the other, which lines the ovisac, the *membrana granulosa*. These two membranes are united together by four bands,—the *retinacula*,—having transparent fluid between them. The whole structure now forms a vesicle, which, from its first describer, De Graaf, has received the name of *Graafian vesicle*, and consists of an outer fibrous and vascular membrane; another inner one,—the ovisac of Barry,—having suspended from it, by the *retinacula*, the ovum, composed of *zona pellucida*, yolk, and germinal vesicle. Graafian vesicles may frequently be seen before puberty in the ovary, but after that period they increase in number, and may be observed in all stages of development scattered through the substance of the organ, those most advanced being near the surface. Towards the end of each menstrual period, such as are ripe burst from the quantity of sanguinolent serum or blood which is poured into them from the external vascular membrane, and the ovum escapes from the surface into the fimbriated extremity of the Fallopian tube, which closes round the ovary, in order to receive it, and through which it is conveyed to the uterus.

The cavity thus left in the ovary is most frequently

filled with coagulated blood, the result of hæmorrhage from the vascular or external layer of the Graafian vesicle, which participates in the congestion of the menstrual period. This coagulum of blood becomes gradually absorbed, in the course of which it changes its colour, and assumes a yellow and puckered appearance. In this state it has been called *corpus luteum*, and it has been supposed to present such peculiar appearances when fecundation has occurred as to warrant medical men in asserting that pregnancy had taken place—a grave error, which modern science has completely exploded. These appearances are described as being,—1*st*, An irregular form in the false, but a regular one in the true *corpus luteum;* 2*d*, An absence of a central cavity lined by a membrane in the false, whilst in the true there are both; 3*d*, Absence of concentric radii in the false, while in the true they are present; 4*th*, The false may be present in both ovaries, while the true only exist in one. All these signs have been shown to be in no way distinctive by numerous recent observations. Thus, in women who have never had children, there have been found *corpora lutea* exactly resembling those supposed to follow pregnancy. In the lower animals, also, four or five *corpora lutea* have been found in the ovaries, resembling each other, although one fœtus only was found in the uterus. It must be manifest that these ideas were the result of the notion that fecundation took place in the ovary, which assuredly it never does. Whether a *corpus luteum* during pregnancy disappears less rapidly than in the unimpregnated state is not known, but such is the only possible difference which can exist in the two states. That it is possible for any physiologist or pathologist to pronounce with certainty between the bodies which do or do not coincide with pregnancy, has been demonstrated in the negative by several remarkable cases which have been raised in the courts of law.

The capability for procreation marks a peculiar period of life, which has been called puberty, on account of the development the pubes then undergoes. In woman, this generally occurs between the thirteenth and sixteenth year, but is earlier in warm climates, and later in cold ones. It has also been observed to be earlier in manufacturing towns than in thinly-peopled districts. Mental and bodily habits exercise an influence; girls accustomed to luxury and indulgence undergoing this change earlier than those reared in hardihood and self-denial. At this time those general and local changes occur which distinguish the adult woman: the mammary glands enlarge; a deposition of fat takes place in the cellular tissue of the skin, which gives to the female form its roundness and fulness; and the menstrual fluid, the most unequivocal sign of puberty, commences to flow. In man, puberty is marked by the low and rough voice—from the size of the larynx and elongation of the vocal cords; by the growth of hair on the chin, upper lips, and cheeks, as well as over the body and limbs; the greater physical power and activity, as compared with the female; the capability of enduring more fatigue; and a larger amount of courage and daring.

FECUNDATION OF GERMS.

The germ-cells, prepared and formed in the ovaries, are discharged from those organs at each menstrual period, and would be excreted from the economy without being further developed, unless they encountered vibratile particles formed in another organ. In phanerogamous plants, the pollen tube enters that of the pistil, and the pollen itself is conveyed to the ovule at its base. The contact of the pulverulent pollen with this ovule fecundates the latter. Of the nature of the stimulus so imparted we know nothing; but the fact is well established in science, that no ovule can furnish productive seeds unless the pollen has had access to it. In all animals in which ova are formed the same thing takes place. Two sets of organs analogous to those in plants are found. In some creatures, as in certain Mollusca, these are also associated in one individual; but in all the vertebrate tribes they exist in different animals, male and female. The former is furnished with organs called the testes, which secrete the spermatic or seminal fluid. This contains minute bodies, possessed of independent motion, which they retain for several days after they have been excreted. In them the fecundating power resides, for it is only when these come in contact with the ova discharged from the ovary of the female that the latter are ever developed into distinct living beings. From this moment that series of changes commences in the ovum whereby an embryo is formed. For this purpose, however, various circumstances are necessary, especially a fitting locality, proper temperature, moisture, &c. Seeds which have been impregnated retain a dormant degree of vitality for many years, and when at length placed in these favourable circumstances, they develop themselves. Generally speaking, instinct guides the lower tribes to deposit their eggs in appropriate localities, and the extraordinary variety of such positions selected by insect tribes, by fishes and reptiles, has furnished a curious subject of observation for the naturalist. In birds, the fecundated ova are hatched by the mother, who elevates them to a proper temperature with the heat of her own body. In mammiferous animals, the young are not born as ova; an organ,—the uterus,—is provided for their reception, where they grow and become developed; and when at length they are capable of supporting an independent existence, they are excreted or parted from the body of the parent by the process of parturition.

The form of the vibratile seminal particle varies in different animals. In mammals generally, it has a round or oval extremity, a so-called head, and a filiform appendage called a tail, and varies in length from the 100th to the 500th of an inch in length. In birds, the thick extremity is more tapering, and the whole is of a spiral form. In certain reptiles and fishes, the filament is much longer, and thickest in the middle, tapering at both extremities, having occasionally a delicate continuation wound spirally round the thicker portion. In some insects and crustacea, they present curious irregular forms, without a filament, and are immoveable. In the vast majority of cases, however, they present active contractile movements. In mammals especially, when watching these under the microscope, it is difficult to divest oneself of the idea that they are animalcules, as they progress through the fluid with the heads forward, propelled by continued vibratile lashings of the tail. The notion put forth by some observers, that they possess internal organs, we have never, after careful research, been able to confirm; and the circumstance that similar structures, with like movements, exist in the reproductive organs of many plants, negatives the idea of their being distinct animalcules.

The mode of fecundation varies in different animals. In some molluscous tribes male and female organs are united in one animal. It is an hermaphrodite, like many plants, and is self-impregnated. In fishes, the female sheds its spawn, and the male, swimming over it, sprinkles the spermatic fluid on the ova, and may be observed at the breeding season to follow her for that purpose. In the higher animals, union of the sexes takes place for the same end. In reptiles, especially in the frog and toad, the male sits on the back of the female, and sheds the semen over the ova immediately after they have left the cloaca. In birds and mammals, it is necessary that the spermatic fluid be deposited in the vagina of the female by the intromission of the penis. From the circumstance that fecundation may take place in fishes and reptiles, as in plants, by simply sprinkling the male element over the female ova, has originated the

modern practice of artificial impregnation. In the same way that horticulturists can multiply varieties, and even fertilize plants with pollen received from a distance; so, by sprinkling the fluid from the milts of male fishes over the innumerable ova which may be squeezed from the roe of the female, they may be fecundated, preserved, and reared in artificial ponds. At this moment, many of the rivers and lakes of France and Scotland are being stored with large accessions of valuable fish so raised, in order to increase the amount of food for the people.

For a long time it was supposed that the mere contact of the vibratile spermatozoids with the ova was all that was sufficient to produce fecundation; but it was first shown by Martin Barry, and has been subsequently confirmed by many other physiologists, that the spermatozoid actually finds its way into the ovum by a minute aperture, and that the male and female elements ultimately blend or melt into one another. This fact may now be considered to be well established, and serves to explain many circumstances long known as to the resemblances which exist in feature and in qualities, mental and bodily, between parents and their offspring. Thus, it has long been a matter of popular observation, that the child in all that relates to the outward form, the gait and manners, takes after the father; while as regards the size, internal qualities, and dispositions, the mother predominates. Not, however, that the male is wholly without influence on the internal organs and vital functions, or the female wholly without influence on the external organs and locomotive powers of their offspring. The law is only general, although it holds very extensively among cattle, as shown by Mr Orton and Dr Harvey. Such facts seem in their turn to be accounted for by the circumstance, that the spermatozoid enters and melts down in the external parts of the yolk of the egg,—that is, in connection with those layers of the germinal membrane which, as we shall subsequently see, form the nervous system and muscles; whereas the glands and internal organs are formed from the mucous layer, which is that part of the membrane furthest removed from the action of the male element.

CHANGES IN THE OVUM WHICH FOLLOW FECUNDATION.

We have seen that ova are formed and discharged from the ovary at regular intervals by the adult female, but that it is only when the spermatozoid enters them that fecundation is produced. At that period the ovum presents the characters of a nucleated cell;—the ovisac, or *zona pellucida*, being the cell-wall; the germinal vesicle being the nucleus; while the fluid between them is opaque and granular, and called the *vitellus*, or yolk. (See figs. 1 and 2.) The size and relative amount of these three parts of each ovum vary in different animals, but they are present in all. There is also generally observed at one part of the germinal vesicle a collection of granules, called the *germinal spot.* (See fig. 2, *a.*) If fecundation does not take place, the ovum degenerates, breaks down, and is ultimately excreted in the mucous discharge from the external passages. But if it encounter the spermatozoids, and one penetrates it, then those changes commence which terminate in the formation of an embryo. These changes have now been followed in numerous animals, and the principal efforts of zoologists are at present directed to the elucidation of the transformations which take place in living beings; so that the whole subject is not only very extensive, but is constantly acquiring new facts. The study of human embryology is incomplete, for, although an ovum has been twice discovered after death in the Fallopian tube of woman, it has never been seen at that period when it enters the uterus. In the dog, rabbit, sheep, and other mammals, however, the various transformations have been very carefully described; and, as it is certain that the same essential mode of development occurs in them as in man, the changes observed in the dog will be selected as a type of what takes place in the impregnated ovum of the higher animals.

Physiology

When the ovum leaves the Graafian vesicle, there is adherent to it externally a greater or less number of the cells which form the granular membrane. On removing these artificially, the ovum presents the appearance represented in fig. 1, when magnified fifty diameters linear. It is composed of a dark, opaque yolk, surrounded by the *zona pellucida*, or vitelline membrane. On cracking this ovum between two glasses, or on tearing it with a needle, the granular yolk flows out, and the germinal vesicle escapes, as in fig. 2, *a*. If such an ovum encounter spermatozoids, the changes subsequently represented take place. One

Fig. 1. Fig. 2. Fig. 3. Fig. 4.

enters the ovum, when both it and the germinal vesicle are dissolved in the yolk,—a circumstance to which the whole structure is indebted for its continuance and for its power of, as well as direction in, development. We next observe that the granular yolk begins to separate into two parts, a process which is accomplished by the spontaneous aggregation of the molecules of which it is composed into two masses instead of one (fig. 3). Each of these two subdivide, producing four (fig. 4); each of these into other two

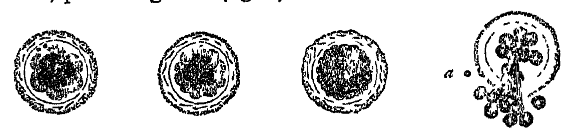


Fig. 5. Fig. 6. Fig. 7. Fig. 8.

(fig. 5); and so on, until at length the whole is reduced into a mass of molecular corpuscles (fig. 7), having a clear space or nucleus in their centres, and subsequently distinct cell-walls (fig. 8). These next arrange themselves in a layer externally, immediately lining the *zona pellucida* so as to form a membrane, which is called the *germinal membrane* (fig. 9). At one part of this it will be observed that the

EXPLANATION OF THE FIGURES.

The mode of development of the embryo is so difficult to understand, that it has been thought right to illustrate this part of the subject copiously by woodcuts, which will serve to indicate better than mere description can do how the various parts and organs successively come into view. They are copied from the accurate plates of Bischoff illustrative of the embryonal development of the dog, but diminished one-half.

Fig. 1.—An Ovum from the bitch freed from the granular membrane, showing the dark internal yolk, and clear external *zona pellucida.* (*Magnified* 50 *diameters.*)

Fig. 2.—The same Ovum lacerated with a needle. The yolk has flowed out, showing the germinal vesicle *a*, with its germinal spot. (50 *diam.*)

Fig. 3.—The Ovum has encountered spermatozoids, which are seen adherent externally to the *zona pellucida.* Fecundation has taken place; the spermatozoid, which has penetrated the transparent zone, together with the germinal vesicle, have been dissolved in the yolk, which is divided into two masses. (50 *diam.*)

Fig. 4.—The Yolk divided into four masses. (50 *diam.*)

Figs. 5 *and* 6.—The process of division in the yolk further illustrated. (50 *diam.*)

Fig. 7.—The Yolk now reduced by division to a large number of molecular cells. (50 *diam.*)

Fig. 8.—The Molecular Cells rendered visible by laceration of the Ovum. They contain a clear space in their centres. (50 *diam.*)

cells and their granular contents are thicker, forming the

Fig 9.

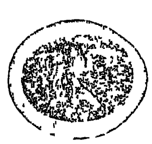


Fig. 10.

germinal area, where the embryo first appears. The ovum has now entered the uterus, and its appearance at this period, magnified ten times, is represented in fig. 10. By cutting or tearing out the portion of the germinal membrane which contains the germinal area, and magnifying it, the subsequent changes it undergoes can be well studied, as in the following figures.

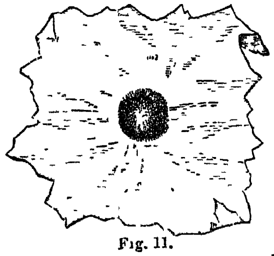


Fig. 11.

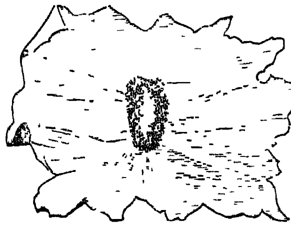


Fig. 12.

The germinal area now enlarges; at first round (fig. 11), it becomes oval (fig.12), and then appears in it a clear space, the *area pellucida*. At the same time, the germinal membrane becomes thicker, and is now easily divisible into two layers,—an upper or outer, called the *serous* or *animal*, and an under or internal, called the *mucous* or *vegetative layer*. The future changes in the embryo may be observed by watching the behaviour of these two layers, and of another that afterwards forms between them in the germinal area. In the centre of the enlarged germinal area there now forms a

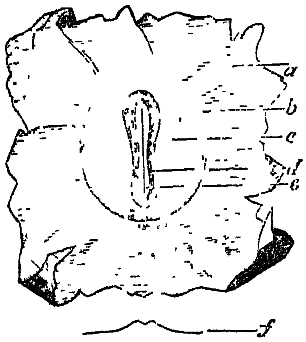


Fig. 13.

groove or channel, the *primitive groove*, by the elevation on each side of the germinal membrane (fig. 13). This enlarges anteriorly, and tapers to a point posteriorly (fig. 14), and ultimately becomes closed by its sides, or *laminæ dorsales*, passing over it and uniting, thus forming the foundation of the cerebro-spinal cavity, and inclosing the *chorda dorsalis*, or embryo brain and spinal cord (figs. 16 and 18). A linear mass of square-shaped cells forms on each side, which is the commencing vertebral column (figs. 14 and 16).

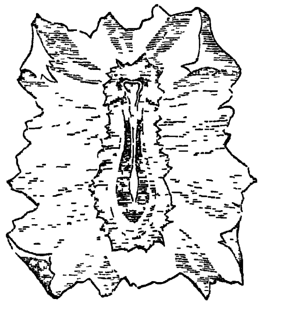


Fig. 14.

Fig 15.

The embryo is now raised prominently upwards above the serous layer (fig. 15), and between it and the mucous layer

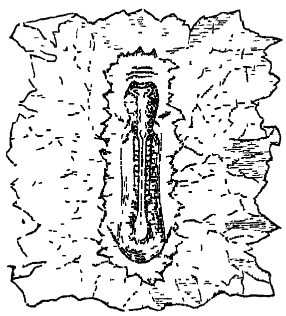


Fig. 16.

Fig. 17.

another mass of cells is formed which constitutes the third or *vascular layer*. Here blood-vessels are developed as a plexus (figs. 16 and 17), which unites itself with the em-

Fig. 9.—An Ovum further developed after it has been placed in water for a short time. In consequence of endosmose, the internal membrane is separated from the *zona pellucida*, and is seen to be formed by the cells which have coalesced. This is the germinal membrane, with the germinal area composed of an extra layer of cells. (50 *diam.*)

Fig. 10.—An Ovum, much larger, taken from the uterus, moistened with water. The germinal membrane is somewhat separated from the *zona pellucida*, and thrown into folds. (10 *diam.*)

Fig. 11.—Portion of the Germinal Membrane surrounding the germinal area, cut out from a further developed ovum. A clear space in the area, called *area pellucida*, is apparent. (10 *diam.*)

Fig. 12.—A similar piece from a somewhat older ovum. The germinal area has become oval. (10 *diam*.)

Fig. 13.—The Germinal Area is now greatly enlarged in the germinal membrane. *a*. Germinal Membrane—*b*. Limit of Vascular Area—*c*. *Area Pellucida*—*d*. *Laminæ Dorsales*—*e*. Primitive Groove.—*f*. Profile of Germinal Area. (10 *diam.*)

Fig 14.—Portion of Germinal Membrane, with the Embryo, from an ovum twenty-four hours older than fig. 13. The primitive groove is not yet closed, but is much stronger, especially above. Here three swellings are observable, which are the three primitive brain-cells. At the inferior end, the groove is of a lancet shape (*sinus rhomboidalis*). In the centre of the groove is a thin streak, the commencement of the *chorda dorsalis*. Six square cells are formed on each side, the commencement of the vertebral column. The germinal membrane is now composed distinctly of two layers, the upper of which (the *serous* or *animal layer*) is cut close round the embryo, showing more distinctly the lower (the *mucous* or *vegetative layer*). (10 *diam.*)

Fig. 15.—The same Embryo, seen sideways, whereby the elevation of the dorsal laminæ, and the groove between them, are better seen. The head is already distinctly elevated above the germinal membrane. (10 *diam.*)

Fig. 16.—An Embryo twelve hours older than the former one. The primitive groove is now for the most part closed over. The first brain-cell is widened out laterally, and bent forwards. The posterior ones are altered in shape from absorption of fluid. There are ten vertebral cells. At both ends of the primitive groove folds of the serous layer are visible—the commencement of the amnios. The serous layer is cut close round the embryo; and upon the mucous layer, fine lines, in the form of a network, are visible—the commencement of the *vascular layer*. (10 *diam.*)

Fig. 17.—The same Embryo turned round and examined on the under or abdominal surface. The head with the broadened-out first brain-cell is seen coming forward. Immediately below this an S-shaped tube is seen, which is the

bryo heart and aorta (figs. 18 and 19), and a circulation is established, which extends over the entire ovum, with the

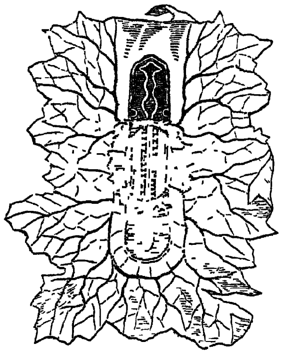


Fig. 18.

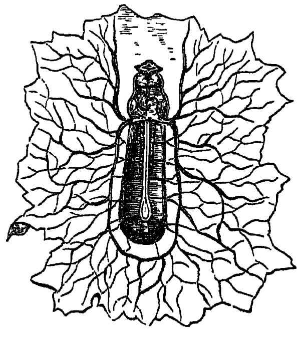


Fig. 19.

exception of its two poles (fig. 20). The embryo now is gradually raised above the surface of the germinal mem-

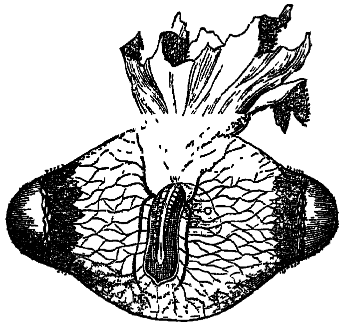


Fig. 20.

brane, while the duplications and re-duplications of its three layers, which are constantly receiving thickness by cell growth, gradually produce the various organs and textures of the body. Three veisicles or sacs are formed in connection with them,—the amnios with the serous, the allan-

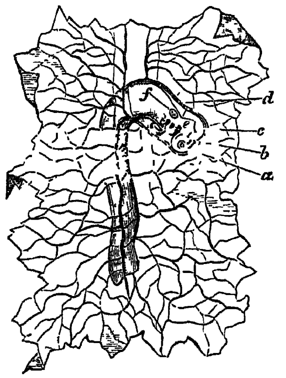


Fig. 21.

tois with the vascular, and the umbilical with the mucous layer. The upper or serous layer of the germinal membrane may be observed from an early period to be reflected backwards, and from before backwards, as well as laterally, gradually to inclose the embryo above (figs. 16 and 18). At length the layer closes, suspending the embryo as it were from one point (fig. 20), which, when it gives way, leaves a sac, which rises from the back of the embryo. This is the *amnios*. From the lower portion of the abdominal groove, and at the inferior extremity of the embryo, a swelling may now be observed (fig. 22, *bb*). This rapidly

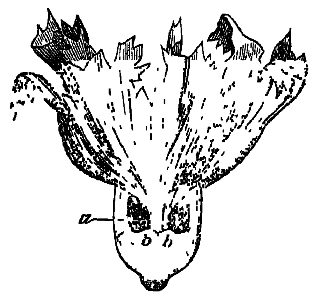


Fig. 22.

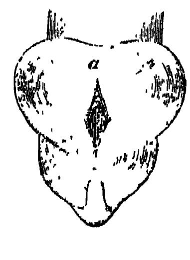


Fig. 23

enlarges, and, at first open in the middle (fig. 23, *a*), coalesces to form another sac, which hangs out of the lower portion of the abdominal opening. This is the *allantois*

rudimentary heart. The lower end branches off on each side to join the vascular network, forming the *venæ omphalo-mesentericæ*. The visceral or abdominal cavity is seen open below, causing the embryo to resemble somewhat the appearance of a partly-decked boat. (10 *diam.*)

Fig. 18.—An Embryo from an Ovum supposed to be twenty-three or twenty-four days old, seen from above. The primitive groove is now completely closed, to form the medullary tube, and exhibits above the three primitive brain-cells. The first of these is seen to be so expanded laterally as to form at each side the embryo eyes. The embryo ears are also seen on each side opposite the third brain-cell. The upper and lower ends of the embryo are now inclosed in a backward fold of the serous layer, which, however, is still open in the centre. The blood-vessels in the vascular layer are now fully formed. (10 *diam.*)

Fig. 19.—The same Embryo seen from below. The head is strongly bent forward, so that the first brain-cell and embryo eyes are best seen on this surface. Below these, two notched processes are seen, which are the first visceral arches. Below these again, the S-shaped heart—terminating, above in the aorta, below in the *venæ omphalo-mesentericæ*. The heart now pulsates, and a circulation is established over the vascular area. (10 *diam.*)

Fig. 20.—An entire Ovum, with the Embryo somewhat older than the last. The villous chorion is raised off the entire centre of the egg, which is suspended by it at one point, where the folds of the serous layer have completely closed over the back to form the amnios. The embryo lies with its inferior half in the plane of the vascular and mucous layers; whilst the head and superior half is prominent, and inclosed by them. At the sides are seen both the *arteriæ* and *venæ omphalo-mesentericæ*, which communicate with the plexus of the vascular layer, and terminate in circular rings, the *venæ terminales*, leaving the two poles of the ovum bare. (5 *diam.*)

Fig. 21.—The same Embryo, removed with its membranes, and viewed from the internal surface of the ovum, sideways. The head and upper portion is seen surrounded by the amnios. In the head is observed the brain, divided into anterior, neighbouring, and middle brain, *a*, *b*, *c*; the third brain cell, *d*; eyes, *e*; ears, *f*; not yet connected with the third brain-cell. There are three visceral arches. The heart is further developed, prominent, and surrounded by the serous membrane. The lower portion of the embryo is covered with the vascular and mucous layers. (5 *diameters.*)

Fig. 22.—The Lower End of an Embryo some hours older than that in the last figure. The mucous and vascular layers are drawn upwards, so that not only is the visceral cavity seen, but the lower portion of the intestinal canal, *a*. At the lower portion of the embryo are two small swellings, *b*, *b*, the commencement of the *allantois*. (10 *diam.*)

Fig. 23.—The Lower End of an Embryo twelve hours older than the last. The *allantois* now forms a sac, the two halves of which, however, are not yet closed. (10 *diameters.*)

(fig. 24). About the same time the inferior layer of the germinal membrane, more or less constricted when it comes

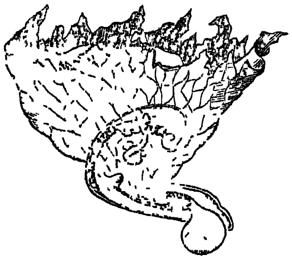


Fig. 24.

out of the abdomen of the embryo, forms a third sac or vesicle, called the *umbilical sac.* The mode of formation and relation of these three sacs will be better understood from the accompanying diagram (fig. 25).

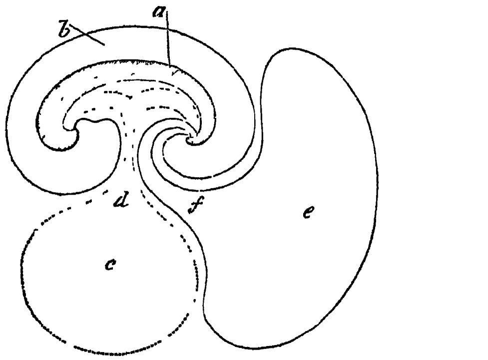


Fig. 25.

The various parts of the body are now rapidly perfected, to the principal of which we may shortly allude,—1*st,* The *chorda dorsalis,* inclosed by the *dorsal laminæ,* which forms the cranio-vertebral canal, are developed below into spinal cord and vertebræ, while superiorly are produced the cerebrum, cerebellum, and cranium (fig. 21, *b, c, d;* and fig. 24). 2*d,* The bent tube, which originally formed the heart, is by a kind of notch first separated into heart and aorta; and the former, by the growth of internal septa, divided into ventricles and auricles. 3*d,* The formation of branches from the aorta, which go to the branchial arches or clefts (fig. 26). 4*th,* The union of these branchial arches to form the bones of the face and jaws; the development of the special senses; and the formation, first, of the upper extremities (fig. 24), and, secondly, of the lower (fig. 27). 5*th,* The appearance of four striated organs deep in the visceral cavity, called Wolffian

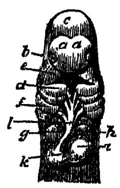


Fig. 26.

Fig. 24.—The Embryo of an Ovum twelve hours older than the last, suspended by the vascular and mucous layers. All the different parts formerly referred to may be seen further developed. The superior extremity is prominent. In the visceral cavity two long striated bodies are seen, the *Wolffian bodies;* and the allantois is now so enlarged as to hang out of the visceral cavity, covered with a network of vessels in connection with the vascular layer. (5 *diam.*)

Fig. 25.—Diagram representing the mode of formation and position of the three Embryonal Sacs. *a.* Embryo—*b.* Amnios—*c.* Umbilical Vesicle—*d.* the Vitelline Duct, or Pedicle of the Umbilical Vesicle—*e.* Allantois—*f.* The Urachus or Pedicle of the Allantois, afterwards the Urinary Bladder.

Fig. 26.—The Head of the same Embryo represented in fig. 24, seen in front. *a.* Anterior Brain-Cells—*b.* Eyes—*c.* Second Brain-Cell—*d.* First Visceral Arch—*e.* Process thereof—*f.* Three Lower Visceral Arches—*g.* Right, and *h,* Left Auricle—*i.* Left, and *k.* Right Ventricle—*l.* Aorta, with aortic branches to the visceral arches. (10 *diam.*)

bodies, which are afterwards transformed into the genito-urinary organs (fig, 27, *o*). 6*th,* The inflexions and constriction of the mucous layer to produce the alimentary canal (fig. 27, *m*). And, *finally,* the enlargement of the various

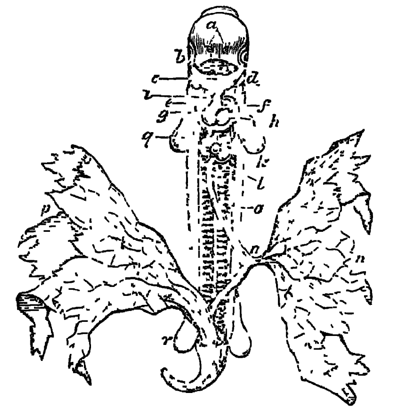


Fig. 27.

glands and internal viscera, and the greater perfection of all the parts referred to (fig. 28); while the abdominal open-

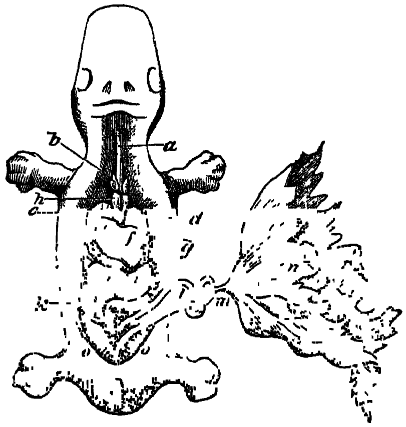


Fig. 28.

ing, closing in front, leaves only a small aperture, through which the united pedicles of the allantoid and umbilical sacs pass to constitute the umbilical cord. To describe each of these processes at length, or the variation which has been shown to exist in them, among the leading tribes of animals, would lead us too far. It will suffice to say, that from the serous layer is principally formed the nervous centres and the organs of sense; from the vascular layer for the most part is produced the voluntary and non-voluntary muscles, the bones, and the blood-vessels; and from the mucous layer, the mucous surfaces and chief portion of the glands.

Besides the changes which occur within the ovum, and

Fig. 27.—An Embryo older than the last, seen in front. *a.* Nasal Apertures—*b.* Eyes—*c.* First Visceral Arch, now the Under Jaw—*d.* Second Visceral Arch—*e.* Right, and *f.* Left Auricle—*g.* Right, and *h.* Left Ventricle—*i.* Aorta—*k.* Liver; between its two lobes is seen the cut *Vena Omphalo-Mesenterica*—*l.* Stomach—*m.* Intestinal Canal, terminating in the Umbilical Vesicle—*n, o.* Wolffian Bodies—*p* Allantois—*q.* Upper, and *r.* Under Extremity. (5 *diam*)

Fig. 28.—Embryo of an egg about four weeks old. *a.* Trachea and Œsophagus—*b.* Thymus Gland—*c.* Right, and *d.* Left Auricle—*e.* Right, and *f.* Left Ventricle—*g.* Left, and *h.* Right Aorta—*i, i, i.* Three Lobes of the Liver—*k.* Stomach—*l.* Intestinal Coils, which by a band *m* (the former *Ductus Omphalo-Mesentericus*), are in connection with the umbilical vesicle *n*—*o.* Wolffian Bodies. (5. *diam.*)

which result in the formation of the embryo, there are others which seem external to it, and which are indirectly very necessary to its formation. As the impregnated ovum descends the Fallopian tube towards the uterus, it becomes covered with an albuminous layer, called the *chorion;* and on passing into that organ, encounters another which lines it, called the *decidua.* When the allantoid sac becomes developed, it sends vessels into a portion of these membranes to form the *placenta,* the relations of which to the various sinuses of the uterus are of a kind that enable the mother to furnish blood to the fœtus by transudation of its fluid substance through a double membrane. The uterus also becomes greatly enlarged and thickened; numerous non-voluntary contractile fusiform cells are formed in it; and at length, the fœtus having arrived at maturity, these commence to contract, and, by a series of expulsive efforts, finally expel the infant. The mammary glands also gradually enlarge, so that about the period of birth they are fitted to furnish a copious supply of milk, under the stimulating action of suction, to which the infant is instinctively impelled for the sake of nourishment.

Such is a general sketch of the various stages of the function of reproduction, a study of which in the different classes of animals has led to the formation of various ingenious hypotheses, whereby it has been sought to bring the order of evolution within the operation of certain laws. One of these, which has excited great attention, is, that the human fœtus passes through transition periods resembling in turn the different inferior beings of the animal scale: that is to say, it at first resembles a zoophyte, then a mollusc, then a worm, a fish, a reptile, and so on. Thus the monads found among the inferior animals have been supposed to be represented by the germinal vesicle. The yolk, when divided, has been thought to resemble a gonium or a volvox. When the primitive groove closes, it has been likened to a worm; afterwards to a molluscous animal; and when the visceral arches appear, to a fish; and so on. This method of viewing the phases of development has led to a generalization thus expressed by Serres,—viz., that "Human organogenesis is a transitory comparative anatomy, as in its turn comparative anatomy is a fixed and permanent state of the organogenesis of man." But that the human embryo ever resembles a worm, a mollusc, reptile, fish, or bird, can on careful examination nowhere be recognised. It is true, that at one period all ova resemble each other; but it is equally certain that from the first moment of their formation they are impressed with a power of developing themselves only in one direction, so that the ovum of a reptile, fish, or bird will always be developed into similar animals, and by no concurrence of circumstances will ever be transformed into different ones. Neither is there any anatomical or structural relation between them, for the visceral arches in the human fœtus are in no way, as has been supposed, analogous with the branchiæ or lungs of the fish, for the former are transformed into the bones of the face, while the lungs originate in inflexions of the mucous layer. The theory, then, may be considered as more fanciful than real, and founded upon loose analogies, which, instead of being strengthened, are weakened as development proceeds, and the true types of such analogies become more evident.

In recent times another theory has been brought forward, denominated *alternate generation* by Steenstrup, but more correctly *parthenogenesis* by Owen. Many of the facts described by the former refer not so much to an alternate as to a continuous development. Thus, many insects spend part of their lives as a worm, and part as a moth. The moth produces the worm, and the worm produces the moth; but this is not an alternate, but a different phase of the same generation. So a correct knowledge of the development of the *Medusa aurita* has shown that what naturalists had considered to be four distinct animals are in fact only different stages in the development of one animal. The formation of the Aphis is especially alluded to by Steenstrup, several of which insects are produced from the mother, and each of which may produce others, although it is only certain of them which become transformed into a fly. But the generation of a plant may be called alternate in the same sense as it is used in the case of the Medusa or the Aphis, inasmuch as the seed produces a leaf and a root, which proceeds to develop other leaves before it finally produces the flowers with the seed like that from which the plant originated. The term *parthenogenesis* (παρθενεία, *virginity*), as expressive of the power of reproduction in various forms without the act of fecundation, is therefore the more correct one.

This doctrine has now led to many important results, among which the discovery of the origin and mode of reproduction of tape-worms, and the manner in which the three kinds of bees are produced, are good examples. It is now known that certain Entozoa are partly developed in one animal and partly in another. Thus, the minute eggs of certain Tœniæ, or tape-worms, enter the body of the mouse, and are converted into cystic worms, which have been considered as distinct creatures. In this stage they would remain in that animal; but the mouse being eaten by the cat, the cystic worm of the former is converted into a tape-worm in the body of the latter. In the same way, the *Cysticercus pisiformis,* found in hares and rabbits, is converted into the *Tœnia pisiformis,* so common in the fox, which feeds on those animals; and the *C. cellulosæ,* so frequent in the flesh of pork and of mutton, is transformed into the *Tœnia Solium* of man. Thus the mystery as to the origin of tape-worm has been cleared up; and the practical result, that if we desire to cure the disease, besides giving anthelmintics and purgatives, we must also prevent the eating of flesh underdone, or game and fish out of season, when it is likely to be infected with *Cysticerci.* So, among bees it has been shown by Dzierzon and Siebold that the queen-bee, during her nuptial flight, receives the semen of the male into a receptacle communicating with the oviducts, but from which it can be shut off at will. The workers having prepared three kinds of cells,—namely, drone-cells, worker-cells, and royal-cells, each of which has its own peculiar form and size,—the queen deposits an egg in each. In doing this, she takes care to bring every one of those destined for the royal and the worker cells into contact with the seminal fluid, but takes equal care to keep free from such contact every one of those destined for the drone-cells. It has also been shown that a worker-bee can be transformed into a queen by feeding it on a peculiar kind of food. It follows that male animals in insects may be produced independent of the union of the ova with spermatozoids, in the same way that buds are thrown out in trees, or polype heads formed without fecundation. The queen-bee in this respect is like a tree, uniting two kinds of development, oviparous and gemmiparous. Her ovary resembles a *gemmarium,* the products of which she fertilizes at will, by shedding on the ovum the semen stored up in her receptacle.

The modern researches into reproduction, therefore, indicate that the tribes of animals hitherto described by naturalists are not so numerous as was once thought, and that many of them are only the metamorphic changes of one creature. They show that animals as well as plants can propagate in two ways—by buds and by germs; the individual developed from the bud being capable of producing an ovum from which another individual may spring that may produce a bud. Thus much of the mystery that has shrouded the origin of many animals has been dissipated, and the arguments by which it has been sought to esta-

blish a spontaneous or equivocal generation overthrown. They also confirm the instinctive convictions, so long established among the human race, which point to the male as being not merely the head and proper representative of the species, but the real reproducer of it also. The man being the head of the woman; she merging in him, and having no right apart from him; their joint offspring, not hers, but truly his; born indeed of her, but begotten by him. Hence the truth of the long-confirmed notion of descent in the male line, which, coupled with the instinct of power, has given rise to the law of primogeniture. Science, jurisprudence, and religion, therefore, unite in proving that the wife is part of the husband; the two being, in the language of Scripture, "no more twain, but one flesh." (A. Harvey.)

PART III.—PATHOLOGICAL PHYSIOLOGY.

Every animated being has a limited period of existence, during which it is constantly undergoing a change. So long, however, as this change takes place uniformly in the different parts of which it is composed, its physiological or healthy condition is preserved. But immediately the action of one organ becomes excessive or weak in proportion to the others, disease, or a pathological state, is occasioned. This state may be induced by direct mechanical violence, but may also occur from the continued or irregular influence of several physical agents, such as temperature, moisture or dryness, quality of the atmosphere, kind of food, &c., &c. These are always acting upon the vital powers of the individual as a whole, as well as incessantly stimulating the various organs to perform their functions. We have previously seen that life may be defined in the words of Béclard—"Organization in action." Health is the regular or normal, and disease the disturbed or abnormal condition of that action.

While such may be assumed to be our notion of disease in the abstract, what constitutes disease in particular has been much disputed. From the time of Hippocrates to that of Cullen and his followers, the external manifestation or symptoms constituted the only method of recognising diseased action, and gradually came to be regarded as the disease itself. Then these symptoms were arranged into groups, divided, subdivided, and named, according to the predominance of one or more of them, or the mode in which they presented themselves. These artificial arrangements are the nosologies of former writers. All philosophical physicians, however, have recognised that the true end of medical inquiry is, if possible, to determine rather the altered condition of the organs which produces the disordered function, than to be contented with the study of the effects they occasion. But the difficulty of this inquiry has been so great, and a knowledge of the means of prosecuting it so limited, that it is only within the last thirty years medicine has been enabled to build up for herself anything like a solid scientific foundation. What has hitherto been accomplished in this way has been brought about by the conjoined cultivation of morbid anatomy, pathology, and clinical observation, greatly assisted, however, by the advance of numerous collateral branches of science, and especially in recent times by chemical and histological investigation. The result has been a complete overthrow of nosological systems, and an attempt to trace all maladies to their organic cause; and doubtless in proportion as this has been successfully accomplished, medicine has become less empirical and more exact. The organic changes, however, which produce or accompany many diseases have not yet been discovered, and consequently a classification of all maladies on this basis cannot be strictly carried out. The organic cause of epilepsy, hydrophobia, and of many fevers, for example, is as yet unknown. When, therefore, the morbid change in an organ is unequivocally the origin of the symptoms, we employ the name of the lesion to designate the disease; but when there is disturbance of function, without any obvious lesion of a part, we still make use of the principal derangement to characterize the malady. Thus, as regards the stomach, we say a cancer or an ulcer of that viscus, and thereby express all the phenomena occasioned. But if we are unable to detect such cancer or ulcer, we denominate the affection after its leading symptom,—dyspepsia, or difficulty of digestion.

In endeavouring to carry out this distinction, however, modern pathologists have fallen into a great error, inasmuch as they have continued to employ the nomenclature of our forefathers, and use words which were simply expressive of the presence of symptoms to indicate the altered condition of organs, the cause of those symptoms. Formerly inflammation meant the existence of pain, heat, redness, and swelling; it now means certain changes in the nervous, vascular, and parenchymatous tissues of a part. Formerly apoplexy meant sudden unconsciousness originating in the brain; now it is frequently used to express hæmorrhage into an organ; and hence the terms apoplexy of the lung and of the spinal cord. The two ideas are essentially distinct, and bear no reference to each other, because the same word may be, and often is, employed under circumstances where its original meaning is altogether inapplicable, and even when the symptoms it was intended to express are altogether absent. Hence it is incumbent on every one who gives to organic changes terms which have been long employed in medicine, to define exactly what he means by them. In this way, old indefinite expressions, though still retained, will have a more precise meaning attached to them.

But notwithstanding the confusion which has necessarily resulted from the rapid advance of medicine in late years, and from the frequent change of ideas with regard to the nature of morbid actions, it still is correct to say that disease is only an alteration in the healthy function of organs. Hence all scientific classification of maladies must be founded on physiology, which teaches us the laws that regulate those functions; and they may be divided, like the functions themselves, into—1*st*, Diseases of Nutrition; 2*d*, Diseases of Innervation; and 3*d*, Diseases of Reproduction.

DISEASES OF NUTRITION.

The various modes in which nutrition becomes impaired can only be understood by knowing the different steps of the nutritive process. For ages medical men have been in the habit of considering the blood to be the primary source of numerous maladies. But our previous description of the process of nutrition must show that the changes in this fluid, and the diseases which accompany them, are for the most part not primary, but secondary; that is to say, they are dependent on previously existing circumstances, to the removal of which the medical practitioner must look for the means of curing his patient. This will become apparent, not so much by analysing the individual disorders to which the various organs and tissues of the body are liable, as by describing the fundamental pathological processes which are common to all parts of the frame. An enumeration and definition of these appear necessary in the first place.

Classification of Diseases of Nutrition.

Congestion, or Excess of Blood in a Part.—This is an over-distension of the blood-vessels, but more especially of the capillaries, with blood. It may be caused by excite-

ment of the nervous system, by mechanical impediments which obstruct the return of venous blood, or by irritation of the textures. However produced, congestion may be temporary, and disappear without producing much disturbance, or, if long continued, it may give rise to one or more of the following conditions:—

FEVER.—When congestion is caused or accompanied by general excitement of the nervous system, it produces fever, a morbid condition characterized by hot skin, accelerated pulse, furred tongue, thirst, and headache,—phenomena usually preceded by a sensation of cold, or rigor. If caused by some poison introduced through the blood, it is called *primary*, the principal forms being *intermittent, remittent*, and *continued.* If produced by injuries to texture, either directly from violence, or indirectly from reflex action causing internal inflammations, it is denominated *secondary* or *symptomatic*.

DROPSY, OR EFFUSION OF SERUM.—When congestion is *passive*, or caused by mechanical obstruction to the flow of blood through the veins, serum transudes through the walls of the capillary vessels, and collects in various places, causing dropsy. If generally diffused, especially through the subcutaneous tissue, it is called *anasarca;* if limited to the peritoneal cavity, *ascites;* if local, *œdema.*

HÆMORRHAGE, OR EXTRAVASATION OF BLOOD.—This may arise from direct injury to a blood-vessel, from a wound, or from disease of its coats. Under such circumstances it may be *arterial* or *venous*, the former distinguished by the blood being of a bright florid, and the latter by its being of claret colour. The capillaries are frequently ruptured from over-distension with blood, which is *capillary* or *congestive* hœmorrhage, causing dropsical effusions or inflammatory exudations to assume a sanguinolent character.

INFLAMMATION, OR EXUDATION OF LIQUOR SANGUINIS.—When congestion is *active*, or arises from irritation of the textures, it may, if excessive, terminate in the exudation through its coats of the *liquor sanguinis.* This is inflammation; an expression still used very vaguely by some pathologists, but which, thus defined, separates the morbid state accurately from congestion or fever on the one hand, and from dropsy, or the processes of growth, on the other. The exudation thrown out undergoes a variety of changes, producing various morbid conditions, according as it lives or dies.

SIMPLE OR INFLAMMATORY EXUDATION consists of the normal *liquor sanguinis*, which infiltrates the neighbouring tissues or collects in serous cavities. It then coagulates, and may undergo the following vital transformations: 1*st*, Into cells and fibres, forming *adhesive lymph*, as on the surface of serous membranes; 2*d*, Into pus-cells, constituting *suppuration*, as in mucous surfaces or in areolar texture; 3*d*, Into granule-cells, forming *inflammatory softening;* and 4*th*, Into various elementary tissues, such as the fibrous, vascular, cartilaginous, bony, &c. In this manner, the exudation may be (1.) absorbed, or undergo *resolution;* (2.) evacuated externally by discharge; or (3.) assimilated to the body. It is the agent which forms abscesses, causes the healing of wounds, and the union of divided tendons, bones, &c.

TUBERCLE, OR TUBERCULAR EXUDATION.—When an exudation, instead of undergoing the vital changes just referred to, assumes a yellow or grayish aspect and cheesy consistence, it is called *tubercle.* It consists of solid irregularly-formed bodies, called *tubercle corpuscles*, more or less associated with molecules and granules. If disseminated in small grains, it is called *miliary;* if in considerable patches or masses, it is *infiltrated tubercle.* When chronic, it may be *encysted*, or present the form of *cretaceous* or *calcareous masses.*

CANCER, OR CANCEROUS EXUDATION.—When an exudation, instead of undergoing the vital transformations previously described, passes into cells and fibres, the former increasing endogenously, it is called *cancer.* If hard, and principally formed of fibres from associated morbid growth, it is called *scirrhus;* if soft, often yielding a milky juice on pressure, it is *encephaloma;* if having a fibrous basis, this is so arranged as to form areolæ or loculi, containing a gelatinous gum or glue-like matter; then it is called *colloid cancer.*

MORTIFICATION, OR MOIST GANGRENE.—When the exudation is poured out rapidly in such quantity as to paralyse the nerves, obstruct the blood-vessels, and prevent the return of circulation in them, it dies, and undergoes chemical putrefactive changes, and is said to be mortified, or to be affected with moist gangrene. It differs from dry gangrene, which is slow death of pre-existing texture from want of nourishment. Sometimes it is epidemic, from external or unknown causes, resembling the blight which affects vegetables.

ULCERATION.—When an exudation does not pass into the vital transformations formerly described, but presses upon the surrounding parts, obstructing the flow of blood in them, death of such parts takes place. Under these circumstances, the whole slowly disintegrates; loss of texture is occasioned, with breach of continuity; and an *ulcer* is formed. Ulceration may also be produced by the direct pressure of a foreign body, continued weight of depending parts, &c.

MORBID GROWTHS OF TEXTURE.—Increased growth of tissues may assume various forms: the organ or structure may be enlarged in whole or in part, still maintaining more or less of its original texture, shape, and function—constituting *hypertrophy.* Membranes may become preternaturally thickened, causing more or less *induration*, whereby the movements of parts may be affected; or the calibres of tubes and ducts may be diminished, producing *stricture.* The vital transformations of an exudation into pus, granule, or other cells, must be regarded as a form of morbid growth, as must the results of the healing process, which give rise to new tissues exactly resembling those previously existing in other parts of the body,—as in cicatrices, callus, &c. Lastly, such growths may assume the form of *tumour.* Morbid growths may be classified into—1*st*, *Fibroma*, or fibrous growths; 2*d*, *Lipoma*, or fatty growths; 3*d*, *Angionoma*, or vascular growths; 4*th*, *Cystoma*, or cystic growths; 5*th*, *Adenoma*, or glandular growths; 6*th*, *Epithelioma*, or epithelial growths; 7*th*, *Echondroma*, or cartilaginous growths; 8*th*, *Osteoma*, or osseous growths; and 9*th*, *Carcinoma*, or cancerous growths.

MORBID DEGENERATIONS OF TEXTURES.—This also may assume various forms. The organ or structure may be diminished in whole or in part, constituting *atrophy*, still, however, retaining its normal shape and function; or the structure of the parts themselves may have undergone alterations, whereby their functions are impaired or destroyed. Such degenerations are of four kinds:—1*st*, They may, in a variety of ways, become indurated and shrivelled up, or converted into a waxy or glue-like material, apparently from an excess of one or more of the albuminous or gelatinous compounds. This is *albuminous degeneration.* 2*d*, They become softer, from an accumulation of fatty granules, either within cells or among the minute elements of the texture. This is *fatty degeneration.* 3*d*, In the same manner, pigment of various kinds is deposited in or replaces the tissue, which may be red, yellow, brown, green, blue, purple, or black, owing to chemical changes ascribable to extravasated blood or bile, or to some peculiar secretion. This is *pigmentary degeneration.* *Lastly*, the tissues may become infiltrated with mineral matter of various kinds,

but generally with salts of lime in solution, which subsequently becoming solidified, impede or destroy function. Such is *mineral degeneration*.

CONCRETIONS.—These are non-organized and non-vascular productions, formed by the mechanical deposition and aggregation of various kinds of matter, generally in the ducts or cavities of the hollow viscera. They may be composed of albuminous, fatty, pigmentary, or mineral substances, but are separable from degenerations from their never being formed out of an organic structure. *Urinary concretions*, or calculi, are composed of the salts which are too predominant in the urine, and which have been precipitated round a central body or nucleus, formed within or introduced from without. *Intestinal concretions* are usually composed of hair or vegetable fibres, which have been swallowed and accumulated also round a central nucleus. *Mineral concretions*, composed of carbonates and phosphates of lime, are common in the mucous passages of various organs, especially the salivary, bronchial, pancreatic, hepatic, and renal. They also occur in the veins, when they are called *phlebolites*. Occasionally they resemble starch grains, and are called *amyloid;* and not unfrequently concretions are found really composed of aggregated or isolated starch corpuscles, which may be called *amylaceous*.

PARASITIC GROWTHS.—These are of two kinds, vegetable and animal. The vegetable parasitic growths may be divided into such as grow on the surface (*Epiphyta*), or those that have been formed in the interior of the body, chiefly on the mucous surfaces (*Entophyta*). The animal parasites may also be divided into such as infest the surface (*Epizoa*), and such as are found in the interior of the body (*Entozoa*). To the former belong the several species of *Pediculus*, or louse; the *Acarus Scabiei*, or itch-insect; the *Entozoon folliculorum*, which inhabits the follicles of the skin; and the *Pulex penetrans*, or guinea-worm. The Entozoa are numerous, and may be divided into—1*st*, *Cystica*, or saccular worms; 2*d*, *Cestoidea*, or chain-worms; 3*d*, *Trematoda*, or flat worms; and 4*th*, *Nematoda*, or thread-worms.

Such is an enumeration and definition of the organic diseases of textures and organs. What are called *functional disorders* of the same parts are such as leave no traces of their existence after death, and are for the most part simple excess or diminution of normal actions. It is only when these last lead to congestions and exudations, terminating in fever or vital transformations, and chemical changes producing degenerations, that a true structural lesion can be said to exist. The causes of these organic alterations of texture are to be sought—1*st*, In increased or diminished stimulation acting directly on the tissues themselves; 2*d*, In increased or diminished excitability of the nervous system operating upon them indirectly; 3*d*, In an altered condition of the blood; and 4*th*, In chemical transformations of texture. These may act separately or combined, and one may occasion the other. We shall treat of these causes under the following heads:—

I.—*Theory of Active Congestion.*

When we irritate the web of a frog's foot, it may be seen under the microscope that—1*st*, The capillary vessels are narrowed, and that the blood flows through them with greater rapidity. 2*d*, The same vessels become enlarged, and the current of blood is slower, although even. 3*d*, The flow of blood becomes irregular. 4*th*, All motion of the blood ceases, and the vessel appears fully distended. 5*th* and *lastly*, The *liquor sanguinis* is exuded through the walls of the vessel, sometimes accompanied by extravasation of blood corpuscles, owing to the rupture of the capillaries.

The first step in the process,—viz., narrowing of the capillaries,—is readily demonstrated on the application of acetic acid to the web of the frog's foot. If the acid be weak, the capillary contraction occurs more slowly and gradually. If it be very concentrated, the phenomenon is not observed, or it passes so quickly into complete stoppage of blood, as to be imperceptible. Although we cannot see these changes in man under the microscope, certain appearances indicate that the same phenomena occur. The operations of the mind, for instance, as fear and fright, and the application of cold, produce paleness of the skin; an effect which can only arise from contraction of the capillaries, and a diminution of the quantity of blood they contain. In the majority of instances, also, this paleness is succeeded by increased redness, the same result as follows from direct experiment on the web of the frog's foot, constituting the second step of the process. In other cases, the redness may arise primarily from certain mental emotions, or from the application of heat. In either case, it depends on the enlargement of the capillaries, and the greater quantity of blood they contain.

It has been asserted that, instead of contraction of the capillaries, the first changes observable are enlargement, with an increased flow of blood. To determine positively the question of contraction or dilatation, Professor Bennett has made a series of careful observations on the web of a frog's foot. Having fixed the animal in such a way that it could not move, he carefully measured with Oberheuser's eye micrometer the diameter of various vessels before, during, and after the application of stimuli. The results were, that immediately hot water was applied, a vessel that measured thirteen spaces of the eye micrometer contracted to 10; another that measured 10 contracted to 7; a third that measured 7 contracted to 5; a fourth, which was a capillary carrying blood globules in single file, and measured 5, was contracted to 4; and another, one of the smallest size, which measured 4, was contracted to 3. With regard to the ultimate capillaries, it was frequently observed that if filled with corpuscles, they contracted little, but if empty, the contraction took place from 4 to 2; so that no more corpuscles entered them, and they appeared obliterated. This was especially seen after the addition of acetic acid. It was also observed that minute vessels that contracted from 4 to 3 afterwards became dilated to 6 before congestion and stagnation occurred. The smaller veins were seen to contract as much as the arteries of the same size.

The variation in the size of, and amount of blood in, the capillaries is conjoined with changes in the movement of that fluid. Whilst the vessels are contracted the blood may be seen to be flowing with increased velocity. After a time the blood flows more and more slowly, without, however, the vessel being obstructed: it then oscillates,—that is, moves forwards and backwards, or makes a pause, evidently synchronous with the ventricular diastole of the heart. At length the vessel appears quite distended with coloured corpuscles, and all movement ceases.

Again, these changes in the movement of the blood induce variations in the relation which the blood corpuscles bear to each other, and to the wall of the vessel. In the natural circulation of the frog's foot, the yellow corpuscles may be seen rolling forward in the centre of the tube, whilst on each side a clear space is left, only filled with *liquor sanguinis* and a few lymph corpuscles. There are evidently two currents, the centre one very rapid, that at the sides (in the lymph spaces, as they are called) much slower. The coloured corpuscles are hurried forward in the first, occasionally mixed with some lymph corpuscles. These latter, however, may frequently be seen clinging to the sides of the vessel, or slowly proceeding a short distance down the tube in the lymph space, and then again stopping. Occasionally they get into the central torrent,

when they start off with great velocity, and accompany the yellow corpuscles. It has been said that these corpuscles augment in number, accumulate in the lymph spaces, and obstruct the flow of blood. In young frogs their number is very great; but then they constitute a normal part of the blood, and in no way impede the circulation. In old frogs, on the other hand, all these, and subsequent changes, may be observed, without the presence of colourless corpuscles. When the capillaries enlarge, however, the central coloured column in the smaller vessels may be seen to enlarge also, and gradually approach the sides of the tube, thus encroaching on the lymph spaces. The slower the motion of the blood, the closer it comes, until at length the coloured corpuscles come in contact with the sides of the vessel, and are more or less compressed and changed in form. At length the vessel is completely distended with coloured corpuscles, the original form of which can no longer be discovered, and the tube appears to be filled with a homogeneous deep crimson fluid. This is congestion. Such a congestion may be temporary: it is

An exact copy of a portion of the Web in the Foot of a Young Frog after a drop of strong alcohol had been placed upon it.

The view exhibits a deep-seated artery and vein, somewhat out of focus; the intermediate or capillary plexus running over them, and pigment cells of various sizes scattered over the whole. At the top of the figure the circulation is still active and natural. About the middle it is more slow, the column of blood is oscillating, and the corpuscles crowded together. At the bottom, congestion, followed by exudation, has taken place.—*a*. A deep-seated Vein, partially out of focus. The current of blood is of a deeper colour, and not so rapid as that in the artery. It is running in the opposite direction. The lymph space on each side, filled with slightly yellowish blood plasma, is very apparent, containing a number of colourless corpuscles, clinging to or slowly moving along the sides of the vessel.—*b*. A deep-seated Artery, out of focus, the rapid current of blood allowing nothing to be perceived but a reddish-yellow broad streak, with lighter spaces at the sides.—Opposite *c*, laceration of a capillary vessel has produced an extravasation of blood, which resembled a brownish-red spot.—At *d* congestion has occurred, and the blood corpuscles are apparently merged into one semi-transparent, reddish mass, entirely filling the vessels. The spaces of the web, between the capillaries, are rendered thicker and less transparent, partly by the action of the alcohol, partly by the exudation. This latter entirely fills up the spaces, or only coats the vessel. (200 *diam.*)

only when, as we have seen, it leads to effusion, extravasation, or exudation, that true organic lesion is apparent. The different changes leading to congestion may be explained as follows:—

1. The contraction and dilatation of the capillaries are explicable by supposing them to be endowed with a power of contractility analogous to that existing in non-voluntary muscles. John Hunter thought they were muscular, from the results of his observations and experiments; and they may be shown by the histologist to consist of a delicate membrane in which permanent nuclei are imbedded. In structure, then, they closely resemble the muscular fibres of the intestine, and we know that, like them, they may be contracted or dilated by emotions of the mind—that is, through the nerves; or by local applications—that is, directly. The narrowing of these tubes, therefore, may be considered, as Cullen thought it was, analogous to spasm; while their dilatation is similar either to the relaxation which follows such spasm or to muscular paralysis. The recent observations of Cl. Bernard and others as to the effects produced by dividing the large nervous trunk of the sympathetic in the neck have singularly confirmed this theory, and shown how the modification of nutrition which characterizes *fevers* is probably owing to a morbid condition of the ganglionic nervous system.

2. The rapid and slow movement of the blood is explicable on the hydraulic principle, that when a certain quantity of fluid is driven forward with a certain force through a pervious tube, and the tube is narrowed or widened, while the propelling force remains the same, the fluid must necessarily flow quicker in the first case and slower in the second. It has been supposed, from the throbbing of large vessels leading to congested parts, that they pump a larger quantity of blood than usual into them. This was called "determination of blood" by the older pathologists, and is now known not to be a cause, but a result, of the changes going on in the capillary vessels and tissues of the affected part. The oscillatory movement, seen later in the transparent parts of small animals, has not been observed in man, and probably depends, in the former, on a weakened power of the heart.

3. It is the stoppage of the blood, and exudation of the *liquor sanguinis*, however, which it is most difficult to explain; for why, so long as there is no mechanical obstruction (and during this process none has ever been seen), should the circulation through the capillaries of a part cease? It has been endeavoured, indeed, of late years, to establish a mechanical obstruction, by supposing the formation of colourless corpuscles in large numbers, which cling to the sides of the capillaries, and so cause interruption of the stream. But this hypothesis is negatived by the following facts:—1*st*, In young frogs the vessels may be seen to be crowded with colourless corpuscles, while the circulation is in no way affected. 2*d*, In old frogs, oscillation and gradual stoppage of the stream may be seen, without any colourless corpuscles being present. 3*d*, The colourless corpuscles, as shown by Remak, are increased, after large venesections, in the horse, without causing active congestion. And 4*th*, In leucocythemia, or white cell-blood, all the vessels are crowded with colourless corpuscles, and yet no active congestion in these vessels, nor exudation of and kind, has been occasioned.

We cannot ascribe the stoppage of the circulation in the capillaries to venous obstruction, or to mechanical pressure of any kind, because all observation proves that such causes, while they induce effusion of serum, never occasion exudation of *liquor sanguinis*. Neither can we suppose it to depend on endosmose, nor on a *vis à tergo*, as such physical causes cannot be shown to apply in all cases. We are compelled, therefore, to attribute the vital force producing these changes, not to anything residing in the blood or in the vessels, but in the tissues which lie outside the vessels. That these do possess a power attractive and selective, whereby matters are drawn from the blood to carry on nutrition and secretion, is now generally admitted in physiology. A modification of this power, whereby the attractive property is augmented, and the selective one diminished,

Physiology

at least offers us an explanation consistent with all known facts, and seems to be the only active agency to which we can ascribe the approach of the coloured particles to the capillary walls, and the passage through them of the exudation.

Theory of the Exudations.

The true cause of exudation, therefore, is irritation of texture, so modifying its vital properties that, instead of selecting and attracting from the blood simply what is necessary to keep up the nutritive processes, it draws out the entire *liquor sanguinis.* This is the exudation which, if it do not die to produce mortification or ulceration, undergoes vital transformations, constituting what have been called the *terminations*, or *resulting phenomena* of inflammation in healthy persons, or tubercle and cancer in certain constitutional states of the system. In the first case, the transformations materially depend on the rapidity with which the exudations are thrown out, or the situation where they occur, and on the vital powers of the body. But in tubercular and cancerous exudations we observe no distinctions from these causes, although it has been remarked that situation so far influences cancer that scirrhus is most common in fibrous, and encephaloma in cellular organs. The more important characters of the three kinds of exudation may be shortly stated as follows :—

We observe in a simple or inflammatory exudation, that it may occur at all epochs in life ; that it may attack all tissues, and most commonly those which are very vascular ; that it may be poured out in large or small quantities ; and that it may occur with greater or less rapidity ; hence the terms *acute* and *chronic.* We further observe, that the acute exudations are generally attended with symptoms of a peculiar character (inflammatory), and have a great tendency to cell or temporary formations, which rapidly break down, are absorbed, and excreted by the emunctories ; that the chronic exudations, on the other hand, have a tendency to fibrous or permanent formations, producing adhesions, strictures, indurations, &c.

We observe in a cancerous exudation that it occurs for the most part in persons of adult or advanced life ; that it may also occur in every tissue, but is by far most common in glandular or fatty organs, such as the liver or female mamma, and is very apt to attack the lymphatic glands *secondarily ;* that its progress, although sometimes slow when very fibrous, becomes rapid when corpuscles abound in it ; that there is a great tendency to the formation of the most perfect forms of cell life, which have the power of self-development, and thereby of spreading to neighbouring tissues ; and lastly, that when by pressure ulceration is produced on free surfaces, it bursts through these in exuberant fungoid excrescences.

We observe in a tubercular exudation that it occurs for the most part in young subjects, between the periods of dentition and of adult age ; that it may also occur in all tissues, but is by far most common *primarily* in the lymphatic glands, and afterwards in fibrous or albuminous textures, as the lungs and serous surfaces ; that its progress is in general exceedingly slow ; that there is no disposition to the formation of perfect cell formation, but rather to abortive corpuscles, which form slowly, and slowly break down ; that there is little tendency to absorption, but great liability to disintegration and ulceration ; and finally, that the local changes are almost always preceded by derangement of the *primæ viæ*, and a group of symptoms known under the name of *dyspepsia.*

Taking, then, the products of simple exudation (say pus) as a standard, we cannot fail to remark, that whilst the cell-development of tubercle is below, that of cancer is above this standard. Of the three kinds of exudation, tubercle is the lowest, and cancer the highest, in the scale.

Of the ultimate cause producing this difference in the formative power of the exudation we are ignorant, but every kind of reasoning must lead us to the conclusion, that these changes and effects depend, not upon the vascular system, which is the mere apparatus for the production of exudation ; not upon the nervous system, which conducts impressions to or from this apparatus ; and not on the texture, which is the seat of the exudation, as that varies, whilst the cancerous or tubercular formation is the same ; but in the inherent composition or constitution of the exudation itself. On this point most pathologists are agreed ; and hence the supposed existence of various kinds of *dyscrasiæ* originating in the blood, which it is imagined explain the different results produced. But here pathologists pause : once traced back to the blood, they are content ; and they have not sufficiently taken into consideration that the blood itself is dependent for its constitution on the results of the primary digestion in the alimentary canal on the one hand, and the secondary digestion in the tissues on the other. Yet it must be evident to every physiologist that if it be the constitution of the blood which determines the nature of the exudation, the causes which produce this must be sought in those circumstances which operate on the composition of the former fluid.

Now, numerous facts render it probable that, while the blood is normal in simple exudation, it contains an excess of nutritive materials in cancerous, and a deficiency of them in tubercular exudation. These are points, however, which can only be established after examining instances of such exudations in detail. But it must not be forgotten, in the meantime, that as the blood is continually undergoing changes, is receiving and giving off new matters, it can scarcely happen that it remains the same for many hours together. An exudation at one time may be very different from that at another. At one period it may abound in elements which do not exist in it at the next. Hence it often happens that a concurrence of circumstances is necessary to occasion a certain result. A cancer, once formed, may remain local until such a series of events arises, comprising, first, the phenomena leading to and producing an exudation ; secondly, the occurrence of this exudation in some other tissue or organ sufficiently predisposed for the purpose ; and thirdly, a peculiar constitution of the blood. Hence why the histologist is continually finding all kinds of intermediate formations between the three leading kinds of exudation, and why, even when the constitution is thoroughly cancerous or tubercular, simple exudations may be poured into tissues as the result of recent wounds or injuries. But, whilst a recent cancerous or a tubercular exudation may be found to accompany, or alternate with, a simple exudation, the two former are seldom met with together ; a circumstance which still further points out the wide difference between the constitutional causes producing them.

The final termination of either kind of exudation may be the same, only each has its peculiarities. We have noticed the tendencies of simple exudation to be transformed into pus or fibres, according to its seat. In the former case, the pus cells break down, and are re-absorbed in a disintegrated and fluid condition into the blood ; in the latter, permanent fibrous tissue is produced, constituting chronic adhesions or cicatrices. The cells of a cancerous growth may also degenerate or decay, but this rarely takes place throughout the whole structure. But it is not uncommon to find in certain encephalomatous tumours yellow matter, either in masses or reticulated through its substance (*cancer reticulare* of Müller). This is generally owing to fatty degeneration of the cancer cells. (See "Fatty Degeneration," in this article). The fibrous structure of cancer may also increase, and occa-

sionally produce cicatrization. Tubercle possesses no such fibrous stroma; but is infiltrated among the elements of various organs, the vascularity of which it tends to destroy. This, indeed, is the reason why a cancerous tumour increases by growth, which tubercle cannot be said to do; the former is vascular, the latter is not: in the one, cells are formed which have the power of re-development; in the other, no reproductive cells are produced. In cancer, the morbid matter circulating in the blood (whatever that is) is concentrated or attracted to the cancerous part, and should none afterwards be present, the healthy blood is made subservient to the purpose of nourishing a foreign growth. In tubercle, successive fresh exudations only are made, which, by their accumulation, augment the volume or amount of the morbid product.

All three forms of exudations may be rendered abortive by the animal matter being broken down and absorbed, while the mineral matter remains, constituting a cretaceous or calcareous concretion. This is not unfrequently seen as the result of simple exudation; is rare in cancerous, but very common in tubercular exudation.

During the disintegration of simple, cancerous, and tubercular exudations, the animal matter broken down is again rendered fluid, re-passes into the blood, and then constitutes that excess of fibrin detected by chemists. The quantity of this will of course vary according to the amount of the exudation and the activity of the disintegrating process. In the blood this effete matter undergoes a series of chemical changes, preparatory to its excretion by the different emunctories, but more especially by the kidneys, in the form of various sediments. The resolution of simple exudation is generally accompanied by the presence of such urinary sediments, which indicate pretty clearly in what way, after it has passed through the phases of development described, it is at length discharged from the body. In the same manner, the amount of these sediments frequently points out the extent of absorption going on in cancerous and tubercular exudations.

Another theory has been advanced regarding the various products of exudation as we have described them—viz., that instead of being new formations in an exuded blood plasma, they are only modifications of pre-existing texture. According to this view, pus-cells are only altered epithelial ones, cancer-cells are an increased development of gland or other cells, and tubercle corpuscles are a degeneration or "necrosis" of these. This theory, though it has many facts for its support, is opposed by others; so that its fallacy is easily demonstrated. For instance, pus-cells may occur in tissues where no epithelial cells exist, as among muscles, while cancer and tubercle are both found in the white substance of the brain, where there are no cells to develop themselves in the one case, or to degenerate in the other.

Theory of Morbid Growths.

This comprehends a consideration of the origin, development, propagation, and decline of morbid growths. Doubtless many facts are yet to be discovered as to the structure, chemical composition, and mode of formation of morbid growths; but enough has been ascertained of late years, from combined histological and clinical research, to necessitate great modifications in the views previously held regarding them. The following account, it is only right to say, is derived not only from careful study of what has been written by others, but from a large amount of original investigation.

Origin of Morbid Growths.—All morbid growths consist—1*st*, In augmented development of pre-existing textures (so-called *homologous* or *homeomorphous* growths); 2*d*, Of new elements which have no previous existence in the economy (so-called *heterologous* or *heteromorphous* growths); and, 3*d*, Of these two sorts of growth mingled together. The causes which induce them are of two kinds,—1*st*, Local irritation, excited directly or indirectly; and, 2*d*, Constitutional or unknown changes, supposed to operate through the blood. Thus the direct stimulus of a blow may so irritate the tissue of a part as to excite increased nutritive action, so causing hypertrophy, or it may give rise to an exudation; and irritation at a distance may, through the nervous system, produce like effects, as when the female mamma is influenced by the state of the uterus. If, on the other hand, the constitution be affected, such local changes may assume peculiar characters. In this manner, age, sex, hereditary predisposition, and concomitant disorders, as syphilis and cancer, not only modify, but give rise to morbid growths.

It has been a favourite idea with pathologists that morbid growths have fixed tendencies from the beginning, such as are impressed upon the ova of various animals, in virtue of which they are necessarily developed in certain directions. If so, this is not traceable to any peculiarity of structure or chemical composition. In this respect morbid growths are like healthy ones, which, however different in ultimate composition, all originate in a finely molecular blastema. A careful observation of the subsequent development of these growths, however, seems to indicate that specific differences are not impressed upon them from the first—that one does not, as a matter of course, exclude the other, and that any of the classes into which they have been divided may supervene upon pre-existing ones. For instance, persons may have a fibrous or glandular growth, and after a time its blood-vessels may pour into it a cancerous exudation, or this latter may undergo a fibrous or fatty transformation. It is only in this manner we can explain numerous cases, which are daily observable in practice, where indolent fibrous tumours suddenly assume increased power of development, and become cancers, or where these last slough out, and subsequently cicatrize.

Besides these constitutional causes, locality and the nature of pre-existing textures have a considerable influence on the formation of morbid growths. Thus, as a general rule, fibrous growths are common in fibrous textures, cartilaginous and bony growths in osseous ones, epithelial growths on epidermic and mucous membranes, and so on. Yet even here the system generally occasions differences. For example, osseous growths in rheumatic constitutions occur at the extremities of long bones; but in syphilitic ones, choose in preference their shafts. In youth, epithelioma occurs in the form of warts on the hands; in syphilitic people it occurs in the genitals; in chimney-sweeps, on the scrotum; in smokers, on the lips, &c. This conjoined influence of constitution and locality indicate the complex causes necessary to produce the results, a study of which is of the greatest moment to the physician, who is desirous, through the former, of operating on the latter, or the contrary, as previously explained in the sketch of the function of nutrition.

Development of Morbid Growths.—All morbid growths, once formed, continue to grow according to the histological laws which regulate development in the textures generally; that is to say, after arriving at a certain point, they attract from the blood-vessels in the neighbourhood, or from such new ones as are formed within themselves, the nutritive materials whereby they augment in bulk. In voluntary muscular fibre, this appears to be accomplished by the fasciculi multiplying fissiparously. In non-voluntary contractile fibre, also, the individual fusiform cells multiply, enlarge, and elongate; a change well observed in the pregnant uterus, in which organ many of the small non-contractile spindle-shaped fibres enlarge, become contractile, and then undergo the fatty degeneration, break down, and

ultimately disappear. In the same manner, the elementary parts in hypertrophies of other textures augment fissiparously or endogenously, as in bone and cartilage.

Other forms of morbid growth, especially tumours, are very variable as to rapidity of increase and volume; but the manner in which the development is accomplished is of three distinct kinds:—*1st*, The elementary textures are produced in the same manner as they are in adult tissues. They are either more numerous or larger, but preserve their normal relation and mode of arrangement (*lipoma, adenoma, angionoma*). *2d*, A matter is thrown out from the blood, which serves as a blastema for the formation of cells, which may be detected in various stages of development, undergoing the same changes that similar textures are seen to present in the embryo (*fibroma, osteoma*). *3d*, The cells, whether pre-existing or newly formed, assume such a property of self-multiplication that their normal relation and mode of arrangement is destroyed (*epithelioma, enchondroma, carcinoma*). These three modes of increase may occur singly or united. Any one or two of them may be superadded to the third, and their occurrence at different times, and in various proportions, accounts to a great extent for the apparent anomalies exhibited in the progress of individual growths.

The third mode of development just alluded to deserves special consideration. It consists of the same kind of endogenous multiplication of cells, with this difference, that sometimes these cells previously existed, whilst at others they have been newly formed in an exudation. Thus the cells in softened cartilage or brain, and those in encephaloma, may be identical; yet the one takes its origin in pre-existing normal cells, whilst the other must arise in the new cells of an exudation, as the white substance of the brain contains no corpuscles from which they could be developed. In the cornea and epithelium similar changes occur, as well as in the bones and mesenteric glands. Yet this lesion, so closely allied in its essential nature, has in these different textures been called by different names, and widely separated pathologically. In the non-vascular cornea and cartilage it has been called *inflammation*, but in the equally non-vascular epithelium it has been named *cancer*. Again, in the vascular bones and glands it has received various names, such as *osteo*, or *medullary sarcoma, enlarged glands*, &c.; whilst in the brain and other localities it has been called *encephaloma*, or *soft cancer*. It seems to us that in all these cases the lesion is the same, and that an advanced knowledge of their nature should lead us to group them together. Calling some of them inflammation, and others cancer, supposing the first to be innocent, and the last malignant, is, we contend, incorrect pathology. True theory points out that all these lesions are equally destructive, in consequence of increased endogenous cell growth, and practical experience has long determined the question of their being alike difficult to control.

As a general rule, the greater the number of cells any growth contains, the more rapidly it extends. Hence why a tumour is subject to the laws which govern development and multiplication of cells in addition to those connected with locality and the general powers of the constitution. Thus, room for expansion and the amount of temperature and moisture exercise undoubted influence over morbid growths. We see the influence of room for expansion in the cases of adenoma and carcinoma. In adenoma the cells are confined within pouches or ducts. They become crowded on each other; and thus, by means of compression, tend to atrophy and breaking down, rather than to self-multiplication. This is assisted if the distension from within so irritates the fibrous stroma of the gland that it becomes hypertrophied, and occasions a further obstacle to expansion around the seat of cell increase. In carcinoma, we observe that the growth takes place in extent and rapidity proportionally to the number and power of expansion in the cells. If compressed by much fibrous or hard tissue, they multiply slowly; but if an ulceration occurs, say in the skin, then they become developed rapidly, and constitute the so-called soft fungoid excrescences. Heat and moisture, as they are essential to cell growth throughout the animal and vegetable worlds (increased temperature with fluidity favouring—cold, and dryness checking it, within certain limits), so the influence of these physical agents may be observed to be equally powerful in morbid growths. Rapid augmentation of a tumour is generally accompanied by increased heat and softening of the parts, whilst colder and harder swellings develop themselves slowly.

Propagation of Morbid Growths.—It has seemed to most pathologists that, while some morbid growths are local, and if removed by the surgeon, do not return, others are constitutional or general, and if cut away, exhibit a great tendency to come back. The former have been called *innocent* or *benignant*, and the latter *malignant*. So far has the notion of malignancy in certain growths been carried, that surgeons have refused to remove them, not because they are inaccessible, or so connected with anatomical parts as to render the operation directly dangerous to life, but simply because they thought the disease was in the blood, and that cutting away the local swelling would either be useless, or give increased activity to the lesion.

But modern research has demonstrated that every kind of morbid growth may be malignant in whatever sense that term be employed, whether used to signify a growth incurable; recurring after the operation or primary lesion; as infiltrating neighbouring or distant tissues and organs; or as continuing its progress and destroying life in spite of all the resources of art. On the other hand, it is easy to prove that all these forms of growth may either disappear spontaneously, or be cured successfully by operation. While, however, we contend that there is no growth which may not be malignant, and none which may not be innocent, it is not denied that some have a greater tendency to spread and affect the system than others. In reference to treatment, therefore, it becomes of the greatest importance to determine the laws which apparently govern the propagation and multiplication of morbid growths, or the circumstances which render—say carcinoma and epithelioma—more susceptible of being communicated to neighbouring and internal organs than purely fibrous or osseous ones.

There is one circumstance which has been overlooked by pathologists, viz., that certain growths abounding in cells have a great disposition to infiltrate themselves among muscles and neighbouring parts, and may be detected there by the microscope, although invisible to the naked eye. In many cases where the surgeon thinks he has removed a morbid growth, he really leaves multitudes of germs behind, which continue to propagate the disease. Hence one of the chief causes of propagation among growths is, that the cells in the process of development become infiltrated among neighbouring tissues. But how do they accomplish this? Van der Kolk suggests that the fluids which they contain mingle with the juice of the parenchymatous substance around them, and that in the latter there are deposited molecules and granules, which, having received from the former certain tendencies to evolution, are ultimately transformed into similar structures. This view is not only exceedingly ingenious but very probable, and will serve to explain how the blood and distant organs are secondarily affected. The notion of solid germs floating in the blood has no facts in its support, but the idea of a fluid secreted by cells being absorbed is consonant with every known law of nutrition.

The fluid, then, of a morbid growth, elaborated in the

process of its development, and the result of cell or other formation, would seem to be the most probable material whereby secondary growths are produced. We have seen that many tumours which have no cells may be recurrent, and attack tissues secondarily. Still, they all contain a parenchymatous juice, and as a general rule those that are most soft and pulpy are most liable to return. Many facts, therefore, show that constitutional tendencies do exist for the reproduction of morbid growths similar to those which have previously been formed. A recurrence of all diseases, and especially of apoplexy, epilepsy, rheumatism, bronchitis, &c., is equally common, and appear to follow the same law. But the idea, that *because* they do so they should be separated under the name of "malignant," appears to us unpathological. Multiplying the numbers of cancers seems equally faulty. We may just as correctly talk of a rheumatism being innocent or malignant, as apply those terms in different cases to fibrous, cartilaginous, osseous, or other kinds of morbid growth, for no other reason than because sometimes they are local, and at others more general.

Decline or Degeneration of Morbid Growths.—In their decline, as in their development, the various kinds of morbid growths follow the laws which regulate degeneration of texture. Some, as lipoma and adenoma, have been known to be gradually absorbed and disappear. Others undergo the albuminous, fatty, mineral, or pigmentary transformations to be subsequently described. To enter into the peculiarities of each morbid growth in this respect would lead us too far. All that need be said here is, that every kind of morbid growth may degenerate, and prove abortive in one way or another. Cancer especially has been known to slough out, and heal by cicatrix, besides having been checked in its development and rendered abortive in every known mode of retrograde transformation.

Theory of Degeneration of Texture.

Degenerations of texture, as previously stated, may be classified into four groups,—viz., the Albuminous, Fatty, Pigmentary, and Mineral degenerations.

Albuminous Degeneration.—It has been previously pointed out that albumen is essential to nutrition, and that it forms the basis of the blood and of the tissues. The flesh which constitutes the food of Carnivora, and the albumen which comprises so large a portion of the fodder of Graminivora, are alike, by the solvent action of the digestive juices, reduced to a fluid state. In this condition it passes into the blood, forming the walls of the blood corpuscles, besides entering largely into the constitution of the *liquor sanguinis* as serum,—that is, albumen dissolved in water. During the building up process of the former it undergoes various transformations, among which those of its conversion into the fibrin of flesh and the gelatine of bones are perhaps the most important. By its association with the other proximate principles also, it enters into the composition of every texture and organ in the body, and again joins the blood as albumen, mixed with a minute portion of effete matter as fibrin. There can be no doubt, as we shall subsequently see, that under certain circumstances it may be changed into fat; and the multitudinous transformations this important element is susceptible of making well merits the term which, in its pure state, Mulder bestowed upon it, namely, that of "proteine."

As albumen, we have seen how it may produce abnormal states of the tissues in various forms. The essential conditions for this kind of degeneration appear to be—1*st*, Extreme slowness of effusion from the blood-vessels, as in cases of chronic tubercle and fibroid transformation; and 2*d*, Mechanical obstruction of the veins in some part of the circulation, giving rise to dropsy. In the former case, it is favoured by excess of acidity in the primæ viæ, which, by its power of dissolving the albuminous compounds, must assist in adding this element to the blood in undue proportion. Why, on the other hand, muscles, cartilage, and the exudations should sometimes pass into the albuminous fibroid degeneration, under pretty much the same circumstances that at others they become fatty, is a point in pathology which is still involved in the utmost obscurity.

Fatty Degeneration.—The causes of fatty degeneration are to be sought in all those circumstances which, while they weaken the vital action of a part, do not interfere materially with the assimilation of hydro-carburets. Yet the disease is not purely local, as it may frequently be observed that the kidneys, liver, heart, and other textures are prone to undergo the fatty change in the same person. Hence everything that increases fatty matter in the blood, such as its introduction by means of assimilation, or its not passing off in consequence of diminished excretion, tends to its production. Thus indulgence in rich food, and alcoholic liquors abounding in carbon, especially if there be little exercise, occasion it. Whether the fatty matter be deposited directly from the blood, or whether it be the subsequent result of a chemical transformation of tissue or exudation, has excited great discussion. Dr Quain supports the latter view, and has performed experiments, whereby it would seem that healthy muscular fibrin may be rendered fatty artificially by digesting it for a fortnight in water. We have repeatedly seen muscles and bones converted into adipocere during the maceration in water necessary to clean the latter, and frequently examined the former during the process, so as to be satisfied that the fibrinous material of flesh undergoes a chemical transformation into fat. We believe with Quain that the same thing occurs in the living body, not only when dead tissues are inclosed in it, as in the experiments of Wagner, but slowly in living texture, until its vigour is at length so impaired that it is incapable of performing its function. This view in no way excludes the probability that in certain cases fatty matter may transude occasionally through the vessels in a fluid state, and collect outside, or be infiltrated to a certain extent among neighbouring textures in a molecular form. Further, we have seen that it may occur within cells as a secretion; and by its accumulation not only may cause atrophy of the nucleus, but obstruction of tubes, and an endless variety of organic and functional derangements in the economy, according to the extent and seat of the degeneration.

Pigmentary Degeneration.—The formation and modifications of pigment, as observed in plants and animals, is a subject which has been little studied, and opens up a wide field of inquiry for the chemical histologist. But in endeavouring to ascertain the causes which give rise to change of colour in the textures, we may attend to the following circumstances :—

1*st*, Colouring matter bears a certain relation to the non-nitrogenous and oily constituents both in plants and animals. Thus, vegetable oils and resins are seen to form where starch or chlorophyle is collected, and these substances disappear in the cells, as the quantity of oil in them increases. In animals we almost always find pigment associated with fat. The brilliant colours of the Invertebrata are so many coloured fats, and the pink fat of the salmon, and green fat of the turtle, indicate the same relation in animals higher in the scale. The epidermic appendages, which are generally coloured, are always covered with fat, secreted by a special apparatus—the sebaceous glands. The blood corpuscles are intimately associated with the chyle, which is an oily emulsion; and the bile is rich in fat. In diseased conditions of the liver, the hepatic cells often contain oil, to the exclusion of the yellow pigment.

2*d*, It would appear that light, heat, and exposure to atmospheric air are connected with the production of pigment. The young leaves of plants are much lighter than

those which are older, and the hair of young animals is not so dark as that of the adult. In autumn, the leaves fade, and become brown, reddish, or yellow; and in man, we observe that the pigment of the hair ceases to be formed in advanced age, which at length becomes white. Young fruit is green, and as it ripens the part exposed to the sun is most coloured. Exposure of the skin of man, as is well known, renders it darker, and the fairest skinned individuals (whose integuments are well loaded with fat) are those who are most subject to freckles. Then it must be remembered that while light evolves colour in living, it destroys pigment in dead textures.

Now, the decomposition of the atmosphere is carried on in vegetables by the leaves, under the stimulus of light, and in animals by the lungs and skin. In plants the leaves fix the carbon and give off the oxygen; in animals the lungs receive oxygen, while carbon is separated in the form of carbonic acid by the same organs, and oxygen in combination with water, in the form of exhalation, is given off both by the lungs and skin. That the skin is connected with respiration is proved by the fact, that if its functions are interrupted, pulmonary diseases, and even asphyxia, are the common results. Carbon is also separated in the form of oily matter largely by the skin and by the liver, an organ also connected with respiration. Hence why Europeans in tropical climates, by breathing a rare atmosphere, eating well, and taking little exercise, are liable to hepatic diseases. Thus the lungs, skin, and liver are intimately associated in the function of excreting carbon; and it is curious that these are the three organs in which pigment is formed. The blood must be brought to the lungs to receive fresh oxygen and give off its carbonic acid, and it is then the white corpuscles of the chyle become coloured, while the blood itself is rendered bright scarlet. On the other hand, the accumulation of carbonic acid in the capillaries communicates the darker tint characteristic of venous blood.

3*d*, There seems to be a certain connection between the materials introduced into the structure of the plant or animal by means of the soil and of food. Some plants are rich in acids, others in alkalies, or various salts originally derived from the soil, and we have seen that these re-agents operate on colouring matter. Although this subject has been very slightly investigated, we can still perceive how, by the evolution of chemical products acting on different pigments, the various shades of colour may be occasioned which we observe in most plants and some animals at certain seasons. Thus green chlorophyle may be changed in one place into a yellow resin, and in another, by the formation of ulmic or other acids, be transformed to reddish or brown. In animals, the influence of nutrition is traced with more difficulty; but even here we may discern that at certain seasons (such as that of breeding) new products are evolved, which, by operating on the blood or the vital properties of cells, may eliminate more or less colour. According to Hensinger, carbonaceous food used in excess tends to the production of pigment, and hence he explains how the Greenlanders, notwithstanding the cold, are dark coloured from their constant consumption of fat.

Mineral Degeneration.—We have already seen that sometimes this takes place in such a regular manner as to form bone, which replaces the pre-existing texture,—as in muscle, membrane, or certain exudations and tumours. But at others it enters into the constitution of a texture dissolved in fluid, and is thus deposited in or throughout its substance, changing its physical and destroying its vital characters. In this way we separate mineral degenerations from concretions, which are accidental collections in hollow viscera, although undoubtedly they insensibly pass into one another. There is scarcely perhaps any tissue, whether elementary or compound, that may not undergo the mineral degeneration. But it is frequently observed in the coats of blood-vessels more or less associated with atheroma, in exudations, in certain morbid growths—rarely in nervous texture.

All these forms of degeneration may pass into concretions, but are separated from them essentially by being transformations of tissue; while concretions, for the most part, are primary precipitations from fluids.

Theory of Parasitic Growths.

Vegetable Parasites.—It was the demonstration by Bassi in 1837 of the vegetable nature of the disease named *muscardine* in silk-worms, which causes so great a mortality among those animals, which opened up to pathologists a new field for observation, and led to the discovery that certain disorders in the higher animals, and even in man himself, were connected with the growth of parasitic plants of a low type. Schönlein of Berlin was the first to detect them in favus-crusts; and since then they have been found in mentagra, pityriasis, and other diseases of the skin, in various exudations on mucous surfaces, in the stomach of dyspeptics, and in tubercular cavities of the lungs. They belong to the lowest forms of vegetable life, never reaching an organization higher than the Algæ and Fungi. They grow in such portions of diseased animal matter as present certain conditions necessary for their germination, and seldom, if ever, spring from the healthy tissues. Such growths in living animals indicate impairment of the nutritive functions, or diminished vital power in the economy. Hence why they are commonly found in young or scrofulous persons with skin eruptions, and in such as are labouring under prostrating diseases,—as typhus, dysentery, or other epidemic disorders. Numerous efforts to propagate these vegetations in healthy tissues have failed, but if inflammation be excited, or abrasions and sores occasioned, then, by fastening down portions of the fungus, it may be made to grow on the unhealthy parts. Boys at school frequently propagate the disease by wearing each other's caps, or using the same combs. Hence why *favus*, or ringworm, is so difficult to eradicate from charity institutions and extensive schools. The mode of development of these growths is the same essentially as that of most cryptogamic plants, and may be easily seen in any well characterized specimen of favus-crust. This consists of branched thalli, with variable-sized elongated cells, separated by partitions, the terminal ones forming mycelia, with sporules forming within them. Occasionally they present round clusters or chains at the extremity of the branches. The square masses of Sarcina are developed fissiparously.

Animal Parasites enter the body by the food or drink; others as ova, or in some stage of transformation. The mystery which so long enveloped the origin and development of tape-worms is now removed by the labours of modern helminthologists, as has been previously explained under the head of "Reproduction."

DISEASES OF INNERVATION.

The manner in which the different parts of the nervous system have their functions deranged or suspended is only to be understood by paying attention—1*st*, To the pathological laws which seem to govern morbid actions in them; and 2*d*, To the definition of what constitute special nervous diseases, and the general causes producing them. It should be remembered that the encephalon, spinal cord, and nerves consist of an aggregation of organs more or less connected together, the functions of which, especially as regards the different parts of the encephalon, are by no means determined. In health these act in harmony, but in disease they are so irregularly disordered that, while the action of one is excited, that of another may be perverted or annihilated. These

derangements of the nervous system are capable of assuming at various times every conceivable disorder of intelligence, sensation, and motion; so that not only may all kinds of diseases which have received names be simulated, but the symptoms may be so curiously combined as to set all arbitrary nosological classifications at defiance. If it be farther remembered that through the brain, spinal cord, and nerves the functions of every organ in the body may be more or less influenced, the endless variety of local as well as of general derangements may perhaps be imagined. Then nothing is more common than to observe some of the most fatal nervous diseases, such as hydrophobia, leaving after death no lesion detectable by the most careful histological examination, whilst on other occasions tumours and extensive destruction of the cerebral mass may exist, without producing any effects whatever. Notwithstanding these difficulties, careful observation, conjoined with a knowledge of physiology, will enable us to approximate closely towards, if not actually reach, a correct view of the disease in the great majority of cases.

GENERAL PATHOLOGY OF THE NERVOUS SYSTEM.

The following are the pathological laws which seem to regulate diseased action of the nervous centre.

1. *The amount of fluids within the cranium must always be the same so long as its osseous walls are capable of resisting the pressure of the atmosphere.*—That the circulation within the cranium is different from that in other parts of the body was first pointed out by the second Monro. It was tested experimentally by Dr Kellie of Leith, ably illustrated by Dr Abercrombie, and successfully defended by Dr John Reid. The views adopted by these distinguished men were, that the cranium forms a spherical bony case capable of resisting the atmospheric pressure, the only openings into it being the different foramina by which the vessels, nerves, and spinal cord pass. The encephalon, its membranes and blood-vessels, with perhaps a small portion of the cerebro-spinal fluid, completely fill up the interior of the cranium, so that no substance can be dislodged from it without some equivalent in bulk taking its place. Dr Monro used to point out that a jar or other vessel similar to the cranium, with unyielding walls, if filled with any substance, cannot be emptied without air or some substance taking its place. To use the illustration of Dr Watson, the contents of the cranium are like beer in a barrel, which will not flow out of one opening unless provision be made at the same time that air rushes in. The same kind of reasoning applies to the spinal canal, which, with the interior of the cranium, may be said to constitute one large cavity, incompressible by the atmospheric air.

Before proceeding further, we must draw a distinction between pressure on, and compression of, an organ. Many bodies are capable of sustaining a great amount of pressure without undergoing any sensible decrease in bulk. By compression must be understood that a substance occupies less space from the application of external force, as when we squeeze a sponge, or compress a bladder filled with air. Fluids generally are not absolutely incompressible, yet it requires the weight of one atmosphere, or 15 lb. on the square inch, to produce a diminution equal to $\frac{1}{20000}$th part of the whole. Now, this is so exceedingly small a change upon a mass equal in bulk to the brain as not to be appreciable to our senses. Besides, the pressure on the internal surface of the blood-vessels never exceeds 10 or 12 lb. on the square inch during the most violent exertion; so that, under no possible circumstances can the contents of the cranium be diminished even the $\frac{1}{20000}$th part. When the brain is taken out of the cranium, it may, like a sponge, be compressed by squeezing fluid out of the blood-vessels; but during life, surrounded as it is by unyielding walls, this is impossible. For let us, with Abercrombie, say that the whole quantity of blood circulating within the cranium is equal to ten,—that is, five in the veins, and five in the arteries; if one of these be increased to six, the other must be diminished to four, so that the same amount, ten, shall always be preserved. It follows, that when fluids are effused, blood extravasated, or tumours grow within the cranium, a corresponding amount of fluid must be pressed out, or of brain absorbed, from the physical impossibility of the cranium holding more matter. At the same time, it must be evident that an increased or diminished amount of pressure may be exerted *on* the brain proportioned to the power of the heart's contraction, the effect of which will be, not to alter the amount of fluids within the cranium, but to cause, using the words of Abercrombie, "a change of circulation" there.

Dr Kellie performed numerous experiments on cats and dogs in order to elucidate this subject. Some of these animals were bled to death by opening the carotid or femoral arteries, others by opening the jugular veins. In some the carotids were first tied, to diminish the quantity of blood sent to the brain, and the jugulars were then opened, with the view of emptying the vessels of the brain to the greatest possible extent; while in others the jugulars were first secured, to prevent as much as possible the return of the blood from the brain, and one of the carotids was then opened. He inferred, from the whole inquiry, which was conducted with extreme care,—"That we cannot, in fact, lessen to any considerable extent the quantity of blood within the cranium by arteriotomy or venesection; and that when, by profuse hæmorrhages destructive of life, we do succeed in draining the vessels within the cranium of any sensible portion of red blood, there is commonly found an equivalent to this spoliation in the increased circulation or effusion of serum, serving to maintain the plenitude of the cranium."

Dr Kellie made other experiments upon the effects of position immediately after death from strangulation or hanging. He also removed a portion of the unyielding walls of the cranium in some animals by means of trephine, and then bled them to death; and the differences between the appearances of the brain in these cases, and in those where the cranium was entire, were very great. One of the most remarkable of these differences was its shrunk appearance in those animals in which a portion of the skull was removed, and the air allowed to gravitate upon its inner surface. He says,—"The brain was sensibly depressed below the cranium, and a space left, which was found capable of containing a teaspoonful of water."

It results from these inquiries that there must always be the same amount of fluids within the cranium so long as it is uninjured. In morbid conditions these fluids may be blood, serum, or pus; but in health, as blood is almost the only fluid present (the cerebro-spinal fluid being very trifling), its quantity can undergo only very slight alterations. There are many circumstances, however, which occasion local congestions in the brain, and consequently unequal pressure on its structure, in which case another portion of its substance must contain less blood, so that the amount of the whole, as to quantity, is always preserved. These circumstances are mental emotions, hæmorrhages, effusions of serum, and morbid growths. Such congestions, or local hyperhemias, in themselves constitute morbid conditions; and nature has to a great extent provided against their occurrence under ordinary circumstances, by the tortuosity of the arteries and the cerebro-spinal fluid, described by Magendie.

Dr Burrows has brought forward several observations and experiments, which he considers opposed to the theory

now advocated. His facts are perfectly correct. We have repeated his experiments on rabbits, and can confirm his descriptions. It is the inferences he draws from them that are erroneous. For the paleness which results from hæmorrhage, and the difference observable in the colour of the brain when animals immediately after death are suspended by their ears or by their heels, is explicable by the diminished number of coloured blood particles in the one case, and by their gravitation downwards in the other. That the amount of fluid within the cranium was in no way affected, is proved by the plump appearance of the brains figured by Dr Burrows, and the total absence of that shrunken appearance so well described by Dr Kellie. Neither does our observation of what occurs in asphyxia or apnœa oppose the doctrine in question, as Dr Burrows imagines, but rather confirms it.

On the whole, whether we adopt the terms of local congestion, of change of circulation within the cranium, or of unequal pressure, our explanation of the *pathological* phenomena may be made equally correct, because each of these modes of expression implies pretty much the same thing. But if we imagine that venesection will enable us to diminish the amount of blood in the cerebral vessels, the theory points out that this is impossible, and that the effects of bleeding are explained by the influence produced on the heart, the altered pressure on the brain exercised by its diminished contractions, and the change of circulation within the cranium thereby occasioned.

2. *All the functions of the nervous system may be increased, perverted, or destroyed, according to the degree of stimulus or disease operating on its various parts.*—Thus, as a general rule, it may be said that a slight stimulus produces increased or perverted action, whilst the same stimulus, long continued or much augmented, causes loss of function. All the various stimuli, whether mechanical, chemical, electrical, or psychical, produce the same effects, and in different degrees. Circumstances influencing the heart's action, stimulating drinks or food, act in a like manner. Thus, if we take the effects of alcoholic drink for the purpose of illustration, we observe that, as regards combined movements, a slight amount causes increased vigour and activity in the muscular system. As the stimulus augments in intensity, we see irregular movements occasioned, staggering, and loss of control over the limbs. Lastly, when the stimulus is excessive, there is complete inability to move, and the power of doing so is temporarily annihilated. With regard to sensibility and sensation, we observe cephalalgia, tingling, and heat of skin, *tinnitus aurium*, confusion of vision, *muscæ volitantes*, double sight, and lastly, complete insensibility and coma. As regards intelligence, we observe at first rapid flow of ideas, then confusion of mind, delirium, and, lastly, sopor and perfect unconsciousness. In the same manner, pressure, mechanical irritation, and the various organic diseases, produce augmented, perverted, or diminished function, according to the intensity of the stimulus applied or amount of structure destroyed.

Then it has been shown that excess or diminution of stimulus, too much or too little blood, very violent or very weak cardiac contractions, and plethora or extreme exhaustion, will, so far as the nervous functions are concerned, produce similar alterations of motion, sensation, and intelligence. Excessive hæmorrhage causes muscular weakness, convulsions, and loss of motor power, perversions of all the sensations, and lastly, unconsciousness from syncope. Hence the general strength of the frame cannot be judged of by the nervous symptoms, although the treatment of these will be altogether different, according as the individual is robust or weak, has a full or small pulse, &c. These similar effects on the nervous centres from apparently such opposite exciting causes, can only be explained by the peculiarity of the circulation previously noticed. A change of circulation within the cranium takes place, and whether arterial or venous congestion occurs, pressure on some portion of the organ is equally the result. The importance of paying attention to this point in the treatment must be obvious.

3. *The seat of the disease in the nervous system influences the nature of the phenomena or symptoms produced.*—As a general rule, it may be stated that disease or injury of one side of the encephalon especially influences the opposite side of the body. It is said that some very striking exceptions have occurred to this rule, but these at any rate are remarkably rare. Besides, it is probable that, inasmuch as extensive organic disease, if occurring slowly, may exist without producing symptoms, whilst it is certain most important symptoms may be occasioned without organic disease, even these few exceptional cases are really not opposed to the general law. Then, as a general rule, it may be said that diseases of the brain proper are more especially connected with perversion and alteration of the intelligence; whilst diseases of the cranial portion of the spinal cord and base of the cranium are more particularly evinced by alterations of sensation and motion. In the vertebral portion of the cord, the intensity of pain and of spasm, or want of conducting power, necessary to sensation and voluntary motion, indicates the amount to which the motor and sensitive fibres are affected. Further than this we can scarcely generalize with prudence.

The fatality of lesions affecting various parts of the nervous centres varies greatly. Thus the hemispheres may be extensively diseased, often without injury to life, or even permanent alteration of function. Convulsions and paralysis are the common results of disease of the ganglia in the cranial portion of the cord. The same results from lesion of the *pons Varolii*. But if the *medulla oblongata*, where the eighth pair originates, be affected, or injury to this centre itself occur, it is almost always immediately fatal.

4. *The rapidity or slowness with which the lesion occurs influences the phenomena or symptoms produced.*—It may be said, as a general rule, that a small lesion—for instance, a small hæmorrhagic extravasation—occurring suddenly, and with force, produces, even in the same situation, more violent effects than a very extensive organic disease which comes on slowly. This, however, will depend much upon the seat of the lesion. Very extraordinary cases are on record where large portions of the nervous centres have been much disorganized without producing anything like such violent symptoms as have been occasioned at other times by a small extravasation in the same place. Here, again, the nature of the circulation within the cranium offers the only explanation, for the encephalon must undergo a certain amount of pressure, if no time be allowed for it to adapt itself to a foreign body; whereas any lesion coming on slowly enables the amount of blood in the vessels to be diminished according to circumstances, whereby pressure is avoided.

5. *The various lesions and injuries of the nervous system produce phenomena similar in kind.*—The injuries which may be inflicted on the nervous system, as well as the morbid appearances discovered after death, are various. For instance, there may be an extravasation of blood, exudation of lymph, a softening, a cancerous tumour, or tubercular deposit, and yet they give rise to the same nervous phenomena, and are modified only by the circumstances formerly mentioned, of degree, seat, suddenness, &c. Certain nervous phenomena also are of a paroxysmal character, whilst the lesions supposed to occasion them are stationary or slowly increasing. It follows that the effects cannot be ascribed to the nature of the lesions, but to something which they all have in common; and this apparently may consist of—1*st*, Pressure, with or without organic

change; 2*d*, More or less destruction or disorganization of nervous texture. Further, when we consider that the same nervous symptoms arise from irregularities in the circulation; from increased as well as diminished action; sometimes when no appreciable change is found, as well as when disorganization has occurred; the theory of local congestions to explain functional alterations of the nervous centres seems the most consistent with known facts. That such local congestions do frequently occur during life without leaving traces detectable after death, is certain; whilst the occurrence of molecular changes, or other hypothetical conditions which have been supposed to exist, have never yet been shown to take place under any circumstances.

SPECIAL PATHOLOGY OF THE NERVOUS SYSTEM.

The special disorders of the nervous system may be classified into—1*st*, Cerebral; 2*d*, Spinal; 3d, Cerebro-spinal; 4*th*, Neural; and 5*th*, Neuro-spinal; according as the brain, spinal cord, or nerves are affected alone, or in combination. Aberrations of intellect always depend on cerebral disturbance, while perversions of motion and sensibility, if extensive, indicate spinal, and if local, neural disorder. Thus, insanity and apoplexy are cerebral; tetanus and chorea, spinal; epilepsy and catalepsy are cerebro-spinal; neuralgia and local paralysis are neural; and all combined spasms, dependent on diastaltic or reflex actions, are neuro-spinal. The following is an enumeration of nervous disorders, with the meanings that ought to be attached to them.

Classification of Diseases of Innervation.

I. *Cerebral Disorders, in which the cerebral lobes (or brain proper) are affected:—*

INSANITY, or mental aberration in its various forms, including *delirium*.

HEADACHE and other uneasy sensations within the cranium, such as lightness, heaviness, vertigo, &c. &c.

APOPLEXY.—Sudden loss of consciousness and of voluntary motion, commencing in the brain. The absence of consciousness necessarily involves that of sensation. The same condition as regards nervous phenomena exists in *syncope* and *asphyxia*, but the first of these commences in the heart, and the second in the lungs. Allied to apoplexy is coma or stupor, arising from various causes affecting the brain, such as pressure, or poisonous agents like alcohol, chloroform, opium, &c. &c.

TRANCE, or prolonged somnolence, either with or without perversion of sensation or motion. To this state is allied *ecstasy*, or unconsciousness with mental excitement.

IRREGULAR MOTIONS, SPASMS, &c., originating in excited or diminished voluntary power, as in certain cases of *dominant ideas, somnambulism, saltatory movements, tremors*, &c.; or, on the other hand, *incapability of movement* from langour, surprise, mental agitation, &c. &c.

II. *Spinal Disorders, in which the cranial and vertebral portions of the spinal cord are affected:—*

SPINAL IRRITATION.—Pain in the spinal column, induced or increased by pressure or percussion, often associated with a variety of neuralgic, convulsive, spasmodic, or paralytic disorders affecting in different cases all the organs and viscera of the body, and so giving rise to an endless number of morbid states.

TETANUS.—Tonic contraction of the voluntary muscles. *Trismus*, if confined to the muscles of the jaw; *Opisthotonos*, if affecting the muscles of the back, so as to draw the body backwards; *Emprosthotonos*, if affecting the muscles of the neck and abdomen, so as to draw the body forwards; and *Pleurosthotonos*, if affecting the muscles of the body laterally, so as to draw the body sideways.

CHOREA.—Irregular action of the voluntary muscles, when stimulated by the will.

HYSTERIA.—Any kind of perverted nervous function, connected with uterine derangement. Nothing can be more vague than this term.

HYDROPHOBIA.—Spasms of the muscles of the pharnyx and chest, with difficulty in drinking and dread of fluids.

SPASMS AND CONVULSIONS.—Tonic and clonic contractions of the muscles of every kind and degree, not included in the above, originating in the cord (centric spinal diseases —Marshall Hall).

HEMIPLEGIA.—Paralysis of a lateral half of the body, generally dependent on disorders of the cranial portion of the spinal cord above the decussation in the *medulla oblongata*.

PARAPLEGIA.—Paralysis on both sides of the body, generally the lower half, in consequence of disorder of the vertebral portion of the spinal cord, below the decussation in the *medulla oblongata*.

III. *Cerebro-Spinal Disorders, in which both cerebral lobes and spinal cord are affected:—*

EPILEPSY.—Loss of consciousness with spasms or convulsions occurring in paroxysms. *Apoplexy with convulsion or paralysis* is also cerebro-spinal.

CATALEPSY.—Loss of consciousness with peculiar rigidity of muscles, so that when the body or a limb is placed in any position it becomes fixed.

ECLAMPSIA.—Tonic spasms with loss of consciousness in infants. The acute epilepsy of some writers.

IV. *Neural Disorders, in which the nerves are affected during their course or at their extremities:—*

NEURALGIA.—Pain in the course of a nerve, although in fact all kind of pain whatever is owing to irritation of the nerves. Thus the sympathetic system of nerves and its ganglia, though ordinarily giving rise to no sensation, may occasionally do so, as in *angina pectoris, colic, irritable testicle and uterus*, and in other agonizing sensations, referred to various organs.

IRRITATION OF THE NERVES OF SPECIAL SENSE.—Of the optic, causing *flashes of light, ocular spectra, muscæ volitantes*, &c.; of the auditory, causing *tinnitus aurium*; of the olfactory, causing unusual *sensitiveness to odour*; and of the gustatory, causing *perverted tastes* in the mouth. Itching, formication, and other sensations referable to the peripheral nerves, also belong to this class.

IRRITATION OF SPECIAL NERVES OF MOTION, as in local spasms of one or more muscles, or of the hollow viscera.

LOCAL PARALYSIS.—Loss of motion or sensibility in a limited part of the body, or confined to a special sense, as in *lead palsy*, or in *amaurosis, cophosis, anosmia, ageustia*, and *anæsthesia*.

V. *Neuro-Spinal Disorders, in which both the nerves and spinal cord are affected.*

DIASTALTIC OR REFLEX ACTIONS.—To this class belong all those diseases depending on irritation of the extremity of a sensitive nerve, acting *through* the cord and motor nerves on the muscular system, and producing a variety of spasmodic disorders, local or general, far too numerous to mention,—which can only be understood by a thorough knowledge of the physiology of the diastaltic or excito-motory system of nerves.

All these disorders may be the result of structural disease of the nervous system, or of what is called *functional derangement*, understanding by this a disease which, even when it causes death, leaves no trace of altered structure detectable with the aid of the microscope. Thus, tetanic rigidity may depend on a spinal arachnitis, as well as on

the irritation from a wound or poisoning by strychnine; and delirium and coma may be caused by cerebral meningitis, as well as by moral insanity, starvation, or poisoning by chloroform or opium. Whether in these cases there be in fact only one cause common to the whole, it is difficult to say; certainly it cannot be demonstrated. It might be contended that in every instance there is a certain amount of congestion producing unaccustomed pressure, or that a peculiar state of nutrition of the part is momentarily produced here or there in the nervous mass. But as neither theory appears to us applicable to all cases, we shall consider the pathological causes of nervous disorders as of four kinds,—1*st*, Congestive; 2*d*, Structural; 3*d*, Diastaltic; 4*th*, Toxic.

1. *Congestive Derangements of the Nervous System.*—The peculiar nature of the circulation within the cranium and vertebral canal has been previously pointed out, and we have seen that, although well defended under ordinary circumstances against any mischievous change, still, when such change does occur, it operates in a peculiar manner. In other words, so long as the bones are capable of resisting atmospheric pressure, although the amount of fluid within these cavities cannot change as a whole, yet the distribution of that amount may vary infinitely. Thus, by its being accumulated sometimes in the arteries, at other times in the veins, or now in one place and then in another, unaccustomed pressure may be exercised on different parts of the nervous centres. This, according to its amount, may either irritate or suspend the functions of the parts; a fact proved by direct experiment, as well as by innumerable instances where depression of bone has caused nervous phenomena which have disappeared on removal of the exciting cause. That congestion does frequently occur in the brain and spinal cord there can be no doubt, although it cannot always be demonstrated after death. The tonic contraction of the arteries is alone sufficient to empty them of their contents, and turgidity of the veins may or may not remain according to the symptoms immediately preceding death, and the position in which the body is placed. But it is observable that those causes which excite or diminish the action of the heart and general powers of the body are at the same time those which induce nervous disturbance, as well as occasion a change of circulation in the cerebro-spinal centres—such as the emotions and passions, plethora and anæmia, unaccustomed stimuli, uterine derangement, &c.

It is only by this theory that we can understand how such various results occasionally occur from apparently the same cause, and again how what appear to be different causes produce similar effects. Thus, violent anger, or an unaccustomed stimulus may, in a healthy person, induce a flushed countenance, increased action of the heart, a bounding pulse, and sudden loss of consciousness. Again, fear or exhaustion may occasion a pallid face, depressed or scarcely perceptible heart action, feeble pulse, and also loss of consciousness. In the first case, or *coma*, there is an accumulation of blood in the arteries and arterial capillaries, and a corresponding compression of the veins; in the second case, or *syncope*, there is distension of the veins and venous capillaries, with proportionate diminution of the calibre of the arteries. In either case, owing to the peculiarity of the circulation within the cranium, pressure is exerted on the brain. Hence syncope differs from coma only in the extreme feebleness of the heart's action,—the cause, producing loss of consciousness, sensation, and voluntary motion, being the same in both. Indeed it is sometimes difficult to distinguish these states from each other; and that they have frequently been confounded, does not admit of doubt.

In the same manner, partial congestion from either cause may occur in one hemisphere, or part of a hemisphere, in the brain, or in any particular portion or segment of the spinal cord. The pressure so occasioned may irritate and excite function, or may paralyse or suspend it; nay, it may so operate as to suspend the function of one part of the nervous system, while it exalts that of another. Thus all the phenomena of epilepsy are eminently congestive, the individual frequently enjoying the most perfect health in the intervals of the attack, although the effects are for the time terrible, causing such pressure that, while the cerebral functions are for the time annihilated, the spinal ones are violently excited. In the same manner are explained all the varied phenomena of hysteria and spinal irritation, for inasmuch as the spinal cord furnishes, directly or indirectly, nerves to every organ of the body, so congestion of this or that portion of it may increase, pervert, or diminish the functions of the nerves it gives off, and the organs which they supply. Congestion, therefore, we conceive to be the chief cause of functional nervous disorders originating in the great cerebro-spinal centre.

2. *Structural Derangements of the Nervous System.*—The various parts of the nervous system, being furnished with blood-vessels, are subject to most of the diseases of nutrition. The brain and spinal cord are especially liable to those lesions which produce effusion, extravasation, exudation, morbid growths, and degenerations of texture. The effects these occasion are identically the same in kind as those caused by simple pressure, or from the other circumstances to be referred to. In their mode of onset, however, they exhibit a difference. Thus, as a general rule, hæmorrhage is indicated by suddenness of attack, acute exudations, by local pain, with fever, chronic exudations and tumours, by gradual perversion of the mental, sensitive, and motor functions in various ways and degrees, according to the part affected. Intelligence suffers in proportion to the extent and nearness of the disease to the hemispherical ganglion, and motion according as the cerebral and vertebral portions of the spinal cord are influenced. Occasionally, after more or less impairment of intellect, sudden paralysis appears; a result attributable to the rupture or deliquescence of tubes which have been already softened, but not sufficiently so to interrupt their power as conductors of the nervous force. Instances, indeed, have been recorded where complete destruction of one half of the brain, or of the whole thickness of the spinal cord, is said to have occurred, in which no paralysis or other symptom has been caused; but it is certain that numerous tubes in such cases were intact during life, and capable of transmitting impressions.

3. *Diastaltic or Reflex Derangements of the Nervous System.*—We have previously seen that recent researches render it probable that the actions hitherto denominated *reflex* are in fact direct; only that the impression which is conveyed commences in the circumference of the body, instead of in the nervous centres. There is every reason to believe that such impressions pass *through* the cord by means of conducting nerve fibres, which cross from one side of that organ to the other, and that histology will yet demonstrate that all these apparently confused actions are dependent on the existence of certain uniform conducting media. Indeed, already we can judge with tolerable exactitude from the effects, what are the particular nerves and segments of the cord which are influenced during a variety of actions; and notwithstanding the immense difficulties of the inquiry, we have every hope that the period is not distant when the diagnosis of many more reflex acts will also be rendered certain. The principle involved in all these acts is, that the irritation which produces them is to be sought for in the nervous extremities rather than in lesions of the centres; and the great importance of this principle in pathology and in practice cannot be too highly estimated, although, for the numerous details which illus-

trate it, we must refer to a previous part of this article, and especially to the works of Dr Marshall Hall. We would point to traumatic tetanus, and to the convulsions resulting from teething and gastric derangements in children, as good examples of diastaltic functional disorders. Numerous symptoms which accompany organic changes belong to the same category. In other words, the structural lesion constitutes the irritant, or cause, while the effect is functional.

4. *Toxic Derangements of the Nervous System.*—The influence exercised by certain drugs is of a kind which causes a close resemblance to various diseases of the nervous system. These influences, if carried to excess, are toxic, and dangerous to life; if employed moderately, and with caution, they constitute the basis of our therapeutic knowledge in a vast variety of diseases. Why one drug should possess one power, and another a different one; or why some should influence the brain, and others the spinal cord or nerves, we are ignorant. Such facts are as much ultimate facts in therapeutics as are the separate endowments of contractility and sensibility in physiology. As pathological causes of functional disorders of the nervous system, their power is undoubted. By their means the five classes of nervous disorders may be occasioned in different ways, producing altogether distinct and peculiar effects. Thus—

Toxic Cerebral Derangements are occasioned by opium and most of the pure narcotics, which first excite and then depress or destroy the mental faculties. According to Flourens, opium acts on the cerebral lobes, while belladonna operates on the *corpora quadrigemina*. The first causes contraction, and the last dilatation of the pupils. *Tea* and *coffee* are pure exciters of the cerebral functions, and cause sleeplessness. *Alcoholic drinks*, *æther*, *chloroform*, and similar stimulants, first excite and then suspend the mental faculties, like opium. The modern practice of depriving persons of consciousness, in order for a time to destroy sensation, has been very much misunderstood in consequence of such remedies having been erroneously and unscientifically denominated anæsthetics. The fact is, they in no way influence local sensibility, or the sense of touch. Their action is altogether cerebral; and hence the danger which has frequently attended their action.

Toxic Spinal Derangements.—*Strychnine* acts especially as an exciter of the motor filaments of the spinal cord, causing tonic muscular contractions, as in tetanus from spinal arachnitis, or from the diastaltic action of a wound. *Woorari* produces exactly an opposite effect, causing paralysis and resolution of the same parts. *Conium* paralyses the motor and sensitive spinal nerves, producing paraplegia, commencing at the feet, and creeping upwards. *Picrotoxine*, according to Dr Mortimer Glover, causes the animal to stagger backwards, as in the experiments of Magendie on the *crura cerebelli*.

Toxic Cerebro-Spinal Derangements.—Of these, the poisonous effects of hydrocyanic acid offer a good example. All the animals we have seen killed by this agent utter a scream, lose their consciousness, and are convulsed. These are the symptoms of epilepsy. *Cold* is at first an exciter of the spinal functions, and is a strong stimulant to diastaltic activity, but if long continued, produces drowsiness and stupor.

Toxic Neural and Neuro-Spinal Derangements are especially occasioned by the action of certain metallic poisons, such as *mercury*, which occasions irregular muscular action, with weakness; and *lead*, which causes numbness and palsy, most common in the hands. On the other hand, *cantharides* stimulates the contractions of the neck of the urinary bladder, and *secale Sornutum* those of the pregnant uterus. *Stramonium* acts as a sedative to the nerves of the bronchi; while *aconite* operates powerfully in paralysing the action of the heart.

DISEASES OF REPRODUCTION.

These consist in the various alterations which may occur in the different stages of the generative functions, and include,—1*st*, Diseases which arrest or modify ovulation; 2*d*, Diseases, nutritive or nervous, which impede fecundation, and occasion barrenness in the female, or impotence in the male; 3*d*, Diseases of the embryo, causing various kinds of monsters, from arrest or excess of development in one or more of its parts. This last subject is now generally studied under the name of *teratology* (τέρας, *monster*), and has in recent times become a very extensive one. Congenital malformations of the fœtus were formerly considered as indicative of some misfortune,—as the effect of witchcraft, or as offsprings of the evil spirit. They are now not only recognised to originate in natural derangements of embryonal development, but the laws which govern such derangements have to a great extent been determined. From these it has become evident that monstrosities are not the result of chance, but are always governed by alterations in the known processes which regulate reproduction, and the evolution of the ovum and its contents. Hence in this, as in every other disordered condition, the real source of the abnormality is to be sought for, not only in the investigation of that condition itself, but in the knowledge, first, of the healthy or physiological state; and secondly, of the manner in which it has become deranged. In all our inquiries, it must be apparent that disease is morbid physiology; and such is the aspect in which we have endeavoured to place it before the reader.

ON DEATH.

Death is the permanent cessation of those properties and functions which constitute life. In this wide sense, it must be apparent that the textures are continually dying, in the same manner that they are continually being generated. What we have described as the fourth stage of nutrition essentially consists in the removal of the particles of the body which have been worn out,—fulfilled their functions, and died. Thus, death is molecular, cellular, fibrous, or tubular, in proportion as these various organic elements become degenerated, and disappear to make way for others which enjoy activity or life, and in their turn die, enter into new chemical combinations, and are excreted like their predecessors. In the more common acceptation of the term, however, death may be considered as *partial* or *general*. Partial death of the animal body is caused by those diseases or injuries which produce mortification, and ulceration in soft, and necrosis and caries in the hard parts, to a greater or less extent. Of this we have already spoken, and therefore need only treat of general death of the system. This has been variously considered as *natural* or *unnatural;* by the former meaning death from old age or gradual decay, and by the latter, death from diseases or violence. In this latter case, death may be gradual or sudden, and be induced by a great variety of agents. It may be said, however, that all the modes of death are reducible to three, viz.,—1*st*, Death by syncope,—that is, beginning at the heart; 2*d*, Death by asphyxia, beginning at the lungs; and 3*d*, Death by coma, beginning at the brain.

Death by Syncope.—All causes which arrest the action of the heart occasion stoppage of the circulation; a circumstance which interferes with the due performance of the vital functions; and death is the consequence. It may occur through the nervous system, through feebleness of the muscular walls of the heart itself, or through loss of blood. As examples of the first method of causing syncope, may be cited concussion, or all sudden shocks to the system,—as from violent blows or injuries, extensive lesions, violent mental emotions, a stroke of lightning, exposure to the sun

(or *coup de soleil*), and certain poisons which, acting especially on nerves going to the heart, paralyse its rhythmical motions, as aconite, digitalis, &c. Syncope from feebleness of the muscular walls is illustrated by the effects of long-continued violent exertion, starvation, and disease of its textures, especially that now recognised as fatty degeneration, one of the most common causes of sudden death. Lastly, excessive loss of blood, whether from direct external injury to a large vessel, sudden bursting of an internal vascular tumour or aneurism, disease of the coats of an artery or vein, leading to sudden or to long-continued loss of blood, are among the frequent causes of syncope.

Death by Asphyxia.—This is produced by all causes which interrupt the act of respiration, or the access of oxygen, so necessary for carrying on the nutritive functions, and has been previously referred to. It is now ascertained that mere obstruction of air does not immediately act upon the heart, which not only continues to contract for a time, but even sends venous blood through the arterial system. From the numerous investigations which have been made to determine in what manner the vital actions are arrested in asphyxia, it would appear that at first non-aërated or venous blood passes freely through the lungs to the heart, from whence it goes to all parts of the system. It operates on the brain, however, as a poison, rapidly suspending the sensorial functions. The capillaries of the lung next refuse to transmit non-oxygenated blood, in consequence of which it is not returned to the right side of the heart, and thus the vital actions cease. These effects are produced with greater or less rapidity, according as the occlusion of air is more perfect, as in cases of drowning and strangulation. In diseases of the heart and lungs, the same results are produced more slowly. The only poisons which operate upon the lungs directly causing asphyxia are certain so-called poisonous gases, such as carbonic acid gas, the fatal effects of which, however, are not so much to be ascribed to any noxious properties it possesses, as to the absence of free oxygen.

Death by Coma.—This is caused by all circumstances which suspend the sensorial functions by first operating on the brain. We observe it produced from the long-continued action of cold, from the influence of narcotic poisons, especially opium and chloroform, and from such injuries of the brain, from without or within, as are not necessarily connected with shock. If a violent blow be given to the head of an animal, it may be observed to suffer from shock or syncope; the heart flutters, and the pulse is weak. But if it recover from this, the heart's action may be restored, whilst sensation is suspended, and it dies comatose. If shock be avoided during the operation, the brain of an animal may be removed, producing coma or stupefaction, which will ultimately kill, although for some time the circulation and respiration continue. In apoplexies, fevers, and other diseases, similar effects are observable.

It should not be overlooked that death in many cases is produced by a conjunction, or by the rapidly-following results of two or all three of these modes. Thus chloroform may kill from the conjoined stupefying action on the brain, as well as from difficulty of respiration. Coma, from pressure on the brain, may, by influencing the *medulla oblongata*, affect the pneumo-gastric nerves, which send branches to the heart and lungs. In this case, death is the most rapid—occurring in all three ways. Hence the humane effort of the hangman not only to produce strangulation, but by dislocation of the bones of the neck to crush the upper part of the spinal cord.

The preceding observations evidently indicate that, in our endeavours to produce recovery from either of these states, much will depend upon the correct information we derive as to the causes producing them. In syncope, our efforts will be directed to restore the action of the heart by stimuli, a proper position, checking hæmorrhage, &c.; in asphyxia, to reproduce respiration; and in coma, to remove any cause which, by pressure on the brain from without or within, interferes with its functions. (J. H. B—T.)

PIACENZA (anc. *Placentia*, Fr. *Plaisance*), a town of Italy, capital of a province of the same name in the duchy of Parma, stands about half a mile from the S. bank of the Po, 2 miles below its confluence with the Trebbia, 37 miles W.N.W. of Parma, and about as far S.E. of Milan. It is of an oblong form, surrounded by ancient walls and ditches, and defended by a citadel which is garrisoned, according to a provision of the Congress of Vienna, with Austrian troops. The streets are in general broad and straight, but dull and deserted; and the grass that grows in many of the thoroughfares shows that the town is much too large for its present population. The most busy part is near the principal square, called *Piazza de Cavalli*, from the equestrian statues in bronze of Allessandro and Ranuccio Farnese, dukes of Parma. In this square is the ducal palace and the town-house, an edifice built by the merchants of Piacenza in 1281, in a mixed style of architecture, and considered one of the finest buildings of the kind of that century. The cathedral of Piacenza, consecrated in 1132, is a fine building in the ancient Lombard style. In the interior, which is adorned with massive pillars supporting wide-spreading arches, there are many fine paintings by various artists. Of the numerous other churches of Piacenza, many are very fine, both from their architecture and the paintings with which they are adorned. The Farnese palace, designed by Vignola, was once a most splendid edifice, but it is incomplete; and is now used for barracks. Among the other public buildings are the governor's house, the custom-house, and the court-house. Piacenza contains a college with a library of 30,000 volumes, an episcopal seminary, several schools, two theatres, a hospital, orphan asylums, and many other charitable institutions. It is the see of a bishop, and the seat of a court of appeal and inferior tribunals. The manufactures of the town consist of woollen and cotton cloth, silk, hosiery, hats, and earthenware. Some trade is carried on in cattle and agricultural produce. The ramparts are now partly used as a public walk, and from them may be obtained some fine views,—with the Alps and the Apennines in the distance; the city, with its magnificent buildings, in the foreground; and the broad stream of the Po appearing here and there, with its numerous willow-covered islands. The origin of the ancient *Placentia* is doubtful, being ascribed by some to the Gauls, and by others to the Etruscans. It is of no historical importance before 219 B.C., when it became a Roman colony. It remained faithful to Rome during the second Punic war, which was then raging, and resisted an attack of Hasdrubal. In the year 200 it was taken and plundered by the Gauls, but it soon recovered from this calamity. After the irruptions of the northern barbarians, Placentia was one of the first cities that recovered its prosperity; and it became in the tenth century a place of considerable commerce. It was for some time independent; but after being subject to several lords in succession, it came into the hands of the Visconti of Milan. In 1447 Piacenza revolted from the Milanese, but was retaken in the same year by Francesco Sforza. Under him and his successors it remained until Louis XII. of France took it. It was then retaken by Pope Julius II., and retained by the Papal See, till, along with Parma, of which duchy it has since formed a part, it was transferred to the Farnese family. Pop. 30,500.

PIANO-FORTE, a well-known modern instrument, in which the immediate sonorous bodies are wires of brass

and steel. It has completely usurped the place of the old harpsichord, upon which it is a great improvement. It has undergone many modifications, which are too numerous to be noticed here. The merit of its invention is disputed by the Italians and the Germans. Count G. R. Carli, in his works printed at Milan in 1784–1794, states (in vol. xiv., p. 405), that the piano-forte was invented in 1718, by Bartolommeo Cristofori of Padua, during his stay in Florence. The count speaks indignantly of the forgetfulness of the Italians regarding their own inventions:—"Della quale inventione ci siamo scordati a segno, che l'abbiam creduta una nuova cosa, allorchè ci venne dalla Germania e dall' Inghilterra, accogliendola come una singolare produzione di quelle felici regioni, destinate ad illuminarci con i lumi presi dagl' Italiani." On the other hand, the Germans assert that it was invented about the year 1717, by C. A. Schrœter, a German organist, and that it was afterwards improved by Silbermann, G. A. Stein, and others. To the Rev. William Mason, the English poet, is ascribed the important improvement of detaching the hammer entirely from the key, and giving to them only a momentary connection when the key is struck by the finger. The English makers have gained great repute by their excellent piano-fortes. Those of Broadwood are distinguished by a rich soft tone, well suited for accompanying the voice. Erard's possess a more powerful and brilliant tone, and are better suited for the public performer of piano-forte sonatas, concertos, &c. The horizontal piano-fortes are those most used, as being the best. The origin of the vertical piano-forte may be found in Père Mersenne's *Harmonicorum libri xii.*, 1652, folio; in which there is an engraving of a similarly formed instrument of an ancient date. We consider the modern extreme extension of the compass of the piano-forte, both grave and acute, as detrimental to the best effects of the instrument. (On this subject, and as to the true powers of the pianoforte, see the article MUSIC, vol. xv., pp. 740–741.) An Italian writer informs us, that in the beginning of the present century he had played upon many piano-fortes of a compass of *six octaves and a half*, made by Antonio Gherardi of Parma.

We quote the following interesting remarks by Mr Thalberg, which were printed in the reports by the juries of the Exhibition of 1851, pp. 326–329:—"To give an idea of the degree of perfection attained at the present day in the construction of the piano, we will describe one of the grand pianos in the Exhibition. This instrument is 8¼ feet in length, and 4½ feet in its greatest width; its frame is of enormous strength compared with the instruments of former times, being heavily braced with wood below the strings, having a complete system of metallic bracing above the strings firmly abutted, and consisting of longitudinal bars let into metal at each end, and having the curved side formed of a number of separate pieces glued together in a mould, to insure durability and fixedness of form. Its sounding-board extends to the frame on all sides, except the space left for the action. The strings are made entirely of steel, and of wire so thick that the tension necessary to bring them to the proper pitch produces an aggregate strain equal to at least 12 tons weight, while they are passed through studs drilled into the metal-wrest plank, thus giving the strings an upbearing position, which prevents the slightest displacement of the point of contact by any force of the hammers; and the system of placing the strings on the instrument, determined by accurate acoustic experiment, causes them to be struck by the hammer at that precise nodical point which produces the freest and clearest tone. The compass is extended to seven octaves from *A* to *A*. The action of this piano is described by Dr Lardner, in a work just published on Mechanics, as a beautiful example of complex leverage in the mechanism which connects the key and hammer. In this instrument the object is, to convey from the point where the fingers act upon the key to that at which the hammer acts upon the string, all the delicacy of action of the finger; so that the piano may participate to a certain extent in that sensibility of touch which is observable in the harp, and which is the consequence of the finger acting immediately on the string in that instrument, without the intervention of any other mechanism. The power of this instrument, depending on the quantity of matter brought into vibration; the resonance, or the perfection of that vibration, depending on the correct proportions of its parts; and the accuracy of intonation, depending on the nature of the bridging, the proportions of the strings, and their arrangement with regard to the blow of the hammer,—are all most admirable; while the action, depending on the peculiar mechanism employed, far surpasses everything else of the kind, for it enables the player to communicate to the strings all that the finest-formed and most skilful hand can express; and becomes as it were a part of himself, reflecting every shade of his feelings from the most powerful to the softest and most delicate sounds. This action is indeed so perfect, particularly in its power of delicate repetition, that if any note is missed in execution upon it, it is the fault of the player and not of the instrument. Many persons have a very meagre notion of the power of expression possessed by the piano-forte. The fact is, however, that it really possesses almost all those elements of expression which belong to any other instrument, and several which are peculiar to itself, from the circumstance of the various parts of music adapted to the instrument being brought out by the same hand and same feeling. An immense difference of volume of tone and of effect is produced by the manner of touching the keys and by the use of the pedals, especially upon an instrument of great power, fine quality of tone, and delicate mechanism in the action. The manufacture of the piano as a branch of trade is of very great importance, from the superior character of the principal workmen, and the vast numbers employed, directly and indirectly, in connection with it. In all the cities of the civilized world there are numerous makers of this instrument, with immense numbers of workmen; and in most secondary towns throughout Europe there are small makers; whilst the increase of the number of pianos, compared with the population, is every year more rapid, a circumstance which is not observed in regard to other musical instruments. This is corroborated by the fact, that some years ago piano-forte music constituted only a very modest portion of a music-seller's stock; whereas now it fills more than three-quarters of his shelves, and makes his chief business. The number of teachers is something wonderful; many are reduced ladies, who find in this exercise of their acquirements the most available means of support. Every professional pianist has often had occasion to exercise his kindly and generous feelings in recommending and assisting accomplished women, whose helpless families would otherwise have been utterly destitute. The social importance of the piano is, beyond all question, far greater than that of any other instrument of music. One of the most marked changes in the habits of society, as civilization advances, is with respect to the character of its amusements. Formerly nearly all such amusements were away from home and in public; now with the more educated portion of society the greater part is at home, and within the family circle; music on the piano contributing the principal portion of it. In the more fashionable circles of cities, private concerts increase year by year, and in them the piano is the principal feature. Many a man engaged in commercial and other active pursuits finds the chief charm of his drawing-room in the intellectual enjoyment afforded by the piano. In many parts of Europe this instrument is the greatest solace of the studious and solitary. Even steam and sailing vessels for

passengers on long voyages are now obliged, by the fixed habits of society, to be furnished with piano-fortes; thus transferring to the ocean itself something of the character of home enjoyments. By the use of the piano many who never visit the opera or concerts become thoroughly acquainted with the choicest dramatic and orchestral compositions. This influence of the piano is not confined to them, but extends to all classes; and while considerable towns have often no orchestras, families possess the best possible substitute, making them familiar with the finest compositions. The study of such compositions, and the application necessary for their proper execution, may be, and ought to be, made the means of greatly improving the general educational habits and tastes of piano students, and thus exerting an elevating influence, in addition to that refined and elegant pleasure which it directly dispenses." (G. F. G.)

PIANOSA, an island in the Mediterranean, belonging to Tuscany, lies about 10 miles S.S.W. of Elba, and nearly 40 from the nearest point of the mainland. It is 3 miles long by 2½ broad, and is about 10 miles in circuit. The surface is low; but it is fertile and well wooded, and is chiefly inhabited by fishermen. In the island are granite quarries, probably worked in the time of the Romans, when it was called *Planasia*. It was here that Postumus Agrippa was banished by Augustus, and afterwards put to death by order of Tiberius. Pianosa was annexed to Elba and granted to Napoleon after his first abdication.

PIAUHI, or PIAUHY, a province of Brazil, bounded on the N. by the Atlantic, E. by the provinces of Ceara and Pernambuco, S. by those of Bahia and Goyaz, and W. by that of Maranhao, lies between S. Lat. 2. 42. and 11. 20., W. Long. 40. 30. and 47. The length of the coast-line is little more than 60 miles; but the province stretches inland for about 400 miles, and has a very considerable breadth in the interior. Its area is 109,668 square miles. On the E. and S. frontiers it is bounded by mountain ranges; the Serra Habiapaba separating it from Ceara, and the Cordillera de Borborema from Pernambuco. From these mountains the country gradually slopes towards the bed of the Parnahiba, the only large river in the province, which it separates from that of Maranhao. The river Piauhi, from which the province derives its name, originates in the southern frontier, and, running northward through pasture lands, enters the Caninde, an affluent of the Parnahiba, 50 miles below Oeiras, the capital, after a course of 140 miles. There are no serras of any consequence, nor any large forests, in this province. It consists of vast grassy plains, little wooded, but in which numerous tall herbs attest the bounty of the sun. Originally the province was explored and subdued on account of its pastures, and not for the sake of slaves or from its possessing mines of the precious minerals or metals, for in these it appears to be deficient. Iron, lead, silver, and other minerals are found, but very little worked. Horses and cattle still form the chief riches of the country. It is to Piauhi that the neighbouring provinces of Pernambuco, Maranhao, Bahia, and Minas Geraes look chiefly for their supply of cattle. Piauhi occasionally suffers greatly from drought; but the evils consequent thereupon are much ameliorated by the presence of several trees which yield abundance of grateful and wholesome juices. The climate is warm and dry; and the soil, being generally flat and fertile, is well adapted for cultivation. Rice, tobacco, and sugar are raised near the rivers and lakes, where abundance of water can be obtained; and in the more arid regions millet, mandioc, and cotton are grown. The only seaport in the province is Parnahiba, on a branch of the river of the same name, where some trade is carried on in hides and cotton. Oeiras, the capital, stands on a small tributary of the Caninde, 320 miles S.S.E. of Maranhao. It is small, with broad but unpaved streets, and neat whitewashed houses, and contains several churches and schools. It is the seat of the provincial legislature, of the governor of Piauhi, and other officials. Some trade is carried on in cattle and agricultural produce. Pop. (with the surrounding district) 6000. Piauhi is divided into six *comarcas*. It has a provincial assembly of twenty-eight members, and appoints to the general legislature of Brazil one senator and two deputies. Pop. (1856) 150,400.

PIAZZA, a town of Sicily, in the province of Caltanisetta, stands on an isolated hill, 18 miles N. of Terranova, and as far E.S.E. of Caltanisetta. It is the see of a bishop; and contains a cathedral and many other churches, several convents, a school, hospital, &c. Woollen cloth and caps are manufactured; and some trade is carried on in grain, oil, fruits, &c. Pop. 13,000.

PIAZZETTA, GIOVANNI BATISTA, an Italian painter, was born at Venice in 1682. His first lessons in art were received from his father, a statuary in wood. But it was not until he had studied the works of Guercino at Bologna that his characteristic style was formed. In spite of a mannered and monotonous colouring and a hasty execution, his pictures there became notable for a strong contrast of light and shadow, and a boldness of relief. He produced pleasing altar-pieces; he succeeded admirably in several caricatures; and he was especially excellent in painting busts and heads. The consequence was, that he rose into high repute. Many followers gathered around him. Pitteri, Pelli, and Monaco engraved several of his pictures. He was also appointed director of the Academy of Painting in his native city, a post which he held till his death in 1754.

PIAZZI, GIUSEPPI. See ASTRONOMY, *History of*.

PICA. See MIRANDOLA.

PICARD, JEAN, an eminent French astronomer, was born at Flèche in 1620, and became priest and prior of Rillé in Anjou. His knowledge of astronomy early attracted notice. On the 25th of August 1645 he was employed, along with Gassendi, in observing the solar eclipse; in 1655 he was appointed to the astronomical chair in the College of France; and in 1666 he was selected by Colbert to assist in founding the Academy of Sciences. Picard, however, was destined to become still better known for his improvements in practical geometry. In 1667, along with Auzout, he was the first to apply a telescope to the quadrant in the measurement of angles. It was his good fortune, shortly afterwards, to introduce the modern method of determining the right ascension of the stars by employing a pendulum to note the instant of their meridional passages. He brought this list of improvements to a close in 1669, by making the first exact measurement of a degree of the meridian. So great indeed were his services to science, that by the time of his death in 1682 he was worthy of being considered the father of French astronomy. The principal works of Picard are *La Mesure de la Terre*, Paris, 1671; *Voyage d'Uranibourg*, Paris, 1680; *Observations Astronomiques faites en divers Endroits du Royaume*; *Observations faites à Baïonne, Bordeaux, et Royan pendant l'Année* 1680; and *La Connaissance des Temps*. There are also several contributions by him in the sixth and seventh volumes of the Memoirs of the Academy of Sciences. (See Delambre's *Histoire de l'Astronomie*, and his article "Jean Picard" in the *Biographie Universelle*.)

PICARD, *Louis-Benoit*, a celebrated French comic dramatist, was born in Paris in July 1769. Although educated for the law, he soon abandoned every pursuit to give himself up entirely to writing for the stage. His ready activity in this new profession was almost unparalleled. He brought into play a fertile brain, a happy skill in sketching manners, a lively wit, a great knowledge of scenic effect, and an abundant flow of diction. Prose comedies, poetical comedies, comic operas, were produced in rapid succession to delight the theatres. The business

of actor, which he undertook in 1797, and that of theatrical manager, which he began not long afterwards, did not withdraw him from the literature of the stage. He continued to write until he had produced more than seventy dramas. Death only put an end to his industry in 1828. The best, though still incomplete, collection of Picard's plays, was that published in 10 vols. 8vo, 1821–23. A supplementary volume, in 8vo, was issued in 1832. He was also the author of *Le Gil-Blas de la Révolution* and other novels.

PICARDS, a religious sect which arose in Bohemia in the thirteenth century. (See ADAMITES.)

PICARDY, an ancient province of France, was founded on the N. and E. by the Strait of Dover, and the provinces of Artois, Flanders, and Champagne; S. by that of Isle of France; and W. by that of Normandy. It is now included in the departments of Aisne, Ardennes, Oise, Pas-de-Calais, and Somme.

PICCINI, NICOLO, a celebrated composer of music, was born in 1728, at Bari, in the kingdom of Naples. In May 1742 he was placed under Leo, in th conservatory of Sant' Onofrio, at Naples. Leo dying soon afterwards, his successor Durante took charge of Piccini as a favourite pupil. In 1754 Piccini left the conservatory, and began to compose operas for the Teatro Fiorentino. His success was so great that he was engaged to write for the San Carlo theatre; and in 1758 was called to Rome to compose the music of *Alessandro nelle Indie*, an opera which he re-composed in 1775 at Naples. He revisited Rome in 1760, and composed *La Cecchina, ossia la buona figliuola*, which was received with rapture, and was soon after heard in every theatre of Italy, to the exclusion of all other operas. In 1756 he married Vincenza Sibilla, formerly one of his pupils in singing. She bore him several children. Induced by promises held out to him by the Neapolitan ambassador at Paris, Piccini went thither at the close of 1776. Not knowing a word of French, he had infinite difficulty in setting to music the opera of *Roland*; and, to add to his annoyances, Gluck raised a violent cabal against him, and endeavoured to prevent *Roland* from being performed. Nevertheless, *Roland* was performed in 1778, and received with great applause. He then composed *Phaon*, *Atys*, *Iphigénie en Tauride*, and *Adèle de Ponthieu*. Sacchini's arrival in Paris led to the forming of another party against Piccini. The court ordered a grand opera from each of the composers. Piccini produced his *Didon*, and Sacchini his *Chimène*. Both were admired, but especially the *Didon*, which is Piccini's best French opera. In 1784 he was appointed singing-master in the royal school of music and declamation. He wrote fifteen operas for the French theatre; but at last, suffering from injustice and neglect, and from the loss of a large sum due to him by the banker La Borde, he left France with his family in July 1791, and reached Naples in September. There he composed, in 1792, his oratorio of *Jonathan*, the best of his serious works. The marriage of one of his daughters with a young Frenchman settled at Naples exposed him to persecution. Two of his old pupils denounced him as a Jacobin, and the minister ordered him to remain shut up in his house. At the same time, he learned that everything he had left at Paris, including his Scores, was lost. He remained for four years in neglect and poverty. His friends in Paris encouraged him to return thither; and accordingly he arrived there on 3d December 1798. The French government granted him 7400 francs a year, and apartments in the Hôtel d'Angivilliers, where part of his family soon rejoined him. Through the good offices of the First Consul Bonaparte, he was appointed inspector of the Conservatory of Music; but the boon arrived too late—he was dying. He expired at Passy on the 7th May 1800, and was interred in the common burying-ground. Only those who have studied the operas of Piccini, Sacchini, Gluck, and Mozart, know how much the latter composer was indebted to the other three. The musical wars carried on in Paris by the partizans of Gluck, Piccini, and Sacchini, are narrated in various publications, such as Marmontel's *Memoires*, &c.; Ginguené's *Lettres*, &c., 1783, 8vo; and his *Notice sur la Vie et les Ouvrages de Piccini*, 1800, 8vo. Piccini composed seventy-nine operas, comic and serious; several oratorios, of which the best are *Jonathan* and *Sara*; a number of pieces of church music; romances and canzonets, published at Paris in Desormery and Bouffet's *Journal de Chant et de Piano*, 1799. (G. F. G.)

PICCOLOMINI, ALESSANDRO, Archbishop of Patras, was a native of Siena, where he was born about the year 1508, being descended of an ancient and illustrious family, which came originally from Rome. He composed with success for the theatre; but he was more distinguished for his genius than for the purity of his manners and his regard to virtue. His charity was great, and chiefly exerted in relieving the necessities of men of letters. He left behind him a number of works in Italian, the most remarkable of which are,—various *Opere Dramatiche*, which laid the first foundation of his character as a writer; *Un Traité della Sphera*; *Una Theoria delle Planète*; a translation of Aristotle's *Art of Rhetoric and Poetry*, in 4to; and *Institutione Morale*, published at Venice, 1575, in 4to, translated into French by Pierre de Larivey, and printed at Paris, 1581, in 4to. These, with a variety of other works, prove his extensive knowledge in natural philosophy, mathematics, and theology. He was the first who made use of the Italian language in writing upon philosophical subjects. He died at Siena on the 12th of March 1578, at the age of seventy.

PICCOLOMINI, *Francesco*, of the same family with the preceding, was born in the year 1520, and taught philosophy with success for the space of twenty-two years, at Siena, Pérugia, and Padua. He afterwards retired to Siena, where he died in 1604, at the age of eighty-four. This city went into mourning on the occasion of his death. His works are,—*Some Commentaries upon Aristotle*, printed at Mayence, 1608, in 4to; and *Universa Philosophia de Moribus*, printed at Venice, 1583, in folio. The latter is his principal work. He laboured to revive the doctrines of Plato, and endeavoured also to imitate the manners of that philosopher. He had as his principal rival the famous Zabarella, whom he excelled in facility of expression and neatness of discourse, but to whom he was much inferior in point of argument.

PICENUM, an ancient province of Italy, was bounded on the N. by the Galli Senones, on the W. by the Umbrians and Sabines, on the S. by the Vestini, and on the E. by the Adriatic Sea. It was a country of romantic beauty. The line of the Apennines ran along the western frontier. A series of heights, shooting off from the eastern side of this central branch, and undulating gradually downwards to the sea-shore, occupied the entire district. Extensive forests waved on the ridges, fruitful orchards and olive-yards basked on the slopes, and fertilizing mountain streams meandered through the valleys. In that delightful region the Picentes seem, during the early periods of their recorded history, to have enjoyed considerable prosperity. They remained long in undisturbed tranquillity, while the neighbouring tribes were vainly struggling against the all-usurping ambition of Rome. That power condescended in 299 B.C. to enter into an alliance with them. Even when they were at length obliged, in 268 B.C., to bow before the resistless destinies of the Romans, they suffered little injury. It was not until the outbreak of the Social War, in 90 B.C., that the Picentes appear to have experienced the toils and calamities of a great struggle. Then they assumed an active and zealous part in the general revolt against Rome. Their capital city, Asculum, gave the signal of in-

surrection by assassinating the Roman proconsul. Their armies kept the Roman general Cn. Pompeius Strabo for a long time at bay. Nor when the tide of battle began to turn against them did their courage waver. They continued to fight until in 89 B.C. they were put down by sheer force. The history of Picenum after this period contains little else than an account of the frequent changing of boundaries of the country.

The most important towns of the Picentes were Ancona, on the sea-coast, and Auximum (*Osimo*), Asculum (*Ascoli*), and Hadria (*Atri*), in the interior.

PICERNO, a town of Naples, province of Basilicata, 8 miles W. of Potenza. It contains a church and a convent; and has manufactures of silk and woollen goods. Pop. 4000.

PICHEGRU, CHARLES, a famous general of the French republic, was the son of humble parents, and was born in 1761 at Arbois in Franche-Comté. His education was favourable for the development of his talents. He received his elementary instruction at the monastery of the Minims. After that he studied mathematics at the college of Brienne, the seminary which the young Napoleon Bonaparte was at that time attending. Then entering a regiment of artillery, he acquired, as he passed through the several gradations from a common soldier up to a serjeant-major, a practical knowledge of military tactics. Thus thoroughly trained, Pichegru only wanted some great opportunity to rise into notice. Accordingly, no sooner had the French revolution broken out, and the army of the Rhine received him within its ranks, than a career of distinction opened up before him. He rapidly rose by the several steps of promotion to the post of general of division. His growing fame then recommended him, in 1793, as a fit person for the chief command of the expedition. Undertaking the precarious task, he set himself to improve the adverse state of affairs. Discipline was enforced, a new system of tactics was introduced, and the self-confidence of the troops was restored. He led them on to the victory of Haguenau, the relief of Landau, and the capture of Lauterburg. Still greater was his success after he had been appointed in 1794 to the command of the army of the north. His firmness and decision soon turned the tide of success against the invaders of his country. The enemies fled before him at Cassel, Courtrai, and Menin, and left all West Flanders in his power. Bruges, Bois-le-Duc, and Nimeguen were compelled to open their gates to his advancing troops. The waters of the Wahl only checked his victorious career for a short time. Taking advantage of an intense frost which froze up the rivers, he crossed on the ice, pressed forward with forced marches, drove the retreating enemy beyond the Yesel, took possession of Amsterdam on the 16th January 1795, and thus effected the conquest of Holland. This was the close of Pichegru's military successes, and the remainder of his life was occupied in endeavouring to effect the restoration of the Bourbons. Appointed to the command of the army of the Rhine, he entered into negotiations with the Prince Condé for the purpose of overthrowing the republic. Having retired in 1796 from military life, and having been chosen in 1797 to be president of the Council of Five Hundred, he still continued to plot. A discovery, a trial, and a banishment to Cayenne did not divert him from his designs. Escaping from his prescribed place of exile, he repaired to England only to involve himself in a desperate conspiracy which was destined to end in his own ruin. In course of time he planned a scheme, along with George Cadoudal, for the destruction of the government of the First Consul; and in January 1804 repaired to Paris, like the other accomplices, to carry it into execution. The plot was discovered; his person was seized, and lodged in the Temple; and on the 6th April 1804 he was found strangled in his cell. For a long time afterwards it was supposed that Pichegru had been murdered by order of Napoleon. It is now, however, generally agreed that he had committed suicide. (For an account of the evidence belonging to the case, see FRANCE.)

PICKERING, a market-town of England, in the North Riding of Yorkshire, 26 miles N.N.E. of York, and 18 S.S.W. of Whitby. It is a long, straggling town; and contains a large old parish church with a tall spire, and an ancient castle. The Independents, Quakers, Swedenborgians, and Primitive and Wesleyan Methodists have places of worship here. The town has also a court-house, several schools, and a savings-bank. The manufacture of brooms is largely carried on, the materials being obtained from the surrounding moors. In the vicinity some Roman remains have been discovered. Pop. (1851) 2511.

PICO. See AZORES.

PICTOR, FABIUS. See FABIUS PICTOR.

PICTOU, a town of Nova Scotia, capital of the county of the same name, stands on the harbour of Pictou, about 3 miles from its entrance, and 72 miles N.E. of Halifax. It is well built of stone; and contains, besides other public buildings, an academy, library, and grammar-school. An extensive and increasing trade is carried on in coal, timber, and fish; the annual value of the exports being about L.100,000.

PICTS. See CALEDONIA, and SCOTLAND.

PICTURE. See PAINTING.

PICTURESQUE literally signifies that which is capable of, or fitted for, pictorial delineation. (For the various theories of the picturesque, see BEAUTY.)

PIEDIMONTE, a town of Naples, in the province of Terra di Lavoro, 21 miles S.W. of Campobasso. It stands in a lofty and commanding position, and is in general well-built. It is the seat of a bishop, and contains a feudal castle, and a palace belonging to the Duke of Laurenzana. There are numerous manufactories in the town, including cotton, paper, flour, fulling, and copper mills. The water-power for these mills is supplied by a torrent supposed to flow by a subterranean channel from Lake Matese. The inhabitants are largely employed in the cultivation of vines and olives in the neighbourhood; and the wine and oils produced are excellent, and contribute in a great degree to the support of the people. Pop. about 7000.

PIEDMONT, PRINCIPALITY OF (Ital. *Piemonte*, or *Pie di Monte*, meaning "foot of the mountain"), a district of the continental portion of the Sardinian States, now forming the divisions of Turin, Coni, Alessandria, Aosta, and Novara. On three sides it is inclosed by mountains; by the Alps on the N. and W., and by the Apennines on the S.; while towards the E. it stretches into the great plain of Lombardy. Its length from N. to S. is 120 miles, its breadth nearly 100; area 15,913 square miles. It is a distinct physical region shut in by the loftiest chains of the Alps and Apennines, and forming the upper part of the valley of the Po, to which it entirely belongs. The western and larger portion of Piedmont is mountainous, being occupied with branches and offsets from the Alps and Apennines, with numerous upland valleys among them; and from these high lands the ground gradually descends in beautifully-waving slopes to the rich level plains which occupy the east of the principality. The Po, which rises in this country, receives within its limits many tributaries. These, though few of them are navigable, are all of the highest importance to the country, as an extensive and skilful system of irrigation is carried on by their means. The soil is thus enabled to produce the richest crops. Wheat, maize, rice, and beans are the principal articles raised. Wine and fruits are also produced; and excellent timber is obtained from the forests. Besides agriculture, the people are largely employed in pastoral pursuits, and great numbers of cattle are reared. The corn produced in Piedmont is more than sufficient for the

wants of the people, and supplies also the adjacent country along the Mediterranean as far as Toulon. Some minerals are obtained in this country; the principal being iron, marble, copper, and argentiferous lead. Manufactures are actively carried on; hosiery, linen, woollen, and silken goods, brandy, glass, and iron, being the chief articles made here. Besides corn and cattle, silk, wine, wool, iron, &c., are exported. The Alpine valleys of Piedmont are celebrated as the country of the Waldenses, who have from time immemorial stood out against the corruptions of the Romish Church, notwithstanding the persecutions to which they have been exposed. They now enjoy toleration. With this exception, the people of Piedmont all profess the Roman Catholic religion. The population of the country is more than 3,000,000. (See SARDINIA.)

PIERIDES, a surname of the Muses, derived from Mount Pieris, near Mount Olympus, where they were first worshipped. Others derive the name from Pierus, an ancient king of Macedon, who migrated from Thrace into Bœotia, where he established their worship.

PIERRE, JACQUES HENRI BERNARDIN DE ST, the author of *Paul and Virginia*, was born at Havre in 1737, of a family which claimed kindred with Eustache de St Pierre of Calais. He seems to have received little regular education, to have shown as a child a passion for animals, and a remarkable power of living in a visionary yet methodical world of his own. The event of his early life was the reading of *Robinson Crusoe*, which awakened in him the fixed idea of founding a colony where nature was to be all beauty and man was to be all virtue. After making some progress in mathematics, St Pierre was admitted as a pupil at the school of the Ponts et Chaussées, and afterwards entered the corps of engineers. He served one campaign in Hesse in 1760, but having quarrelled with his superior officers, he left France, and offered his services to Catherine of Russia, and subsequently to the King of Poland. But his vain and irascible temper led him to regard every post as unworthy of him; and, returning to France in 1766, he succeeded, by dint of importunity, in receiving the appointment of chief engineer of the Isle of France. Disappointed also with this undertaking, St Pierre returned to France in disgust in 1771, and began to form some valuable literary friendships. He was on terms of intimacy with Condorcet, Rousseau, and D'Alembert, and resolved to enrol himself among this literary fraternity, and make letters his vocation. He accordingly set to work; and in 1784 published the first portion of the *Etudes de la Nature*, which instantly brought him both fame and fortune. These *Studies* came recommended to that age by their true sensibility, their gentle and vague piety, their pensive melancholy, and their keen sympathy with solitude. Just four years had elapsed when St Pierre published his fourth volume of these *Etudes* containing the celebrated idyl of *Paul et Virginie*, on which his fame now chiefly rests. The remainder of his life was highly prosperous. He was made intendant of the Jardin-du-Roi, and was subsequently installed professor of morals in the École Normale. He died in 1814, leaving his *Harmonies de la Nature* ready for publication. St Pierre's second wife survived him, and afterwards married his idolizing biographer Aimé Martin, who collected and published *Les Œuvres de J. H. Bernardin de St Pierre, mises en ordre*, par L. Aimé Martin, 12 vols. 8vo, Paris, 1818–20.

PIERRE D'OLERON, a town of France, in the department of Charente-Inférieure, stands near the centre of the island of Oleron. It contains a distillery, vinegar manufactory, and tile-work. Excellent salt is obtained here; and some trade is carried on in wine. A tribunal of commerce is held in the town. Pop. 4769.

PIERRE-LÈS-CALAIS, a town of France, in the department of Pas de Calais, forms one of the suburbs of Calais. It has manufactures of cotton, lace, leather, buttons, hats, salt, and beet-root sugar. The railway to Lille traverses the town. Pop. 11,524.

PIERRE, ST, a town in the West Indies, on the N.W. coast of Martinique; N. Lat. 14. 44., W. Long. 61. 18. It is the largest town not only in the island, but in the whole of the French possessions in the West Indies, and it is said to be the finest of all the towns in the West Indies. Built on a narrow strip of level ground, along the shore of a semicircular bay, it consists of three broad streets parallel to the shore, crossed by several others. The principal streets are traversed by streams of water, which produce a delightful coolness and freshness in the hot climate. The town is fortified, and contains many handsome churches and a botanic garden. The anchorage in front of the town is good, but very much exposed. A considerable trade is carried on. Pop. about 30,000.

PIERRE, ST, a small island belonging to France, off the south coast of Newfoundland. Its area is about 8 square miles. It is occupied with rocky heights about 500 feet above the sea, and with ponds and marshes in the lower ground. Stunted pines and birches are almost the only vegetation; and the people live chiefly by fishing. A village of the same name, with a roadstead and fort, stands on the S.E. coast. Pop. about 1200.

PIETISTS, the name given to a sect of reformers which sprung up in the Lutheran Church in Germany towards the end of the seventeenth century. (See SPENER, *Philip Jacob*.)

PIETRA DE FUSI, a town of Naples, in the province of Principato Ultra, stands on a hill 1½ mile N.E. of Montefusco. It contains several churches and chapels. Pop. 5000.

PIETRAPERZIA, a town of Sicily, in the province and 5 miles S.E. of Caltanisetta. Sulphur, gypsum, and other minerals are obtained in the vicinity; and an active trade is carried on in corn. Pop. 8500.

PIGALLE, JEAN BAPTISTE, an eminent French sculptor, was the son of a carpenter, and was born in Paris in 1714. His first efforts in sculpture were rather unpromising. In the school of Lorraine he showed little or no aptitude for the art. Under the tuition of Lemoyne, he was an unsuccessful competitor for the prize of the Academy; and it was only after he had studied for three years the master-pieces of Italy, and had returned to his native city, that he took a high place in his profession. The career of Pigalle then began to be prosperous. A statue of Mercury in 1744 gained for him admittance into the Academy; and an image of the Virgin not long afterwards introduced him to the patronage of Madame de Pompadour. A series of high commissions was the consequence. He was employed by Louis XV. to execute that group of "Mercury and Venus" which was presented to the King of Prussia in 1748, and which is still at Sans Souci. He set up that great master-work, the allegorical tomb of Marshal Saxe, in the church of St Thomas at Strasbourg. He executed a bronze statue of Louis XV., which continued to adorn the town of Rheims till it was destroyed by the republican fury of the Revolution. He was also intrusted with the erection of a tomb to the Duc d'Harcourt in one of the chapels in the church of Notre Dame at Paris. Meanwhile Pigalle had been rising to a high place in the Academy. The office of professor had been conferred upon him in 1752, and that of rector in 1777. He had just attained to the highest dignity, the chancellorship, when he died in 1785.

PIGEON. See ORNITHOLOGY.

PIGHIUS, ALBERT, one of the opponents of Calvin, was born at Kempen, in the province of Overyssel, in 1490, and was educated at the university of Louvain. He entered upon the field of religious controversy about 1523

with no small reputation. His mathematical knowledge had been shown in several works; his theological attainments had been proved in several of the principal chairs in the Netherlands; and his fame as an orator was so great that Pope Adrian VI. had sent for him to Rome. The position which he now assumed in the great contest of the Reformation was not unworthy of such a reputation. The Supreme Pontiff despatched him to defend the cause of the Church of Rome in Germany. It was his privilege shortly afterwards, in 1524, to take part in the discussions and decisions of the diet of Ratisbon. He attained his greatest notoriety when he entered the lists against Calvin, and published his pamphlet *De Libero Hominis Arbitrio et Divina Gratia, adversus Lutherum, Calvinum, et Alios*. Cologne, 1542. Pighius died in 1542, in the possession of the provostship of St John in Utrecht.

PIGHIUS, *Stephanus Vinand*, a laborious antiquary, and the nephew of the preceding, was born at Kempen, in the province of Overyssel, in 1520, and completed his education at Cologne. Although a churchman, he gave himself up to antiquarian pursuits. Eight years in the early part of his life were devoted to the study of the ancient remains at Rome. During the rest of his career his attention was chiefly occupied in arranging and digesting the information he had collected. He had just published the first volume of his researches, under the title of *Annales Romanorum*, when he died in 1604. The two remaining volumes were entrusted to the editorial care of Andreas Schott, and the entire work appeared at Antwerp in 1615, in 3 vols. folio.

PIGNOTTI, LORENZO, an Italian historian and fabulist, was born in 1739 at Figlini, a small town between Florence and Arezzo. His life was characterized throughout by a genial attachment to literature. At the school of Arezzo and the university of Pisa he was distinguished for his devotion to poetry and the classics. While practising as a medical man at Florence, he continued the study of polite learning. At length, after his appointment, in 1774, to the chair of physics at Pisa, his literary zeal vented itself in authorship. With agreeable and well-selected incidents, and in a simple and natural style, he wrote many fables, which soon became known in other countries. A more laborious, though not more successful, undertaking was his *History of Tuscany*. Commencing at the time of the early Etruscans, he availed himself throughout of all the materials collected by his predecessors. At intervals, his own well-informed mind supplied a fresh and original chapter on such topics as the origin of the Italian language, the revival of letters and arts, and the condition of science at the end of the fifteenth century. He had just brought the entire work to a conclusion, when he died in 1812. It was published under the title of *Storia della Toscana sino al Principato con diversi Saggi sulle Scienze, Lettere, ed Arti*, in 9 vols. 8vo, Pisa, 1813. An edition of Pignotti's Fables and Poems appeared in 1820.

PIKE. See ICHTHYOLOGY.

PILAO-ARCADO, a town of Brazil, in the province of Bahia, stands on the river San Francisco, S. Lat. 14. 15., W. Long. 42. 40., 65 miles W. of Jacobina. It has a church, a school, and large salt-works. Numbers of cattle are reared at this place. Pop. 5000.

PILATE, PONTIUS, was the sixth Roman procurator of Judæa (Matt. xxvii. 2; Mark xv. 1; Luke iii. 1; John xviii. xix.), and the one under whom Jesus Christ taught, suffered, and died (Acts iii. 13; iv. 27; xiii. 28; 1 Tim. vi. 13; Tacitus, *Annal.* xv. 44). Pilate succeeded Valerius Gratus as governor of Judæa, and held office for ten years during the reign of Tiberius. His character, as indicated by Philo-Judæus, by Josephus, and in the New Testament, is, without exception, stubborn, cruel, and avaricious. His imperious cruelty at last cost him his office. Josephus informs us (*Antiq.* xviii. 4, 2) that the Samaritans, having been treated by Pilate in a barbarous manner, complained to Vitellius, governor of Syria, who ordered him to Rome to give an account of his conduct to the emperor. Tiberius was dead before Pilate arrived; but Eusebius relates that the guilty procurator was banished to Vienne in Gaul, where he committed suicide about the year A.D. 38.

PILATRE DE ROZIER, JEAN FRANÇOIS. See AERONAUTICS.

PILCHARD. See ICHTHYOLOGY.

PILCOMAYO, or ARAQUA-GUAZI, a river of South America, in Bolivia and the Plata Confederation, rises in the former country on the eastern slope of the Andes, near Chuquisaca, and flows S.E. through Bolivia and Plata, till it falls into the Paraguay nearly opposite Assumption; total length estimated at 1000 miles. It is navigable for boats nearly the whole of its length; but it is very shallow in the dry season, and where it is narrow the current runs with great force. The only city on its banks is Chuquisaca. Its chief affluents are the Pilaya and Paspaya. About 150 miles from the Paraguay it divides itself into two arms, inclosing a marshy island.

PILES, ROGER DE, an historian and critic of art, was born of a noble family at Clameci in 1635. His love for painting appeared early, and was never lost amid the public business which engrossed his life. Travelling as tutor, and then as secretary, to the son of President Amelot, he sedulously increased and matured his knowledge of pictures. Sent as a spy of the French king to the Hague, he practised the profession of a painter in order to conceal his real character. Nor could a Dutch prison damp his enthusiasm for art. During his confinement he wrote his principal work, the *Lives of the Painters*. Piles died at Paris 1709. A collection of the works of this author was published in 5 vols. 12mo, 1767.

PILEUS and PILEUM (πῖλος and πιλίον), were terms applied by the Greeks and Romans to any piece of *felt*, and particularly to a felt cap, a hat made to fit close to the head, and without any brim. The pileus was usually of a half-egg shape, but was frequently more elevated. The Greeks, who bequeathed the art of felting to the Romans, doubtless derived it themselves from Asia. The Phrygian cap or bonnet, which was of a similar shape and texture to the pileus, seems to have been peculiar to the inhabitants of Asia Minor generally, as we find it continually introduced by artists as the symbol of Asiatic life. The felt cap was the emblem of liberty among the Romans. When a slave obtained his freedom, he exchanged the hair of his head for an undyed pileus.

In contradistinction to the brimless pileus, the Greeks and Romans wore the *petasus* (πέτασος), a species of hat also made of felt, and consisting of a great variety of forms, from that of a mere circular disk to shapes closely resembling our "wide-awakes."

PILLAR. See *Glossary* to ARCHITECTURE.

PILLAU, a town of Prussia, in the government of Königsberg, stands at the entrance of the Frische Haff, 25 miles W. of Königsberg, of which it is the port. It is defended by a fort, and has a good harbour, a lighthouse, a Protestant church, and a school of navigation. Ship-building and fishing are actively carried on here. The entrance to the Frische Haff is very narrow and shallow, so that large vessels have to discharge their cargoes here, which gives the town a considerable trade. Pop. 3491.

PILLEEBHEET, a town of British India, capital of a pergunnah of the same name, in the district of Bareilly, N.W. Provinces, stands on the left bank of the Gurrah, 802 miles N.W. of Calcutta. The river, which is here 250 yards broad, is crossed during the dry season, from December to June, by a ford, and at other times by a ferry. The town is extensive, and is the seat of an active com-

merce. Timber, pitch, honey, wax, wool, various metals, and other goods, are brought hither from Kumaon and Chinese Tartary, and are exchanged for the produce of the plains. The rice of Pilleebheet, which is valued in India for its fine flavour, is grown in the valley of the Kosilla, in the south of Kumaon, and brought to market here. Pop. (1853) 26,760.

PILLORY (Fr. *pilori*, probably from Lat. *pila*, a pillar), a mode of punishment by a public exposure of the offender long used in most countries of Europe. No punishment has been inflicted in so many different ways as that of the pillory. Sometimes the machine was constructed so that several criminals might be pilloried at the same time; but it was commonly capable of holding but one at once. Francis Douce, in his *Illustrations of Shakspeare*, vol. i., p. 146, gives six representations of distinct varieties of this instrument. These varieties are all reducible, however, to the simplest form of the pillory. It consisted of a wooden frame or screen raised on a pillar or post several feet from the ground, and behind which the culprit stood supported on a platform, his head and hands being thrust through holes in the screen, so as to be exposed in front. This screen, in the more complicated forms of the instrument, consisted of a perforated iron circle or *carcan* (hence the name given to the pillory in French), which secured the hands and heads of several persons at the same time. The pillory was abolished in Britain in 1837, by the statute 1 Vict., c. 23; and in France in 1832.

PILOT, in many maritime countries, is the name applied to a particular officer in a ship who has the charge of the helm and the ship's course. The term is usually applied in this country, however, to a person taken on board at any particular place, to conduct the vessel into or out of particular harbours, or along certain coasts. Charters of incorporation were formerly granted to pilots of this class, such as those of the Trinity House. Deptford, Strond, and those of the Cinque Ports, &c. For the present state of the law respecting "pilotage," see the Merchant Shipping Act 1854, entitled "An Act to amend and consolidate the Acts relating to Merchant Shipping," 17 and 18 Vict., c. 104, in which will be found various enactments respecting the license, regulation, and guidance of pilots belonging to the United Kingdom only.

PILSEN (Bohem. *Plzen*, Lat. *Pilsna*), a town of Bohemia, capital of a circle of the same name, stands at the confluence of the Mies and Radbusa, which form the Beraun, 53 miles W.S.W. of Prague, and about the same distance S.E. of Eger. It is well built, for the most part of stone, and fortified. Among the public buildings are numerous churches, the most remarkable of which is that of St Bartholomew, a fine Gothic structure, built in 1292. The town-hall and the hall of the Teutonic knights are also in the Gothic style. Pilsen contains two convents, a theatre, a philosophical institution with a library and museum, a grammar school, other educational establishments, two hospitals, and an infirmary. Manufactures are carried on of cloth, leather, and musical instruments. Standing on the high road from Prague to the middle and south of Germany, Pilsen is a place of considerable trade, and its weekly and yearly markets are of some importance. Rich coal-pits and iron mines are worked in the vicinity. Pop. (1851), exclusive of the military, 11,486.

PILUM, a missive weapon used by the Roman soldiers. (See ARMY, § *Roman Army*.)

PIMENTO, ALLSPICE, or JAMAICA PEPPER, is the unripe fruit of *Eugenia Pimenta* (Nat. Ord. *Myrtaceæ*), dried in the sun. (See BOTANY.) It receives the name *allspice*, from its resemblance in flavour to a mixture of cloves, cinnamon, and nutmeg. The tree is a native of the West Indies, but is cultivated almost exclusively in Jamaica; thence the produce is called *Jamaica pepper*. It is formed into plantations, intersected with broad walks, known as *pimento walks*. The berries are gathered in an unripe state, when the essential oil which they contain is most abundant; they are then spread out, and dried by frequent turning in the sun, when their colour changes from green to a fine clove-brown. The flavour resides within the shell of the pimento, which is, when dried, about twice the size of a pepper-corn, and incloses two seeds. The consumption of allspice in the United Kingdom has very greatly increased during the past ten years. It is occasionally used in medicine, but chiefly as an article of cookery. It yields an essential oil, known as "oil of pimento," used in perfumery and confectionary. (See OILS.) The importations of pimento for 1857 amounted to 31,014 cwts., of which 4035 cwts. were entered for home consumption, yielding, at the rate of 5s. per cwt., a total duty of L.1009.

PIMLICO, a suburb of London, in the county of Middlesex, and liberty of Westminster, lies to the W. of St James's and the Green parks, about 2½ miles W.S.W. of St Paul's. It has many handsome streets and squares, and includes within its limits Buckingham Palace.

PINCHBECK. See BRASS.

PIND-DADUN-KHAN, a town of British India, in the Punjab, stands about 4 miles from the W. bank of the Jhelum, from which it is separated by a green plain; N. Lat. 33. 11., E. Long. 74. 25. It consists of three small groups of houses, not far apart, built of mud, with a framework of cedar, which is got from the mountains to the N., and floated down the river. Salt is obtained in abundance in the vicinity, so as to supply a great part of the Punjab. Pop. 13,588.

PINDAR, the greatest of the Greek lyric poets, was a native of Bœotia, and was born either in Thebes, the capital of that country, or at Cynoscephalæ, a little village between Thebes and Thespia. His father's name is variously given as Daiphantus, Pagondas, or Scopelinus, and his mother's as Cleidice or Myrto. He was born, as he himself mentions (*Fragm. Incert.*, 102), at the time of the Pythian games, which fell in the beginning of July. Clinton fixes the year as Ol. 65.3, or B.C. 518; Böckh as Ol. 64.3, or B.C. 522. Both of these dates are uncertain; but Böckh's computation is now regarded as more probably the correct one. The time of his death is equally doubtful. If it be true, as is commonly believed, that he lived eighty years, Clinton's calculation would give 439 B.C., and Böckh's 442 B.C., as the date of his death. His wife was Megacleia, the daughter of Lysitheus and Callina. Another account gives his wife's name as Timoxena; but it is not unlikely that this Timoxena may have been a second wife, whom he married on the death or divorce of the first. He had one son, named Daiphantus, and two daughters, Eumetis and Protomache.

The family to which Pindar belonged was one of the noblest in Thebes, as is proved by the fact, that the poet wrote the ode which his son Daiphantus sung on his election as *daphnephorus*, an office open to none but members of the highest families in the city. (See DAPHNEPHORIA.) They were famed for their skill in flute-playing, a profession held in much esteem at Thebes. Pindar inherited the family talent, and something more. His father, seeing the bent of his genius, sent him to Athens, where, under the celebrated dithyrambist, Lasos of Hermione, he learned music, dancing, and all the mysteries of the chorus requisite for his training as a lyric poet. He also attended the schools of Agathocles and Apollodorus, and, though a mere lad, was allowed by them to instruct the cyclic chori. How much he owed to these preceptors we do not know. Probably it was not much; at least enough is known of Lasos to show that he had little share in forming Pindar's style. The best part of the young poet's training was probably that which he received on his return from Athens, in his

twentieth year, from his countrywomen, Myrtis and the Tanagrean Corinna. To the instruction and example of the latter, in particular, he was deeply indebted. Corinna was, like Pindar himself, a teacher of choruses. Plutarch relates that she encouraged her pupil to select the themes for his muse from the mythology of his country, and to devote his chief attention to the subject-matter of his song, treating the music and other accessories as of merely secondary importance. On one occasion, when, in compliance with her suggestion, he brought her an ode in which were inwoven all the mythic legends of Thebes, she told him, with a smile, that he "ought to sow with the hand, but not with the whole sack." The pupil became in course of time ambitious enough to enter the lists with his teacher. She accepted the challenge, and, either from her beauty or the superiority of her verse, was five different times declared victor. She was by no means pleased, however, when her rival Myrtis followed her example: "I blame the clear-voiced Myrtis,—I, that she, born a woman, should enter into the contest with Pindar."

Between the age of twenty and twenty-two Pindar began his professional career as a poet. His earliest poem that has come down to us is an Epinician ode (the 10th Pythian) in honour of Hippocles, a noble youth of Pelinna in Thessaly, who had won the prize at the Pythian games. His fame soon grew so great, that he was engaged to compose similar hymns by Hiero, tyrant of Syracuse; Thero, tyrant of Agrigentum; Arcesilaus IV., king of Cyrene; and many other rich and powerful men in Greece and the Greek colonies. About 473 B.C., in compliance with urgent and repeated invitations, Pindar paid a visit to Hiero at Syracuse. It was intended that he should take up his abode permanently with that "tyrannus;" but the arts of court-life soon became distasteful to his independent spirit, and he returned home after an absence of four years. Among his most active patrons was Alexander, son of Amyntas, king of Macedonia. In the praises which he bestowed on this potentate may be found the reasons why, a century and a half later, at the capture of Thebes,

> "The great Emathian conqueror bade spare
> The house of Pindarus, when temple and tower
> Went to the ground."

Nor were the free states of Greece backward in doing honour to his merits. Foremost in the number was Athens, which, in allusion to her heroism during the Persian wars, he had celebrated in one of his dithyrambs as "the pillar of Greece, glorious Athens, the divine city." The Athenians gave him, though a Theban, the *proxenia*, or complimentary franchise of their town, and on one occasion a present of 10,000 drachmæ. After his death they erected a statue in his honour. Similar compliments were paid him by Opus and Ægina, and a still more delicate one by the inhabitants of Ceos, who once employed him, in preference to their own illustrious poets Simonides and Bacchylides, to write a procession-ode for them. The Rhodians inscribed his 7th Olympian ode in characters of gold on the temple of Minerva at Lindus.

In the great events that took place in Greece during his time, Pindar, unlike his contemporary Æschylus, seems to have taken no share. He watched with keen interest the struggle of Athens against Persia, and his countrymen, whose conduct in that struggle was not actively patriotic, were far from pleased with the praises which he lavished on the Athenian victors. The story, that they fined him, and that the Athenians paid the fine, rests on no good foundation. The most marked feature of the poet's personal character was his veneration for the gods. His profession, indeed, demanded that he should show great reverence for their worship and religious observances. That these were not to him mere vain ceremonies we may safely infer. He not only consecrated a temple to the Great Mother and Pan near his own house in Thebes, and statues to Jupiter Ammon in Libya, and to Mercury of the Agora in his native city, but he also rejected or toned down in his odes such myths as represented gods or heroes in undignified or immoral situations.

The poems of Pindar that have descended to us entire belong, with one exception, to the class of Epinician or triumphal odes. That exception is the 11th Nemean, in which the bard celebrates the installation of Aristagoras as prytanis at Tenedos. His extant remains, however, prove him to have excelled in many other departments of lyric poetry; and the ancients themselves do not seem to have attached any special importance to those of his works by which alone we can rightly estimate his powers. Horace no doubt spoke the opinion of antiquity when he attributed to Pindar an unrivalled skill in the kinds of verse specified in the well-known lines;—

> "Seu per audaces nova dithyrambos
> Verba devolvit, numerisque fertur
> Lege solutis,
>
> Seu deos regesque canit deorum
> Sanguinem, per quos cecidere justâ
> Morte centauri, cecidit tremendæ
> Flamma Chimæræ;
>
> Sive quos Elea domum reducit
> Palma cœlestes, pugilemve equumve
> Dicit et centum potiore signis
> Munere donat;
>
> Flebili sponsæ juvenemve raptum
> Plorat."

In the first of these stanzas are mentioned the dithyrambs, or cyclic chorus; in the second, the hymns and pæans; in the third, the *Epinikia*, or songs of triumph; and in the last, the *threnoi*, or dirges; in all of which styles alike Pindar's eminence was unquestioned. The Epinikia, on which we mainly form our estimate of Pindar, are divided into four books. To value them aright it is necessary to appreciate duly the occasions which called them forth. They were written in honour of a victory gained at one of the four great national festivals of Greece—the Olympic, Isthmian, Pythian, and Nemean games. A victory in any of the great contests at these games shed a lustre not only on the conqueror himself, but also on the family and state to which he belonged. On the evening of the day of victory, the conqueror walked in state to the altar of the god of the games, attended by the festive train, which sang his praises. On his return home, a solemn reception was prepared for him by his native town; sacrifices and thanksgivings were offered in his behalf to some god; and the whole proceedings ended in a public banquet and a comus. Hence arises the apparent incongruity of the Epinician odes, in which outpourings of the deepest devotion are found side by side with the wildest utterances of frantic revelry. The victory itself is seldom described; sometimes it is not even mentioned. The glory of the conqueror; his valour,—for none of the contests were without danger; and even his wealth,—for none but persons of at least considerable means could afford the time and money required for the training as fixed by law,—were the themes on which the poet enlarged. The birth of the conqueror is also praised, and, where possible, a parallel drawn between his exploits and those of the mythic founder of the state or city to which he belonged. Indeed the mythic element is a leading feature of the Pindaric odes. Far from being merely ornamental or digressional, it is closely inwoven with the general texture and design of the poems, though its purport is sometimes difficult enough to trace. The structure and distribution of the Epinikia were very intricate; and the chorus which performed them had to be taught their parts either by the bard himself or by some master of the lyric art. The personality of the poet appears in all his odes; he speaks through the mouths of

the chorus as if in his own proper person. It may be questioned how far such a license is consistent with true art; but it gave Pindar what he wanted, an opportunity, namely, of criticising and denouncing his rivals, of defending himself from their attacks, and now and then of sounding his own praises. This latter practice, as in Ol. ii. 83, he occasionally indulges in to an extent scarcely reconcileable with modesty. It is to be remembered, however, that these touches of strong personal feeling, and the sometimes seeming extravagance of his mirth, were by no means inconsistent with the wild revelry of the banquets at which his odes were intended to be sung. The style of Pindar is wonderfully vivid and picturesque. His best English expositor, J. W. Donaldson (in his essay *De Stylo ac Dictione Pindari*), declares that in this quality Pindar had no rival among his own countrymen, and no equal or superior till the age of Dante: "Vivido vigore ingenî fere omnes Græcos superat, atque in ea facultate, quæ res non visas depingit, et quasi sensibus subjicit, neminem cum eo contenderem, præter Durantem illum Aligerum." The general morale of his writings, too, is high and pure. In the moments of his wildest hilarity he uses no improper word or phrase: "Vates deorum ac sacerdos, sic ut oraculum loquebatur." No evil deed is by him once defended; no divinity scoffed at or denounced.

The editions of Pindar are numerous. The *princeps* was published at Venice at the Aldine press in 1513; another by Calliergi appeared at Rome two years later, with the Scholia. The first critical edition is that of Erasmus Schmidius, Wittemberg, 1616. The other editions of the seventeenth century are that of Joannes Benedictus, Salmurii, 1620; and the Oxford edition of 1697. Heyne's celebrated first edition was published at Göttingen in 1773; a second version of this work, with a valuable essay on the Pindaric metres by Hermann, appeared at the same place in 1798. The best German edition of Pindar is that of August Böckh, Leipsic, 1811–21, in 3 vols. 4to, which has thrown an entirely new light on the music of the Greeks, and the artistic construction of their lyric poetry. Dissen's edition, published in the *Bibliotheca Græca*, Gotha, 1830, 2 vols. 8vo, is nothing more than a rather masterly abridgment of Böckh's great work. The illustrative matter is exceedingly good; but as the fragments are not given complete, it cannot be said to supersede its immediate predecessor. Thiersch's Pindar, Leipsic, 2 vols. 8vo, 1820, has a valuable introduction; and the text of the poet, as given in Bergk's *Poetæ Lyrici Græci*, is very accurate. Of English editions, by far the best is that of the Rev. John William Donaldson, London, 1841, in 1 vol. 8vo. It contains the cream of the best German editions, and besides embodying in the notes the results of great original research and scholarship, possesses a learned and masterly Latin essay, *De Stylo ac Dictione Pindari.* The English translations of Pindar are not numerous. The oldest is that of West, which has little to recommend it; Moore's exhibits much more taste and vigour. Better than either is that of the Rev. H. F. Cary, London, 1833, which, however, has the disadvantage of being founded on Heyne's somewhat antiquated edition of the poet.

PINDEMONTE, Ippolito, a delightful Italian poet, was the younger son of a patrician family, and was born at Verona in 1753. A course of education at Este and Modena, and a tour through Europe, fostered and matured his literary taste. A severe illness, which unfitted him for public life, was the occasion of bringing his accomplishments into exercise. Retiring to a country house in the neighbourhood of Verona, he spent his quiet days in the congenial labour of poetical composition. He translated from his favourite classical poets, recorded the solemn thoughts which sprung up amid the stillness of solitude, and descanted upon the news which came at intervals from the distant world. His *Versi* appeared in 1784, his *Volgarizzamento dell' Inno a Cerere scoperto ultimamente e attribuito ad Omero* in 1785, his *Saggio di Poesie Campestri* in 1788, his *Poesie* in 1798, his *Arminio Tragedia* in 1804, and his *Epistole in Versi* in 1805. He had but recently published a prose work, entitled *Elogi di Letterati*, when he died in 1828. A collection of Pindemonte's works appeared in 8 vols., Milan, 1829.

PINDUS, a long mountain chain in ancient Greece. It began, under the name of *Lacmon* or *Lacmus*, about the 40th degree of N. Lat. among the Macedonian and Illyrian ranges. Running southward, it sent off in different directions the rivers Peneus, Aous, Aracthus, and Achelous, and formed the boundary between Thessaly and Epirus. When it reached the 39th degree of latitude it assumed the name of *Tymphrestus*, and shot forth the branch of Mount Othrys. A little farther south, its heights were merged into other ranges. Pindus was deemed a favourite haunt of Apollo and the Muses.

PINEROLO, or Pignerol, a town of the kingdom of Sardinia, capital of a province of the same name, in the division of Turin, stands near the foot of the Alps, on the Chisone, 21 miles S.W. of Turin. It is surrounded by a wall of no great strength; and though irregularly and not very well built, contains several squares, one of which, the Piazza d'Armi, is large and handsome. There are here a fine modern cathedral, several other churches, numerous convents, a town-hall, theatre, college, hospital, and barracks. Manufactures of iron, cloth, paper, leather, and silk are carried on; and there is a considerable trade in these articles, as well as in corn, wine, spirits, &c. Pinerolo, along with Fenestrelles, Oulx, Cesana, and the surrounding country, though originally a part of Piedmont, was in the possession of France from 1631 till the peace of Utrecht in 1713. It was once very strongly fortified; but its defences were blown up by the French in 1713. Pop. 14,000.

PINGRÉ, Alexandre-Gui, a French astronomer, was born at Paris in 1711, and was educated at a religious establishment at Senlis. The first part of his career was devoted to theology; but in 1749 the offer of a teachership in an academy at Rouen gave him a motive for applying himself to astronomy; and about 1753 his appointment to the office of librarian in the academy of St Geneviève afforded facilities for carrying out the study. Henceforth all the energies of Pingré were directed to astronomical pursuits. He became an indefatigable observer of transits and eclipses; and contributed many papers to the Memoirs of the Academy of Sciences, of which he was an associate. Especially in the numerical calculations which he made did his unwearied activity appear. He verified Lacaille's table of the eclipses of the first eighteen centuries of the present era, and carried back the computations to the date of 1000 years before Christ. He also calculated the orbits of all the known comets in a work which was published at Paris in 1783, under the title of *Cométographie*, and which was his only important publication. Pingré died at Paris in 1796. (See Delambre's biography of this astronomer in the *Biographie Universelle*.)

PINKAFELD (Magyar *Pinkafö* or *Pinkafej*), a market-town of Hungary, in the county of Eisenburg, stands on the Pinka, not far from the Styrian frontier, 19 miles W. of Güns. It contains a palace belonging to the Batthyani family; and in the vicinity there is an abundant and much-frequented chalybeate spring. Woollen cloth of various kinds is manufactured here, and an active trade in horses is carried on. Pop. 4000.

PINKERTON, John, a voluminous writer, was born in Edinburgh in 1758, and was educated at the grammar school of Lanark. A self-willed devotion to literature began to characterize him at an early period. Before entering into business, he occupied his time with dipping at random into French classics and mathematics. While serving his apprenticeship

with an Edinburgh writer to the signet he persisted in writing and publishing insipid rhymes. On his abandonment of the legal profession, and his removal to London in 1780, this perverse literary ardour took a new direction. His mind now wandered with all its usual laborious eccentricity into the field of antiquarian research. Sometimes he pored over the ancient literature of his native country, forming collections of ballads, and adding imitations by himself. At other times he made historical compilations, boldly distorting every fact that did not accord with his own prejudices, and fiercely denouncing every one who might dare to dissent from his own conclusions. A long series of curious and whimsical publications was the result. There were *Select Scottish Ballads*, in 2 vols., 1783; *Ancient Scottish Poems*, in 2 vols. 8vo, 1786; *Dissertation on the Origin and Progress of the Scythians and Goths*, 8vo, 1787; *An Enquiry into the History of Scotland preceding the Reign of Malcolm III.*, in 2 vols. 8vo, 1789; and *The History of Scotland during the Reign of the Stuarts*, in 2 vols. 4to, 1797. His *Geography*, published in 1802, in 2 vols. 4to, is considered valuable. In spite of these and many other works, the author had great difficulty in securing a maintenance, and died in indigence at Paris in 1826. Pinkerton was intimate with Gibbon and Horace Walpole.

PINION, in *Mechanics*, an arbor or spindle, having in the body of it several notches, which catch the teeth of a wheel that serves to turn it round; or it is a lesser wheel that plays in the teeth of a larger.

PINNACE, a small vessel navigated with oars and sails, and having generally two masts rigged like those of a schooner.

PINNACLE. See *Glossary* to ARCHITECTURE.

PINS. Metal pins are said to have been introduced into this country from France in the year 1543, previous to which ladies were accustomed to fasten their dresses by means of skewers of boxwood, ivory, or bone. For some time after their introduction pins must have been costly, for we find that they were acceptable New-Year's gifts to ladies, and that presents of money were made for buying pins; whence money set apart for the use of ladies received the name of *pin-money*. In the reign of Henry VIII. a law was passed that "no person should put to sale any pin, but only such as shall be double-headed, and have the heads soldered fast to the shanks of the pins, well smoothed, the shanks well shapen, the points well and round filed, canted, and sharpened." The manufacture of pins was introduced into several towns of Great Britain by individuals who, in some cases, are called the inventors of the article. Pins must soon have been made and sold at a very cheap rate, to justify the common remark, "Not worth a pin," and equivalent expressions in some of our early writers, such as Tusser:—

> "His fetch is to flatter, to get what he can;
> His purpose once gotten, a *pin* for thee than."

Pins are made of brass wire, which is furnished to the pin-maker in a thick, close form, and he reduces it to the proper gauge by drawing. The coil of wire thus produced is straightened by being interlaced and pulled between seven strong metal pegs, and thus made to describe a series of zig-zags, until the coil or twist is taken out of it. When a length of from 12 to 20 feet has been thus straightened, it is cut off, and when a number of these lengths have been collected, they are cut up into short lengths, each containing enough wire for about six pins. These lengths are pointed at each end on an iron cylinder or round head of steel, cut with a double row of teeth, which meet obliquely in the middle of the face. This is called a *mill;* and on the same axis with it is a smaller steel mill with finer teeth. The grinder points from fifty to eighty pin wires at one operation, forming the points first at the larger mill, and smoothing them on the finer-cut mill. By a peculiar action of the thumb and finger the grinder gives the required rotatory motion to the wires. The dust given off during the pointing is injurious to health, and should be removed by careful ventilation. The pointed wires are next placed in a small box shorter than themselves, from which one end is removed, and the projecting portions are cut off by means of shears. The same operation being performed on the opposite ends, the intermediate lengths are returned to the pointer. The heads of the pointed portions are in some cases formed by jumping up a portion of the blunt end of the shaft. In Germany the heads have recently been formed in composition metal, cast after the manner of bullets, with a hole in the centre for the insertion of the shaft; but the older and more common method is to form the heads separately with a few coils of wire. In the latter method, a long, close spiral of wire is formed on a piece of stiff wire about 40 inches long, and of the exact thickness of the pin: this wire, called the *mould*, is attached to an ordinary spinning-wheel, and made to rotate rapidly, and the soft heading-wire being held to it, becomes closely coiled round it nearly from end to end. The coil thus formed is slipped off the mould, and is cut into heads by means of a small chisel, to which a quick chopping motion is given. The heads are next annealed by being raised to a red heat in an iron ladle. The shafts are headed by girls, who are seated with a number of pin-heads in their laps, and, taking up a shaft between the finger and thumb, pass it through the heads, and catch up one on the point; if more than one be taken up, it is removed by the fingers. The head is fastened by placing the shaft in a small steel die sunk to half the size of the head, while another die similarly sunk is allowed to drop upon it, the effect of which is to close the coil firmly upon the shaft. The upper die is suspended vertically in a frame, and can be raised by means of a treadle. Under the lower die is a small spring, which raises the pin out of the die as soon as the blow has been struck, and the upper die raised. A skilful workwoman will thus head 1500 pins in an hour. The next operation is *yellowing*, or scouring in a barrel containing wine lees, or a solution of tartar, and made to rotate for half an hour, the effect of which is to make the pins chemically clean. Then comes the *whitening* or tinning, for which purpose about 6 lb. of pins are put into a copper pan, and upon them 7 or 8 lb. of grain tin; then more pins, and upon them more tin; and so on in alternate layers until the copper is filled; water is added, the pan is set on the fire, and when hot, cream of tartar is sprinkled in, and the water is left to boil for an hour. The pins are next taken out, washed in water; and the process is repeated once or twice, until the pins are properly tinned. The pins are then polished in a rotating barrel containing warm bran: the bran is separated by winnowing; and the pins are collected in bowls for *papering*. The papers having been crimped with irons, the folds for one row are gathered up and placed between the jaws of a vice. A girl, with her lap full of pins, takes up a row by passing a pocket-comb among them, and resting the points in grooves in the vice, presses the heads forward with the thumb, which is covered with a leather guard. In this way the pins are quickly papered. Mourning-pins are blackened after the yellowing by being coated with a black varnish; but a neater and sharper mourning-pin is now made by means of steel wire tempered to a deep purple colour.

Pins are of various sizes, from the large blanket-pin 3 inches in length, to the smallest ribbon-pins, of which 300,000 weigh only 1 lb. Insect-pins, used by entomologists, are of finer wire than ordinary pins, and vary in length from 3 inches to a size smaller than ribbon pins. It has been calculated that ten tons of pins are made every week in England alone, requiring from fourteen to fifteen tons of brass wire.

Attempts have been made to produce pins by machinery, the most successful of which is by Mr Wright, patented in

1824. It is stated as an objection to machine-made pins, that as the heads are made by pressure, a soft wire must be used, which renders the pin liable to bend. (C. T.)

PINSK, a town of European Russia, in the government of Minsk, stands in an extensive marshy plain on the Pina, which here falls into the Pripetz, 148 miles S.S.W. of Minsk. It contains Greek and Roman Catholic churches, several convents, and a college formerly belonging to the Jesuits. Manufactures of Russia leather are carried on here; and there is a considerable trade. Annual markets are held at Pinsk. Many of the inhabitants are Jews or Tartars. Pop. (1851) 8716.

PINTELLI, or PONTELLI, BACCIO, a Florentine architect, was constantly employed at Rome by Pope Sixtus IV. between 1471 and 1484. Among other fabrics, he designed the church of Santa Maria del Popolo, and the Ponte Sisto. But his most notable work was the Sistine chapel, an edifice which was destined to be adorned with some of the greatest masterpieces of modern painting. The death of Pintelli is supposed to have taken place at Urbino about 1490 or 1491.

PINTURICCHIO, BERNARDINO, an eminent Italian painter, was born at Perugia in 1454, and studied under Pietro Perugino. His success in art was very considerable. With the occasional aid, as it is supposed, of his friend and fellow-pupil Raphael, he contrived to design naturally and to execute gracefully. The liveliness of his faces, and the magnificence of his architecture, in spite of a vicious habit of gilding his ornaments, completed the general effect, and made his pictures striking and popular. In course of time, popes, cardinals, and other ecclesiastics noticed him, and entrusted him with several important commissions. He was employed to decorate many churches, and other edifices, both at home and throughout Italy. At length he attained the summit of his excellence in the cartoon at Siena, which represents the most memorable events in the life of Pius II., and in the great work at Spello, which consists of pictures of "The Annunciation," "The Nativity," and the "Dispute with the Doctors." Notwithstanding such a fortunate career, Penturicchio is said to have come to a wretched end at Siena in 1513. According to Vasari, he died of chagrin at having narrowly missed an opportunity of discovering a quantity of gold pieces. Another account states that his wife left him on a sick-bed to perish by hunger. (See Vasari's *Lives of Painters*, &c., and Lanzi's *History of Painting in Italy*.)

PINUS, the PINE-TREE. See BOTANY, and PLANTING.

PIOMBINO, a seaport-town of Tuscany, in the province of Pisa, stands on the channel of the same name, 69 miles S.S.W. of Florence. It is surrounded by walls, and has a citadel, three forts, a fine church, a palace, and a small harbour. In the vicinity there are salt-works, and some remains of the ancient town of *Populonia*. Some trade is carried on here. Piombino was at one time the capital of an independent principality, which included the island of Elba. Pop. 4000.

PIOMBO, FRA, SEBASTIANO DEL. See SEBASTIANO.

PIOVE-DI-SACCO, a town of Austrian Italy, in the government of Venice and province of Padua, stands on the Brenta Canal, 12 miles S.E. of Padua. It contains a castle, several churches and chapels, and many country houses belonging to the Venetians. Leather and linen are manufactured here. Pop. (1846) 6596.

PIOZZI, HESTHER LYNCH, who was the daughter of John Salusbury, Esq. of Bodvel in Caernarvonshire, and was born in 1739, is celebrated for her connection with Dr Johnson. In 1764, the year after her marriage with her first husband, the wealthy brewer Thrale, her intimacy with the great moralist began. A turn for literature, a fondness for intelligent conversation, and a smart, lively fancy, enabled her to appreciate his society. Apartments were allotted to him in her house in the city, and in her villa at Streatham; and her hospitable table was the scene of many of his most brilliant nights. She continued to soothe his hypochondria, and study his wayward tastes, until her marriage with the Italian musician Piozzi in 1784 broke off the friendship. Even then the connection between the two names did not cease. In 1786, while living in Florence, she wrote a book narrating, in a flippant, garrulous, and clever style, many of the superstitious whims, the ridiculous oddities, the brow-beating retorts, and the vehement outbursts of the departed lexicographer. Up till her death, too, in 1821, she continued to talk to another generation about the great men of the Johnsonian age. Besides her *Anecdotes of Dr Johnson*, Mrs Piozzi published *A Collection of Letters to and from Dr Johnson*; a popular poem, entitled *The Three Warnings*; and several miscellaneous works. A book entitled *Piozziana*, by a Friend, appeared in 1833.

PIPE, a musical instrument, various in kind. (See MUSIC, and ORGAN.) Without entering into useless details regarding the ancient αὐλοι and *tibiæ*, we may mention that Strutt, in his *Sports and Pastimes of the People of England*, gives representations of the pipe and tabor, as used in England in the fourteenth century to accompany a dancing-dog, a cock on stilts, a horse rearing, &c. From the drawings we cannot ascertain the nature of the pipe represented. We may, however, suppose it to have been similar to the *galoubet* used in France, along with the tabor, from a very remote period. This *galoubet* is a small instrument of the flageolet kind. Its use, for more than the last two centuries, has been confined to Provence. It has only three finger-holes, and is played with the left hand, whilst the right beats the tabor, which is attached to the performer. The compass of the *galoubet* is two octaves and a tone from D on the third line of the treble clef up to E in *altissimo*. Great skill is required to bring out all the sounds of its compass. Some of the players on this small and imperfect instrument are said to be so dexterous as to be able to perform upon it very difficult pieces of music composed for other instruments, such as the violin, &c. It is always accompanied by the tabor, which is a small drum of a cylindrical form, and rather longer and narrower in its relative proportions than the common drum. In the last century several books of instruction were published at Paris by distinguished performers on the *galoubet*. It was upon a very small instrument of this kind that the blind Sardinian peasant Picco performed so wonderfully at London and at Edinburgh in 1856. (G. F. G.)

PIPE-OFFICE is an office in which a person called the *clerk of the pipe*, makes out leases of crown-lands, by warrant from the lord treasurer, or commissioners of the treasury, or the chancellor of the exchequer. The clerk of the pipe also makes out all accounts of sheriffs, &c., and gives the accountants their *quietus est*.

PIPERS, a musical term, now applied to performers on the bagpipe. Thus we have Northumbrian pipers, Irish pipers, Calabrian pipers, Scottish pipers, &c. The bagpipe seems to be one of the most ancient of musical instruments. It had various names in ancient times and in different countries. Boccaccio introduces it as a fashionable instrument in his *Decameron*; and, from the accounts of the household expenses of our British monarchs, we find that the bagpiper was a court musician in the olden time. In Strutt's *Sports and Pastimes of the People of England* we find a bagpipe-player on stilts, from an illuminated manuscript of the thirteenth century, in the reign of Henry III.; and another bagpiper of the same century, with a girl dancing upon his shoulders. Some of the most curious representations of bagpipers and their instruments (*chori* or *cori*) are given by Gerbert *De Cantu et Musica Sacra*, plates 33 and 34 of the second volume. (G. F. G.)

PIR PANJAL (*Saint's Mountain*), a mountain range of India, stretching from N.W. to S.E., between Cashmere and the Punjab. Its length is about 40 miles, from the Baramula pass on the N.W. to the Pir Panjal pass on the S.E.; and its highest point, which is in N. Lat. 33. 40., is about 15,000 feet above the sea. Its structure on the Cashmere side consists of primary rocks, while the summit is basaltic, and transition formations also appear in some places. The pass of Pir Panjal, though 12,000 feet high, is below the snow-line, and remains passable for a great part of the year.

PIRÆUS, in *Ancient Geography*, a celebrated port to the W. of Athens, consisting naturally of three harbours or basins, which lay neglected till Themistocles put the Athenians on making it a commodious port; the Phalerus, a small port, and not far from the city, being what they used before that time. The Piræus, as Athens flourished, became the common emporium of all Greece. Hippodamus, an architect, celebrated as the inventor of many improvements in house-building, besides other monuments of his genius, was employed to lay out the ground. Five porticoes, which, communicating with one another, formed the *Long Portico*, were erected by the ports. Here was an *agora* or market-place, and, farther from the sea, another called *hippodamia*. Beside the vessels were dwellings for the mariners. A theatre was opened, temples were raised, and the Piræus, which surpassed the city in utility, began to equal it in dignity. The cavities and windings of Munychia, natural and artificial, were filled with houses; and the whole settlement, comprehending Phalerus and the ports of the Piræus, with the arsenals, the store-houses, the famous armoury of which Philo was the architect, and the sheds for 300, and afterwards 400 triremes, resembled the city of Rhodes, which had been planned by the same Hippodamus. The ports, on the commencement of the Peloponnesian war, were secured with chains. Sentinels were stationed, and the Piræus was carefully guarded.

The Piræus was reduced with great difficulty by Sylla, who demolished the walls, and set fire to the armoury and the arsenals. In the civil war it was in a defenceless condition. Calenus, lieutenant of Cæsar, seized it, invested Athens, and ravaged the territory of the state. Strabo, who lived under the emperors Augustus and Tiberius, observes that the many wars had destroyed the long walls, with the fortress of Munychia, and had contracted the Piræus into a small settlement by the ports and the temple of Jupiter the Saviour. (See Athens.)

Piræus, the seaport of Athens, stands on an isthmus joining to the mainland a rocky promontory overlooking the gulf of Salamis, 5 miles S.W. of Athens. The modern town has been entirely built since 1834, and contains many fine houses, four churches, six schools, a custom-house, and a lazaretto. The harbour is deep and good, though rather difficult of entrance; and a quay has recently been constructed capable of accommodating numerous vessels. The number of vessels belonging to the port in 1855 was 496, tonnage 18,331; in the same year there entered, exclusive of the coasting trade, 814 ships, tonnage 229,412; and there cleared 595, tonnage 173,736. The commerce of Piræus is great, and rapidly increasing in importance. The value of the imports was in 1854, L.155,840; and in 1855, L.270,280. The chief articles imported are corn from Turkey and Egypt, sugar, coffee, and all kinds of manufactured articles. The export trade is not so great; it amounted in value in 1854 to L.12,520, and in 1855 to L.28,080. Raw silk, wool, and leeches are sent to France; wine, cheese, honey, &c., to Turkey; hides, tobacco, &c., to Austria; and silk to Britain. Pop. (1852) 5526.

PIRANESI, Giovanni Battista, a very eminent Italian engraver, was born in the former half of the eighteenth century, and studied his art at Rome. The sight of the great architectural remains of that city soon kindled within him a flame of enthusiasm, which continued to burn throughout his career. With all the powers of his ardent genius in full play, he began to copy and restore the ruined edifices. His cunning hand faithfully imitated the actual remains of a fabric; his exquisite invention, catching the design of the original architect, supplied the parts that were wanting; his artistic skill introduced groups of vases, altars, tombs; and his scientific distribution of light and shade completed the picture, and threw a striking effect over the whole. One engraving after another was executed with unrivalled brilliancy; and a magnificent vision of the palaces and temples of the ancients continued to rise before the eyes of the public. As the great work went on, the zeal of the artist only waxed stronger. In course of time it was found necessary to call in the aid of all his children, and of several pupils. He did not, in fact, slacken in his exertions until in 1778 his enthusiasm was quenched by death. The plates of Piranesi were collected and preserved by his son and coadjutor Francesco. They were afterwards published, to the number of about 2000, in 29 vols. fol., Paris, 1835–37.

PIRANO, a town of the Austrian empire, in the kingdom of Illyria, and circle of Istria, stands at the extremity of a small peninsula separating the bay of Trieste from that of Largone, 13 miles S.W. of Trieste. It is well built, and contains an old castle and a Gothic cathedral. The harbour is large, but shallow; and there is good anchorage for large vessels in the roads. There are also docks for ship-building. Fishery and trade are actively carried on; the exports consisting of wine, oil, and salt from the works in the neighbourhood, which are the largest in Istria. Pop. 9200.

PIRATE (πειρατής), a sea-robber, or an armed ship which roams the seas without any legal commission, and seizes and plunders every vessel she meets with indiscriminately, whether friends or enemies.

PIRMASENS, or Pirmasenz, a town of Bavaria, in the circle of Palatinate, stands in a hilly and well-wooded country, 22 miles W.S.W. of Landau. It is well built, and surrounded by a wall; and contains several churches, and a palace, formerly the residence of Louis IX. of Hesse-Darmstadt. Shoes, musical instruments, straw-hats, mirrors, and other articles are manufactured here. Pop. 5600.

PIRNA, a town of Saxony, in the circle of Dresden, stands on the left bank of the Elbe, 10 miles S.E. of Dresden. It rises in terraces from the river up to the fortress of Sonnenstein, which is now used as a lunatic asylum. This fortress was stormed by the Swedes in 1639; and in 1758 the Prussians took it, and destroyed the outer works. The town is surrounded by walls, and entered by two gates. It contains a fine Gothic parish church, several other churches, an orphan hospital, and a handsome railway station. It is the seat of a court of law, and of several public offices. Calico, porcelain, beet-root sugar, &c., are manufactured here; and there is a considerable trade and navigation on the Elbe. In the vicinity there are good quarries of sandstone. Pop. 6592.

PIRON, Alexis, a French poet, was born at Dijon in July 1689, where his father was an apothecary, and where he passed more than thirty years in idle and destructive dissipation. He was at length obliged to quit the place of his nativity, in order to avoid the reproaches of his fellow-citizens, on account of an ode which he had written, and which gave them great offence. His relations not being able to give him much assistance, he supported himself at Paris by means of his pen, the strokes of which were as beautiful and fair as those of an engraver. He lived in the house of M. de Belleisle as his secretary, and afterwards with a financier, who, however, did not know that he had a man of genius under his roof. His reputation as a writer commenced with some pieces which he published for the

Pisa.

entertainment of the populace, and which showed strong marks of original invention; but what fully established his character in this way was his comedy entitled *Métromanie*, acted in 1738, and replete with genius, wit, and humour, and which was pronounced the best that had appeared in France since Regnard's *Gamester*. Piron's mischievous ingenuity was partly the cause which excluded him from the French Academy. "I could not," said he, "make thirty-nine people think as I do, and I could less think as thirty-nine do." He called that celebrated society "les invalides du bel esprit," and yet he often endeavoured to become one of those invalids. He died on the 21st of January 1773, at the age of eighty-three. He had prepared for himself the following characteristic epitaph:—

Ci gît Piron, qui ne fut rien,
Pas même académicien.

A collection of his works appeared in 1776, in seven vols. 8vo, and nine vols. 12mo. The principal pieces are,—*L'Ecole des Pères*, a comedy acted in 1728 under the title of *Fils Ingrat; Callisthène*, a tragedy, the subject of which is taken from Justin; *L'Amant Mysterieuse*, a comedy; *Gustave Wasa* and *Ferdinand Cortez*, two tragedies, some scenes of which discover an original genius, but the versification neither pleases the ear nor affects the heart; *Métromanie*, a comedy; *Les Courses de Tempe*, an ingenious pastoral, in which the manners both of the town and country are pleasantly drawn; with some odes, poems, fables, and epigrams. In this last kind of poetry he was very successful, and he may be placed after Marot and Rousseau. Excepting *Métromanie, Gustave Wasa, Les Courses de Tempe*, some odes, about twenty epigrams, three or four fables, and a few epistles, the rest of his works are but indifferent, and have no claim to any extraordinary merit.

PISA, a town of the grand duchy of Tuscany, capital of the province of the same name, in a fertile plain on both sides of the Arno, 8 miles above its mouth, and 45 W. of Florence. It is surrounded by walls and ditches, about 6 miles in circuit, and is entered by six gates. A great part of the area thus inclosed is occupied by gardens, or entirely unoccupied; and this gives the outer part of the town a very dreary and decayed appearance. But the central part has no lack of cheerfulness and animation; its broad though irregular streets are lined with many stately palaces and gorgeous marble buildings. Both sides of the Arno are lined with quays, and with a street called the Lung d'Arno containing many splendid edifices. Three bridges span the river; one of them, of marble, is among the finest structures of the kind in Europe. In a large open grass-grown space, at the N.W. corner, stand the four most remarkable edifices,—the cathedral, baptistery, leaning tower, and *Campo Santo*, or cemetery,—all built of white marble in the same style, beautifully grouped together, apart from the other buildings. The cathedral, whose architect was Buschetto, is a splendid building, founded 1067, and consecrated 1118. It is in the form of a cross, with a nave, 4 aisles, transepts, and choir. Its whole length is 311 feet; breadth of the nave and aisles, 106 feet; length of the transepts, 237 feet; breadth of the western front, 116 feet; height from the pavement to the summit of the roof, 112 feet. In the centre rises an elliptical dome, adorned on the outside with eighty-eight columns, and supported in the interior by four piers. The nave is separated from the aisles by twelve Corinthian columns on each side; and these are surmounted by arches; and these again by a number of smaller shafts. The cornices, as well as the bases and capitals of the columns, have been formed by Buschetto with great skill from various fragments of antiquity brought from different places. The twelve altars in the nave and transepts are said to have been designed by Michael Angelo. They are simple in general design, and have much variety in their details. The high altar is heavy; richly and elaborately ornamented. The church also contains many paintings and painted windows, a fine pulpit, and three magnificent bronze doors. It has suffered much from the sinking of the ground, and was greatly injured by a fire in 1596. In the nave is hung a large bronze lamp, the oscillations of which are said to have suggested to Galileo the theory of the pendulum. Opposite the west front of the cathedral stands the baptistery, a circular building 116 feet in diameter, surmounted by a conical dome 102 feet high. In the interior there is a corridor, raised on three steps, running round the building, for the accommodation of spectators of the rite of baptism, which is administered at a large font in the centre. It is of white marble, carved, and inlaid with coloured stones; and has in the centre an image of St John on a column. The baptistery contains a remarkably beautiful pulpit by Niccola Pisano. The exterior of the building is adorned with sculptures and statues. The famous leaning tower of Pisa stands at the other end of the cathedral, overhanging its base more than 13 feet. In shape it is cylindrical, 53 feet in diameter at the base, and 179 feet high; and it consists of eight tiers of columns supporting semicircular arches, and forming as many galleries round the tower. Its leaning position is probably accidental, owing to the sinking of the soil; but it is quite safe, as the centre of gravity falls considerably within the base, and the walls are strengthened with iron bars. The view from the top is extensive and beautiful. The Campo Santo, which stands to the north of the other edifices, is of an oblong form, 415 feet long by 138 broad, and is surrounded by an arcade 34 feet broad and 46 high. In the centre is a mound of earth, said to have been brought from Mount Calvary, and formerly used as a burial-place for its supposed miraculous qualities. The surrounding arcade contains numerous ancient and modern sculptures, and the walls are covered with frescos, some of which are much admired. Pisa contains numerous other churches, some of them remarkable for the beauty of their architecture, or of the pictures they contain: in that of St Catherine is still preserved the pulpit from which Thomas Aquinas used to preach. There are also numerous fine palaces in Pisa. The university of Pisa, founded in the fourteenth century, was formerly one of the most celebrated in Italy; but its faculties of law and philosophy have recently been transferred to Siena. It has nearly 300 students. In the quadrangle stands a fine marble statue of Galileo, erected in 1839. Attached to the university are a library, a museum of natural history, and a botanic garden. The town contains an academy of fine arts, several schools, hospitals, a theatre, &c. It is defended by a citadel to the north, and a fortress to the south of the Arno. Some remains of antiquity, especially of baths, still exist at Pisa. The manufactures of the town are few and unimportant, consisting of cotton and woollen stuffs, soap, white lead, vitriol, &c. The trade has very much declined since the rise of Leghorn. Of the origin of the ancient *Pisæ*, which occupied the same site as the modern town, several traditions are given, but little is known with certainty: whether founded by Pelasgians; or, as the poets would have us to believe, by Greeks from the Elean Pisa; or, according to a third account, by Etruscans. It was at one time Etruscan; but its early fightings with the Ligurians, and its exploits in piracy and trade, are buried in the dim obscurity of those early times. We do not even know how, nor exactly when, *Pisæ* became subject to the growing power of Rome. It certainly was a dependent ally of the republic before the second Punic war, and its port was used as a place of departure for Spain and Gaul. It was also for a long time the frontier city against the Ligurians; and suffered frequently from the invasions of these people in their protracted wars with Rome. In 180 B.C. a colony was established here, and it soon be-

came one of the most flourishing places in Etruria; but its history again becomes obscure in the decline of the Roman empire. It passed successively under the dominion of the Goths, Lombards, and Franks, when they conquered Italy; and subsequently became virtually an independent state, owning allegiance nominally to the marquises of Tuscany, who were vassals of the emperor. In this condition the city gradually rose to much importance, and maintained a fleet of galleys, which was employed with much success against the Mohammedan pirates on the coasts of the Mediterranean. They even went so far as to conquer, in 1022, the island of Sardinia, with the assistance of the Genoese, and afterwards that of Corsica, which they received in 1091 as a fief from the Papal See. This was the period of their greatest prosperity, when the city was decorated by its magnificent ecclesiastical edifices. For about four centuries Pisa was one of the most powerful maritime powers in the Mediterranean; but this high rank was lost in the course of the long wars with Genoa, which began in 1070, and resulted in the destruction of the harbour of Pisa in 1290. Meanwhile the city was also engaged in the wars between the Guelphs and Ghibelines in Italy. Pisa supported the latter or imperial party, and was attacked by Florence, the head of the opposite side. It was in these contentions that Ugolino, Count Gherardesca, whose story has been rendered famous by Dante, after being for ten years captain-general of Pisa, was displaced by the Pisans for favouring the Guelph party, and died by starvation, with his sons and grandsons, in the Tower of Famine, which is still pointed out in the city. Peace was at last made with Florence in 1293, and with Genoa in 1299; and the city, now shorn of its naval power, afterwards lost by the same unhappy feuds its independence too. War soon after broke out anew, and Pisa had to contend single-handed against the whole power of Tuscany. In 1326 they lost Sardinia, after repeated attempts to retain it. But the city itself long held out against its foes, and was only reduced by domestic feuds and treachery under the power of Florence in 1406; the chief families proudly withdrawing to Sardinia and Sicily. On the French invasion in 1494, Pisa made a last effort for independence, but was a second time conquered by Florence in 1509. Its liberty was now lost for ever; and it has continued since that time subject to Florence, whose fortunes it has shared. Pisa is celebrated as the birthplace of the famous Galileo. Pop. 25,000. The province of Pisa has an area of 1176 square miles. Pop. (1857) 229,730.

PISA, LEONARDO. See ALGEBRA.

PISANO, ANDREA, an eminent Italian sculptor, born at Pisa about 1280, and had the honour at a very early age of introducing a new style of art. Taking as his models the collection of ancient statues which were preserved in the cathedral and the Campo Santo of his native city, and also adopting Giotto's new method in design, he improved immensely upon the coarse and infelicitous manner of his predecessors, and rose to the first place in his profession. As a result of this proficiency, it came to pass that Pisano was summoned by the Florentines to take up his abode amongst them, to adorn their city, and to receive their patronage. He was employed to ornament with statues of the apostles and saints the façade of Santa Maria del Fiore. He was engaged during twenty-two years in executing the great gate of bronze for the church of San Giovanni, a work which still remains a proof of his genius. Many other commissions, both in sculpture and in architecture, continued to be entrusted to him until he died in 1345, surrounded with affluence, and dignified with the titles of citizen and magistrate.

PISANO, *Niccola*, a very celebrated Italian sculptor and architect, was born at Pisa about the beginning of the thirteenth century. The restoration of art was the great task of his life. Studying the ancient sarcophagi in his native place, he acquired a style closely resembling the antique. Then being extensively employed both as a sculptor and an architect, he gave in many different cities of Italy many specimens of a new and improved manner of design, invention, and composition. The urn at Bologna, which procured for him the name of "Niccola of the Urn," and the marble pulpit in the church of San Giovanni at Pisa, which was sculptured over with the "Universal Judgment," were especially instructive to the artists of the day. Architects, sculptors, and even painters, felt themselves stimulated and assisted in their several pursuits. Nor did his influence cease when he died in 1278. The revival in art was continued by his son Giovanni, who died in 1320, leaving many memorials throughout Italy of his excellence in sculpture and architecture.

PISCINA, a large basin in a public place or square, where the Roman youth learned to swim, and which was surrounded with a high wall, to prevent filth from being thrown into it. This word is also used for a lavatory amongst the Turks, placed in the middle court of a mosque or temple, where the Mussulmans wash themselves before they offer their prayers.

PISEK (Lat. *Piseca*), a town of Bohemia, capital of a circle of the same name, stands on the Wottawa, here crossed by a fine bridge, 24 miles W.S.W. of Tabor, and 55 S.S.W. of Prague. It is surrounded by an ancient wall, and contains a castle, several handsome churches, a grammar school, military academy, &c. There are here an iron-wire work, cotton factories, dye-works, and manufactories of musical instruments. Pisek is the seat of law courts for the circle. Pop. (1846) 6092.

PISIDIA, a district of Asia Minor, originally included within Pamphylia or Phrygia, was constituted a separate province in the division of the Roman empire under Constantine the Great. It was bounded on the N. by Phrygia, on the W. by Phrygia and Lycia, on the S. by Pamphylia, and on the E. by Cilicia and Isauria. The physical character of the country was wild and variegated. Offshoots from Mount Taurus extended themselves in all directions; a rich fertile valley occasionally intervened; and a chain of lakes inclosed the landscape. The habits of the inhabitants were in accordance with their mountain home. Under their original name of *Solymi*, they lived a lawless, free-booting life, spurning the advance of civilization, and daring any invader to follow them into their rugged fastnesses. Rome conquered them only to find that their spirit of independence was not broken. They would not brook the establishment of a single garrison or colony. It was only their towns that paid tribute. They carried their invincible disposition down to modern times; and under the appellation of *Karamanians* they still continue to be wild, rapacious, and suspicious of strangers.

The principal towns of Pisidia were Selge, Cremna, Sagalassus and Termessus.

PISISTRATUS, the son of Hippocrates, was descended from one of the most illustrious families of Athens, which claimed to derive their origin from Codrus, and through him traced their pedigree to Nestor and the Pylian kings. At the time that he began to take part in the political affairs of his country, there were three factions struggling for power; those of the lowlands, highlands, and coast. Megacles, chief of the great family of the Alcmæonidæ, took the lead of the coast party, whilst Pisistratus headed the democratical faction of the highlanders. Solon had tried to calm their passions by the wisdom of his laws, but the contending parties had refused to submit; and when he returned, after an absence of several years, he found much confusion, and everything tending towards a state of anarchy. Pisistratus was determined to secure to himself the chief authority in the government; and by pretending to the people that he was in danger of his life, he

obtained a guard for the security of his person, and it was not long before he made himself master of the citadel. He thus became what was afterwards called Tyrant of Athens, B.C. 560; though Herodotus expressly states that all the laws continued in force, and that the constitutional powers of the magistrates were not in the least restricted. Solon used to say that, were it not for his ambition, there would not be a better disposed man, or a more worthy citizen, in Athens. Though Solon was no doubt deeply mortified that his countrymen were unable to maintain the political constitution which he had formed for them, it does not appear that he broke off all connection with Pisistratus. He took the wiser course of trying to direct his measures for the benefit of his country, and assisted him in the administration of the commonwealth. How long Pisistratus continued to maintain himself in power is not stated, but he was at last driven into exile by the two parties of Megacles and Lycurgus uniting their strength. A dispute between the victors induced Megacles to propose an accommodation with Pisistratus, upon condition that he should marry his daughter; and this was at once acceded to. A quarrel, however, with Megacles again took place, and Pisistratus was obliged to retire to Eretria in Eubœa. Here he continued to increase his influence till a favourable opportunity presented itself of regaining his former position. It was in the eleventh year of his second banishment that he returned, when the Athenians flocked to his standard, and, in the words of Herodotus, preferred tyranny to liberty. He defeated the Alcmæonidæ, and entered Athens, promising safety to all who returned quietly to their homes. Some of the leaders were of course banished, but the great body of the people seem to have benefited by the change. He was kind to the poor, and introduced many laws and regulations which were highly advantageous to his country. He was a lover of learning, and is said to have been the first who arranged the poems of Homer as we now have them. Cicero speaks of his eloquence in the highest terms. He continued to direct the administration of Athens till his death, B.C. 527, thirty-three years after his first usurpation, of which time he ruled seventeen years. He left two sons, Hippias and Hipparchus, who succeeded to his power.

PISTICCIO, a town of Naples, in the province of Basilicata, between the Basiento and the Salandrella, 15 miles S. by W. of Matera. It contains several churches, a convent, hospitals, and manufactories of woollen cloth. Pisticcio was nearly destroyed by an earthquake in 1688. Pop. 6200.

PISTOJA, or PISTOIA (anc. *Pistoria*), a town of Tuscany, in the province of Florence, near the Ombrone, not far from the opening of the valley of that river into that of the Arno, 21 miles N.W. of Florence. It is inclosed with lofty ramparts bearing the Medici arms, and covers a large extent of ground; though, as the population is not commensurate with the size of the town, much of the space is occupied with gardens. The streets and squares are broad, and lined with handsome buildings, but they are pervaded with that dulness which characterizes many Italian towns. Many of the public buildings possess much interest. The cathedral has been built at different dates, and the interior modernized in 1838 and 1839. Though not very remarkable for architecture, it contains a great variety of paintings, sculptures, and monuments. Opposite the cathedral is a baptistery in the Italian-Gothic style. The church of St Andrew, which was probably the original cathedral, contains a finely-carved pulpit by Giovanni da Pisa. Several of the other churches in the town are remarkable for their architecture or the paintings they contain. The Palazzo Pretorio and the Palazzo della Communita, Italian-Gothic buildings of the thirteenth century; the episcopal palace, built in 1787; and other similar buildings, are among the ornaments of Pistoja. The town has also several convents, a large hospital founded in 1218, a clerical seminary and other schools, two good public libraries, and a theatre. Pistols are said to have been so named because first made at Pistoja; but they are not now manufactured here. Musket-barrels, cutlery, nails, iron wire, musical instruments, silk fabrics, &c., are produced. Some trade is carried on in silk, straw bonnets, and other articles. *Pistoria* was originally an Etruscan town, but no remains of this period have been preserved. It was a municipal town of small importance under the Romans, and is only historically remarkable for its proximity to the scene of the final defeat and death of Catiline, B.C. 62. Under the Lombards, Pistoja was a place of importance, and was surrounded by walls. After being for some time independent, it became subject to Florence about the middle of the twelfth century. From the dissensions of the Pistojan family of Cancellieri arose in 1296 the factions of the Bianchi and Neri, whose contentions spread to Florence, and involved it, as well as Pistoja, in the greatest calamities. Finally, in 1306, Pistoja was surrendered to the Neri, who destroyed its walls, a blow from which the town never recovered. Pop. 12,387.

PISTON, in pump-work, is a short cylinder of metal or other solid substance, fitted so as to slide air-tight in the cavity of the barrel or body of the pump.

PITCAIRN ISLAND, a solitary island in the Pacific Ocean, S. Lat. 25. 4., E. Long. 130. 8. It is about 7 miles in circumference, and is elevated, and surrounded with steep cliffs. The highest peak on the island is 1046 feet above the sea. The N. coast, where the settlement was, presents a very fine appearance, the ground, which is thickly wooded, rising in the form of an amphitheatre, flanked by steep cliffs. The coasts of the island are for the most part inaccessible to vessels, as they are rocky and exposed to a heavy swell. There are a few small coves, and some traces of coral, but no coral reefs. The island has three landing-places; two having a steep ascent from the beach, and the other, which was generally used by the inhabitants, is very difficult of access. The structure of the island is sandstone, with particles of iron; and volcanic rocks also exist. The soil is deep and rich, consisting of clay mixed with sand. The climate is healthy, and the temperature varies from 59° to 89°. Bananas, plantains, yams, sweet potatoes, cocoa-nut trees, fig trees, mulberry trees, screw pines, and other vegetables are indigenous; while the bread-fruit tree, tobacco, &c., have been introduced. Swine, goats, and domestic fowls are the principal animals. The island was discovered by Carteret in 1767, and named after one of his officers called Pitcairn, who was the first to see it. Its chief interest, however, is connected with the mutineers of the Bounty and their descendants, who lived on it for upwards of sixty years. It was in 1790 that nine of these mutineers landed there, along with six men and twelve women from Tahiti. Although the island was then uninhabited, there is little doubt, from the remains that were subsequently discovered, that it was at one period occupied by natives, who had either become extinct or migrated to some other land. Violent quarrels soon began to break out among the settlers, excited by the use of spirits that were distilled from a root found on the island; and these feuds proved so bloody, that within ten years after the original settlement on the island, the whole of the Tahitian men and all the Englishmen but one, had perished. John Adams, the only surviving mutineer, having a Bible and Prayer-Book that had been saved from the Bounty, was struck on their perusal with remorse for his crimes; and becoming a true Christian, began, with the aid of these books, to instruct the Tahitian women who remained, and their children by the white men. The result of this has been, that a very remarkable community grew up in this lonely isle, distinguished, according to the testimony of all who have visited them, by the kindness and gentleness of their character, and

the virtuous simplicity of their life. As the number of the inhabitants increased, it was feared that the island might not be sufficient for their sustenance; and accordingly, in March 1831, the Pitcairn islanders were conveyed by the British government to Tahiti; but they being dissatisfied with their new position, and having lost several of their number by sickness, returned soon after to their original settlement. In May 1856 the whole community finally left Pitcairn Island, and landed on the 8th of June at Norfolk Island, where land had been allotted to them by the British government. (See NORFOLK ISLAND.)

PITCAIRNE, ARCHIBALD, an eminent physician, was born at Edinburgh on the 25th December 1652. Having taken his master's degree at the university of his native city in 1671, and having spent some time in the study of law, he afterwards turned his attention to medicine. He prosecuted the latter study with great ardour and success for five years in France, and took his medical degree at Rheims on the 13th of August 1680. Returning to Edinburgh, he entered upon a distinguished professional career. On the foundation of the Royal College of Physicians in 1681, Pitcairne was chosen a fellow of that learned body. His publication of *Solutio Problematis de Inventoribus* in 1688 extended his professional reputation, and had the effect of procuring for him the chair of physic at Leyden in 1692. The students of that venerable university—and among them were Boerhaave and Mead—found the Scot too abstract and geometrical in his medical prelections for their tastes, which led to Pitcairne's return to his native city during the following year. He took to his former practice, and soon gained a British reputation as a skilful physician. What leisure he had he contrived to occupy in the composition of satirical verses, which seem to have pleased his friends while they exasperated his enemies. His satirical propensities, combined with his violent prejudices as a Jacobite and an Episcopalian, and a relish for questionable jests, led him into contests, professional and otherwise, both frequent and fierce. The ferocious attack to which he was subjected in the *Apollo Mathematicus*, published in 1695, and ascribed to the pen of Dr Eyzat, was the precursor to a rancorous and disreputable pamphleteering war, conducted by the members of the Royal College of Physicians. At the outset of the squabble Pitcairne rashly unseated himself in the Royal College. He retired in sullen protest, but overtures of reconciliation and pacific resolutions having been duly framed and agreed upon, the breach was got healed, and the suspended doctor resumed his seat after a six years' absence. In 1701 Pitcairne published a volume of eight dissertations at Rotterdam, entitled *Archibaldi Pitcarnii Dissertationes Medicæ*, which he enlarged by the addition of six new discourses in 1713. Of these fourteen dissertations an English translation was soon afterwards published in 8vo, by Drs Sewell and Desaguiliers, under the title of *The Whole Works of Dr Archibald Pitcairne published by himself; wherein are discovered the true Foundation and Principles of the Art of Physic, with Cases and Observations upon Distempers and Medicines.* A tract containing *Epistola Archimedis ad Regem Gelonem, Albæ Græcæ reperta anno æræ Christianæ* 1688, appeared at Amsterdam in 1706. Dr Pitcairne died on the 26th October 1713, in the sixty-first year of his age.

Four years after the author's death appeared a volume made up mainly of notes of his lectures, taken by his pupils. A complete collection of his works in Latin prose, with the addition of a few poems, entitled *Archibaldi Pitcarnii, Medici celeberrimi Scoto-Britanni, Opera Omnia Medica*, appeared at Leyden, 4to, 1737. To Pitcairne also is assigned a share in the composition of *The Assembly, a Comedy by a Scots Gentleman*, London, 1722, and Edinburgh, 1766; a performance characterized more by ribaldry and profanity than by wit or humour. To him also is ascribed the authorship of *Babell, a Satirical Poem on the Proceedings of the General Assembly in the year* 1692, Edinburgh, 1830. His Latin poems, of which an edition was published under the title of *Selecta Poemata*, Edinburgh, 1727, were much esteemed during his own day. They are chiefly to be admired for their point and pungency. Pitcairne belongs to the mathematical and mechanical school of physic; and in the annals of medicine his name is honourably mentioned with those of Borelli, Bellini, and other great masters of the mathematico-medical art. Despite his numerous failings, he seems to have been a man of a highly benevolent disposition; and he is said to have been in the habit of relieving many who knew not their benefactor. "In short," says Dr Sewell, "he was one of the greatest and most useful men in his profession this age has produced; of a free and universal genius, a good orator, poet, and philosopher. He was of a pleasant engaging humour. Life sat very easy upon him in all its circumstances. He despised many, but hated none."

PITCH. See TAR.

PITEA, or NORTH BOTHNIA (Swed. *Norrbotten*), a lân or province of Sweden, lying between N. Lat. 65. and 69., E. Long. 15. 15. and 24. 10., is bounded on the N. and W. by Norway, S. by the lan of Umea, and E. by the Gulf of Bothnia and Russian Lapland; area, 32,934 square miles. A great part of this country, lying to the N., is occupied by the largest plain in Sweden. This extends from the foot of the Kiolen Mountains, which separate it from Norway, to the shore of the Gulf of Bothnia; and, with the exception of a few small hills, it is entirely flat, covered here and there with marshes and small lakes. At the foot of the mountains the land is 1300 feet above the sea; but it gradually slopes downwards, and about midway, between the mountains and the sea, has only an elevation of 400 feet. In the higher portions of this plain dwarf birches are almost the only growth; farther down these appear as trees, and pines also grow; and near the sea the whole country is covered with forests, except the banks of the rivers, where the soil is cultivated. This plain extends from the Russian frontier as far to the S.W. as the Lulea, beyond which river the country consists partly of mountains and partly of plains and valleys. The Kiolen range, which here attains its highest elevation in Mount Sulitelma, sends off numerous ridges towards the E., which are separated by wide valleys. The greater part of this country is covered with wood, except in the more lofty regions. Near the Bothnian Gulf, however, farming is carried on to some extent. The principal rivers of Pitea are,—the Tornea, with its affluent the Muonio, forming the boundary between Sweden and Russia; the Calyx, the Lulea, and the Pitea; all flowing from the mountains into the Gulf of Bothnia, and most of them flowing through numerous lakes. The capital of the lan is Pitea, a town of 1545 inhabitants, which stands on an island at the mouth of the river of the same name, and has a harbour and docks. Lulea and Tornea are the chief other towns. Pop. of the lân (1855), 60,108.

PITHIVIERS, a town of France, capital of an arrondissement in the department of Loiret, on the top and sides of a hill near the Oeuf, 25 miles N.E. of Orleans. It is pretty well built, and contains the ruins of a square castle, erected in the tenth century. Linen, hosiery, farming implements, &c., are made here; and the place is famous for almond cakes and lark pies. Some trade is carried on in saffron, wool, wine, honey, &c. Pop. (1855) 4348.

PITHOU, PIERRE, a Frenchman of great literary eminence, was descended from an ancient and noble family in Normandy, and born at Troyes in 1539. His taste for literature early showed itself, and his father cultivated it to the utmost. He first studied at Troyes, and was subse-

quently sent to Paris, where he became the scholar and friend of Turnèbe. Having finished his pursuits in languages and the belles lettres, he was removed to Bourges, and placed under Cujas to study the civil law. On the removal of Cujas to Valence, Pithou followed him, and continued to profit by his lectures until the year 1560. In 1563 Pithou published his *Adversaria Subcesiva*, a work highly applauded by Turnèbe, Lipsius, and other learned men, and which laid the foundation of that extensive fame which he subsequently acquired. Soon after this, Henri III. advanced him to some considerable posts, in which, as well as at the bar, he acquitted himself most creditably. Pithou, being a Calvinist, narrowly escaped being involved in the massacre of St Bartholomew in 1572; a circumstance which seems to have frightened him out of his religion, which he soon afterwards abjured in favour of the Catholic faith. He died upon his birthday in the year 1596.

Pithou published a great number of works upon law, history, and classical literature; and he gave several new and correct editions of ancient writers. He was the first who made the world acquainted with the *Fables* of Phædrus, and the little anonymous poem entitled *Pervigilium Veneris*, from manuscripts in his possession. He published his master Cujas' *Observations on the Roman Law*, accompanied with remarks and annotations of his own. We are also indebted to him for the discovery of the laws of the Visigoths, which he published in 1579. His principal writings on the canon law are,—*Corpus Juris Canonici*, 1687, 2 vols. folio; *Codex Canonum vetus ecclesiasticum*, in folio; *Gallicæ Ecclesiæ in schismate Status*, in 8vo; and *A Treatise on the Liberties of the Gallican Church.* Pithou also published an edition of the *Capitularies*, a series of French annalists, from the eighth to the thirteenth century; *Memoirs of the Counts de Champagne and de Brie;* the *Historical Fragments of St Hilarius*, containing curious particulars respecting the Council of Rimini; and the writings of several ancient doctors of the Gallican Church, of which several had until then remained inedited. We are likewise indebted to him for editions, from the best manuscripts, of several ancient geographers, the *Itinerary from Bordeaux to Jerusalem*, the works of Salvian, the works of Juvenal and Persius, Petronius, and the moral distichs attributed to Cato.

PITISCUS, SAMUEL, a learned philologist, was born at Zutphen in 1637, and became rector of the college of that city, and afterwards of St Jerome at Utrecht, where he died on the 1st of February 1727. He wrote a *Lexicon Latino-Belgicum*, 1704, in 4to; a *Lexicon Antiquitatum Romanorum, in quo ritus et antiquitates, tum Græcis et Romanis communes, tum Romanis particulares exponuntur*, Leeuwarden, 1713, in 2 vols. folio; and he published good editions, with prefaces and notes, of Quintus Curtius, Polyhistor, Solinus, with the Observations of Salmasius on Pliny, Suetonius, Aurelius Victor, the *Pantheon Mythicum*, and the *Antiquitates Romanæ* of Rosini. In 1685 Pitiscus announced a *Lexicon Catullo-Tibullo-Propertianum*, which unfortunately never appeared.

PITOT, HENRI, descended of a noble family of Languedoc, was born at Aramon, in the diocese of Usez, on the 29th of May 1695. He studied the mathematics without a master; and went to Paris in 1718, where he formed a close friendship with the illustrious Reaumur. In 1724 he was admitted a member of the Royal Academy of Sciences at Paris, and in a few years he rose to the rank of pensioner. Besides a great number of Memoirs printed in the collection of that society, he published in 1731 the *Theory of the Working of Ships*, in one volume 4to, a work of considerable merit, which was translated into English, and caused the author to be admitted into the Royal Society of London. In the year 1740 the States-General of Languedoc made choice of him as their chief engineer, and at the same time gave him the appointment of inspector-general of the canal which unites the two seas. The city of Montpellier being in want of water, Pitot brought from a distance of three leagues the water of two springs, which furnish a plentiful supply of that necessary article. The water is brought to the magnificent Place du Peyron, and thence distributed throughout the city. This work is the admiration of all strangers. In 1754 Pitot was honoured with the Order of St Michael. He died in 1771, aged seventy-six. Pitot was a practical philosopher, and a man of uncommon probity and candour. He was a member of the Royal Society of Sciences of Montpellier, before which his *éloge* was pronounced in 1772 by M. de Ratte, perpetual secretary, in presence of the states of Languedoc; and in the Royal Academy of Sciences of Paris, the same honour was done him by the Abbé de Fouché, who was then secretary.

PITS, or PITSEUS, JOHN, an English biographer, was born in 1560, at Aulton in Hampshire, and educated at Wykeham's school, near Winchester, where he remained until he was about eighteen years of age, when he was sent to New College, Oxford, and admitted a probationer. Having continued in that university not quite two years, he left the kingdom as a voluntary exile, and retired to Douay. He thence proceeded to the English college at Rheims, where he remained about a year, and then went to Rome, where he continued a member of the English college nearly seven years, at the expiration of which he was ordained priest. In 1589 he returned to Rheims, where, during two years, he taught rhetoric and the Greek language. He then quitted Rheims on account of the civil war in France, and retired to Pont-à-Mousson, in Lorraine, where he took the degrees of Master of Arts and Bachelor in Divinity. From this he travelled into Germany, and resided a year and a half at Triers. He then visited several of the principal cities in Germany, and continuing three years at Ingoldstadt in Bavaria, took the degree of Doctor in Divinity. Having made the tour of Italy, he returned once more to Lorraine, where he was patronized by the cardinal of that duchy, who preferred him to a canonry of Verdun; and about two years afterwards he became confessor to the Duchess of Cleves, daughter of the Duke of Lorraine. During the leisure he enjoyed in this employment, he wrote in Latin the *Lives of the Kings, Bishops, Apostolical Men, and Writers of England.* The last of these, commonly known and quoted by the title of *De Illustribus Angliæ Scriptoribus*, was published after his death. The three others still remain in manuscript amongst the archives of the collegiate church of Liverdun. The Duke of Cleves having died about twelve years after Pits had been confessor to the duchess, the latter returned to Lorraine, attended by our author, who was promoted to the deanery of Liverdun, which, with a canonry and officialship, he enjoyed till the close of his life. He died in 1616, and was buried in the collegiate church. Pits was undoubtedly a scholar, and not an inelegant writer; but he is justly accused of ingratitude to Bale, from whom he borrowed his materials, without acknowledgment. He quotes Leland with great familiarity, without ever having seen his book; his errors are innumerable, and his partiality to the Catholic writers is obvious. Pits likewise wrote *De Legibus*, Triers, 1592; *De Beatitudine*, Ingoldst., 1595; *De Peregrinatione*, Dusseld., 1604. (See *Biog. Brit.*)

PITT, CHRISTOPHER, an English poet, celebrated for his translation of Virgil's *Æneid*, was the son of a physician, and was born at Blandford in the year 1699. Having studied four years at New College, Oxford, he was presented to the living of Pimperne in Dorsetshire, which he held during the remainder of his life. He had so poetical a turn, that whilst he was a school-boy he wrote

two large folios of manuscript poems, one of which contained an entire translation of Lucan. He was much esteemed while at the university, particularly by the celebrated Dr Young, who used familiarly to call him his son. Pitt gained very high reputation by his excellent English version of Vida's *Art of Poetry*. This success animated him to another undertaking demanding much greater ability and judgment. This was his metrical translation of Virgil's *Æneid*. He had Dryden as his rival, and he naturally observed his failures and avoided them. On comparing the two versions, that of Dryden leads the reader forward by his general vigour and sprightliness, while that of Pitt frequently stops him to contemplate the excellence of a single couplet; Dryden's faults are forgotten in the hurry of delight, Pitt's beauties are neglected in the langour of a cold and listless perusal. In short, that of Pitt pleases the critics, Dryden the people. He likewise wrote a Miscellany, which appeared in 1727. This amiable poet died in the year 1748, without leaving, it is said, one enemy behind him.

PITT, EARL OF CHATHAM.

Pitt, *William*, first Earl of Chatham, a celebrated British statesman and orator, was born on the 15th of November 1708. He was the youngest son of Mr Robert Pitt of Boconnock in Cornwall, and grandson of Mr Thomas Pitt, governor of Fort St George in the East Indies in the reign of Queen Anne, who sold an extraordinary diamond to the King of France for L.135,000, and thus obtained the name of *Diamond Pitt*. The subject of this notice was educated at Eton, whence, in January 1726, he was removed to Trinity College, Oxford, which he entered as a gentleman commoner. Here the superiority of his mind soon attracted notice, and he was also remarked for his powers of elocution; but at the age of sixteen he experienced the first attacks of an hereditary and incurable gout, which continued at intervals to torment him during the remainder of his life. He quitted the university without taking a degree, and visited France and Italy, whence he returned without having received much benefit from his excursion. His father was now dead, and as he had left very little to the younger children, it became necessary that William should choose a profession. He decided for the army, and a cornet's commission was procured for him in the Blues. But, small as his fortune was, his family had the power and the inclination to serve him. At the general election of 1734 his elder brother Thomas was chosen both for Old Sarum and for Oakhampton. When Parliament met in 1735 Thomas made his election for Oakhampton, and William was returned for Old Sarum. At the time when he obtained a seat in Parliament he was not quite twenty-one years of age. The intention of bringing him thus early into Parliament was to oppose Sir Robert Walpole, who had now been fourteen years at the head of affairs. In fact, his abilities soon attracted notice, and he spoke with great vehemence against the Spanish convention in 1738. It was on the occasion of the bill for registering seamen in 1740, which he opposed as arbitrary and unjustifiable, that he is said to have made his celebrated reply to Walpole, who had taunted him on account of his youth; but the language of that reply, as it now stands, is not the diction of Pitt, who may have said something like what is ascribed to him, but of Dr Johnson, who then reported, or rather wrote, the debates for the *Gentleman's Magazine*. In 1746 Pitt was appointed joint vice-treasurer of Ireland; and in the same year treasurer and paymaster-general of the army, and a privy councillor. The office of paymaster he discharged with such inflexible integrity, even refusing many of the ordinary perquisites of office, that his bitterest enemies could lay nothing to his charge, and he soon became the darling of the people. The old Duchess of Marlborough, who carried to the grave the reputation of being decidedly the best hater of her time, and who most cordially detested Walpole and his associates, left Pitt a legacy of L.10,000, in consideration of "the noble defence he had made for the support of the laws of England, and to prevent the ruin of his country." In the year 1755 Pitt, deeming it necessary to offer a strong opposition to the continental connections then formed by the ministry, resigned his places, and remained some time out of office. But his resignation having alarmed the people, he was, in December 1756, called to fill a higher office, and appointed secretary of state. In this situation, however, he was more successful in obtaining the confidence of the public than in conciliating the favour of the king, some of whose predilections he had conceived himself bound to oppose. The consequence was, that soon afterwards Pitt was removed from office, whilst Legge, with some others of his friends, were at the same time dismissed. But the nation had a mind not to be deprived of his services. The most exalted notion had been formed of him throughout the country; his patriotism was believed to be as pure and disinterested as his adilities and eloquence were confessedly transcendent; and his colleagues shared in the same general favour. In a word, the opinion of the country was so strongly expressed, both directly and indirectly, that the king thought it prudent to yield; and on the 25th of June 1757 Pitt was again appointed secretary of state, Legge became chancellor of the exchequer, and the other arrangements were made conformably to his wishes. Pitt was now in effect prime minister; and the change which soon took place in the aspect of public affairs evinced the ability of his measures, and the vigour of his administration. His spirit animated the whole nation; and his activity pervaded every department of the public service. His plans were ably conceived and promptly executed; and the depression, which had been occasioned by want of energy in the cabinet, and ill success in the field, was followed by exertion, confidence, and triumph. The whole fortune of the war was changed. In every quarter of the globe success attended our arms. The boldest attempts were made both by land and by sea, and almost every attempt proved fortunate. In America the French lost Quebec; in Africa they were deprived of their principal settlements; their power was abridged in the East Indies; in Europe their armies were defeated; and, to render their humiliation more complete, their navy, their commerce, and their finances were almost ruined. Amidst this full tide of success George II. died, on the 25th of October 1760, and was succeeded by George III., who ascended the throne at a time when the French court had just succeeded in obtaining the co-operation of Spain.

The treaty commonly called "family compact" had been secretly concluded; but the English minister, correctly informed of the hostile intentions of Spain, determined to anticipate that power, and strike a blow before this new enemy should be fully prepared for action. He therefore proposed in the council an immediate declaration of war against Spain, urging forcibly that the present was the favourable moment for humbling the whole House of Bourbon. But when he stated this opinion in the Privy Council, the other ministers, averse to so bold a measure, opposed the proposition of the premier, alleging the necessity of mature deliberation before declaring war against so powerful a state. Irritated by the unexpected opposition of his

colleagues, Pitt replied, "I will not give them leave to think; this is the time; let us crush the whole House of Bourbon. But if the members of this board are of a different opinion, this is the last time I shall ever mix in its councils. I was called into the ministry by the voice of the people, and to them I hold myself answerable for my conduct. I am to thank the ministers of the late king for their support; I have served my country with success; but I will not be responsible for the conduct of the war any longer than while I have the direction of it." To this declaration the president of the council answered, "I find the gentleman is determined to leave us; nor can I say that I am sorry for it, since he would otherwise have certainly compelled us to leave him. But if he is resolved to assume the right of advising his Majesty, and directing the operations of the war, to what purpose are we called to this council? When he talks of being responsible to the people, he talks the language of the House of Commons, and forgets that at this board he is responsible only to the king. However, though he may possibly have convinced himself of his infallibility, still it remains that we should be equally convinced before we can resign our understandings to his direction, or join with him in the measure he proposes." The opposition he thus encountered the nation attributed to the growing influence of Lord Bute. But however this may have been, Pitt was a man of too high, not to say imperious a temper, to remain as the nominal head of a cabinet which he was no longer able to direct. Accordingly, on the 5th of October 1761, he resigned all his appointments; and, as some reward for his services, his wife was created Baroness Chatham in her own right, whilst a pension of L.3000 a year was settled on the lives of himself, his lady, and his eldest son.

No fallen minister, if fallen he could be called, ever carried with him more completely the confidence and regret of the nation, whose affairs he had so successfully administered. But at this time the king was also popular; and the war being continued by his new ministers with vigour and success, no discontent appeared until after the conclusion of the peace. The impulse given by Pitt had carried them forward in the same direction which he had pursued; but they were equally incapable of profiting by the advantages which had been already gained, or of prosecuting the war until the objects for which it was originally undertaken should be accomplished. The victories gained over France and Spain having greatly elated the nation, the feeling which almost universally prevailed amongst the people was, that we should either dictate peace as conquerors, or continue the war until our adversaries were more effectually humbled. This was likewise Pitt's opinion. Accordingly, when the preliminaries of peace came to be discussed in Parliament, he went down to the House of Commons, though suffering severely from an attack of gout, and spoke for nearly three hours in the debate, giving his opinion on each article of the treaty in succession, and, upon the whole, maintaining that it was inadequate to the conquests of our arms, and the just expectations of the country. Peace was, however, concluded on the 10th of February 1763, and Pitt continued unemployed.

After his resignation in 1761, Pitt conducted himself in a manner worthy of his high character. So far from giving a vexatious and undiscriminating opposition to the ministry which had succeeded his own, he maintained his popularity in dignified retirement, and came forward only when questions of great importance were to be discussed. One of these occurred in 1764, on the subject of general warrants, the illegality of which he denounced with all the energy and vigour of his eloquence. Another occasion, when he came forward in all his strength, was the consideration of the discontents which had arisen on account of the Stamp Act. In March 1766, the repeal of that act having been proposed by the Rockingham ministry, Pitt, though not connected with them, ably supported the measure, which was carried, but whether prudently or the contrary is still a matter of dispute. About this time Pitt had devised to him by will a considerable estate in Somersetshire, the property of Sir William Pynsent of Burton-Pynsent in that county, who, from admiration of his public character, disinherited his own relations, in order to bequeath to him the bulk of his fortune. After the dissolution of the Rockingham ministry, a new administration was formed, and in 1766 Pitt was appointed lord privy seal. At the same time he was created a peer by the titles of Viscount Pitt of Burton-Pynsent, in the county of Somerset, and Earl of Chatham, in the county of Kent.

Whatever might be his motives in accepting a peerage, it is certain that it proved very prejudicial to his character, and that in consequence he sank as much in popularity as he rose in nominal dignity. The "great commoner," as he was sometimes called, had formed a rank for himself, on the basis of his talents and exertions, which titular honours might obscure, but could not illustrate; and, with the example of Pulteney before him, he should have been careful to preserve it untarnished by empty distinctions, shared by the mean and the worthless as well as by the great, the gifted, and the good. Lord Chatham, however, did not long continue in office after being elevated to the peerage. On the 2d of November 1768 he resigned the place of lord privy seal, and never afterwards held any public employment; nor does he appear to have been at all desirous of returning to office. He was now sixty, and the gout, by which he had so long been afflicted, disabled him, by its frequent and violent attacks, for close and regular application to business. In the intervals of his disorder, however, he failed not to exert himself upon questions of great magnitude; and in 1775, 1776, and 1777, he most strenuously opposed the measures pursued by the ministers in the contest with America. His last appearance in the House of Lords was on the 2d of April 1778. He was then very ill, and much debilitated; but the question was important, being a motion of the Duke of Richmond to address his Majesty to remove the ministers, and to make peace with America on any terms. His lordship made a long speech, in which he summoned up all his remaining strength to pour out his disapprobation of a measure so inglorious. But the effort overcame him, for in attempting to rise a second time, he fell down in a convulsive fit; and though he recovered for the time, his disorder continued to increase until the 11th of May, when he expired at his seat at Hayes. His death was lamented as a national loss. As soon as the news reached the House of Commons, which was then sitting, Colonel Barré made a motion, that an address should be presented to his Majesty, requesting that the Earl of Chatham should be buried at the public expense. But Mr Rigby having proposed the erection of a statue to his memory, as more likely to perpetuate the sense of his great merits entertained by the public, this was unanimously agreed to. A bill was soon afterwards passed, by which L.4000 a year was settled upon John, now Earl of Chatham, and the heirs of the late earl to whom that title might descend. His lordship was married in 1754 to Lady Hester, sister of Earl Temple, by whom he had three sons and two daughters.

The principal outlines of Pitt's character have been variously sketched, sometimes with, and sometimes without, any depth of shadow. The truth is, that there scarcely ever lived a person who had less claim to be painted altogether *en beau*, or who so little merited unsparing censure. Lord Macaulay says, "That he was a great man, cannot for a moment be doubted; but his was not a complete and well-proportioned greatness. The public life of Hampden

 or of Somers resembles a regular drama, which can be criticised as a whole, and every scene of which is to be viewed in connection with the main action. The public life of Pitt, on the other hand, is a rude though striking piece, abounding in incongruities, and without any unity of plan, but redeemed by some noble passages, the effect of which is increased by the tameness or extravagance of what precedes and of what follows. His opinions were unfixed; and his conduct, at some of the most important conjunctures of his life, was evidently determined by pride and resentment. He had one fault, which of all human faults is most rarely found in company with true greatness. He was extremely affected. He was an almost solitary instance of a man of real genius, and of a brave, lofty, and commanding spirit, without simplicity of character. He was an actor in the closet, an actor in the council, and an actor in Parliament; and even in private society he could not lay aside his theatrical tones and attitudes. We know that one of the most distinguished of his partizans often complained that he could never obtain admittance to Lord Chatham's room till everything was ready for the representation; till the light was thrown with Rembrandt-like effect on the head of the illustrious performer; till the flannels had been arranged with the air of Grecian drapery, and the crutch placed as gracefully as that of Belisarius or Lear." Yet, with all his faults and affectations, he possessed, in a very extraordinary degree, many of the elements of true greatness. He had splendid talents, strong passions, quick sensibility, and vehement enthusiasm for the grand and the beautiful. There was something about him which ennobled even tergiversation itself. He often went wrong, very far wrong; but, amidst the abasement of error, he still retained what he had received from nature, "an intense and glowing mind." In an age of low and despicable prostitution, the age of Dodington and Sandys, it was something to have a man who might perhaps, under some strong excitement, have been tempted to ruin his country, but who never would have stooped to pilfer from her; a man whose errors arose, not from a sordid desire of gain, but from a fierce thirst of power, glory, and vengeance. "History owes him this attestation, that, at a time when anything short of direct embezzlement of the public money was considered as quite fair in public men, he showed the most scrupulous disinterestedness; that, at a time when it seemed to be generally taken for granted that government could be upheld only by the basest and most immoral arts, he appealed to the better and nobler parts of human nature; that he made a brave and splendid attempt to do, by means of public opinion, what no other statesman of his day thought it possible to do except by means of corruption; that he looked for support, not, like the Pelhams, to a strong aristocratical connection, not, like Bute, to the personal favour of the sovereign, but to the middle class of Englishmen; that he inspired that class with a firm confidence in his integrity and ability; that, backed by them, he forced an unwilling court and an unwilling oligarchy to admit him to an ample share of power; and that he used his power in such a manner as clearly proved that he had sought it, not for the sake of profit or patronage, but from a wish to establish for himself a great and durable reputation by means of eminent services rendered to the state."

A great many unmeaning phrases have been employed, and much rhetorical exaggeration has been expended, in attempts to characterize Lord Chatham's style of eloquence. The following estimate by Lord Macaulay, from whom we have borrowed some of the foregoing observations, is at once deep, discriminating, and brilliant.

"In our time the audience of a member of Parliament is the nation. The three or four hundred persons who may be present when a speech is delivered may be pleased or disgusted by the voice and action of the orator; but in the reports which are read the next day by hundreds of thousands, the difference between the noblest and the meanest figure, between the richest and the shrillest tones, between the most graceful and the most uncouth gesture, altogether vanishes. A hundred years ago, scarcely any report of what passed within the walls of the House of Commons was suffered to get abroad. In those times, therefore, the impression which a speaker might make on the persons who actually heard him was everything. The impression out of doors was hardly worth a thought. In the Parliaments of that time, therefore, as in the ancient commonwealths, those qualifications which enhance the immediate effect of a speech were far more important ingredients in the composition of an orator than they would appear to be in our time. All those qualifications Pitt possessed in the highest degree. On the stage, he would have been the finest Brutus or Coriolanus ever seen. Those who saw him in his decay, when his health was broken, when his mind was jangled, when he had been removed from that stormy assembly of which he thoroughly knew the temper, and over which he possessed unbounded influence, to a small, a torpid, and an unfriendly audience, say that his speaking was then for the most part a low monotonous muttering, audible only to those who sate close to him; that, when violently excited, he sometimes raised his voice for a few minutes, but that it soon sank again into an unintelligible murmur. Such was the Earl of Chatham; but such was not William Pitt. His figure, when he first appeared in Parliament, was strikingly graceful and commanding, his features high and noble, his eye full of fire. His voice, even when it sank to a whisper, was heard to the remotest benches; when he strained it to its full extent, the sound rose like the swell of the organ of a great cathedral, shook the house with its peal, and was heard through lobbies and down staircases, to the Court of Requests and the precincts of Westminster Hall. He cultivated all these eminent advantages with the most assiduous care. His action is described, by a very malignant observer, as equal to that of Garrick. His play of countenance was wonderful; he frequently disconcerted a hostile orator by a single glance of indignation or scorn. Every tone, from the impassioned cry to the thrilling aside, was perfectly at his command. It is by no means improbable that the pains which he took to improve his great personal advantages had in some respects a prejudicial operation, and tended to nourish in him that passion for theatrical effect which was one of the most conspicuous blemishes in his character.

But it was not solely or principally to outward accomplishments that Pitt owed the vast influence which, during nearly thirty years, he exercised over the House of Commons. He was undoubtedly a great orator; and from the descriptions of his contemporaries, and the fragments of his speeches which still remain, it is not difficult to discover the nature and extent of his oratorical powers.

He was no speaker of set speeches. His few prepared discourses were complete failures. The elaborate panegyric which he pronounced on General Wolfe was considered as the very worst of all his performances. "No man," says a critic who had often heard him, "ever knew so little what he was going to say." Indeed, his facility amounted to a vice; he was not the master, but the slave of his own speech. So little self-command had he when once he felt the impulse, that he did not like to take part in a debate when his mind was full of an important secret of state. "I must sit still," he once said to Lord Shelburne on such an occasion, "for when once I am up, everything that is in my mind comes out."

Yet he was not a great debater. That he should not have been so when he first entered the House of Commons, is not strange; scarcely any person has ever become so without long practice and many failures. It was by slow

degrees, as Burke said, that Mr Fox became the most brilliant and powerful debater that Parliament ever saw. Mr Fox himself attributed his own success to the resolution which he formed when very young, of speaking, well or ill, at least once every night. "During five whole sessions," he used to say, "I spoke every night but one; and I regret only that I did not speak that night too." Indeed, it would be difficult to name any great debater who has not made himself a master of his art at the expense of his audience.

But as this art is one which even the ablest men have seldom acquired without long practice, so it is one which men of respectable abilities, with assiduous and intrepid practice, seldom fail to acquire. It is singular that, in such an art, Pitt, a man of splendid talents, great fluency, and dauntless boldness, whose whole life was passed in parliamentary conflict, and who during several years was the leading minister of the Crown in the House of Commons, should never have attained to high excellence. He spoke without premeditation; but his speech followed the course of his own thoughts, and not that of the previous discussion. He could, indeed, treasure up in his memory some detached expression of a hostile orator, and make it the text for sparkling ridicule or burning invective. Some of the most celebrated bursts of his eloquence were called forth by an unguarded word, a laugh, or a cheer. But this was the only sort of reply in which he appears to have excelled. He was perhaps the only great English orator who did not think it an advantage to have the last word, and who generally spoke by choice before his most formidable opponents. His merit was almost entirely rhetorical. He did not succeed either in exposition or refutation; but his speeches abounded with lively illustrations, striking apophthegms, well-told anecdotes, happy allusions, passionate appeals. His invective and sarcasm were tremendous. Perhaps no English orator was ever so much feared.

But that which gave most effect to his declamation was the air of sincerity, of vehement feeling, or moral elevation, which belonged to all that he said. His style was not always in the purest taste. Several contemporary judges pronounced it too florid. Walpole, in the midst of the rapturous eulogy which he pronounces on one of Pitt's greatest orations, owns that some of the metaphors were too forced. The quotations and classical stories of the orator are sometimes too trite for a clever school-boy. But these were niceties for which the audience cared little. The enthusiasm of the orator infected all who were near him; his ardour and his noble bearing put fire into the most frigid conceit, and gave dignity to the most puerile allusion."

Such is the character of this great statesman and orator, as drawn by one masterly hand. It may perhaps both instruct and interest our readers if we present another, delineated by an artist equally distinguished for the vigour, judgment, and fidelity with which he paints such grand pieces for the gallery of history. The preceding, as we have already said, is from the pen of Lord Macaulay; the following is understood to be from that of Lord Brougham:—

"The first place among the great qualities which distinguished Lord Chatham is unquestionably due to firmness of purpose, resolute determination in the pursuit of his objects. This was the characteristic of the younger Brutus, as he said, who had spared his life to fall by his hand,—*Quicquid vult, id valde vult;* and although extremely apt to be shown in excess, it must be admitted to be the foundation of all true greatness of character. Everything, however, depends upon the endowments in whose company it is found; and in Lord Chatham these were of a very high order. The quickness with which he could ascertain his object, and discover his road to it, was fully commensurate with his perseverance and his boldness in pursuing it; the firmness of grasp with which he held his advantage was fully equalled by the rapidity of the glance with which he discovered it. Add to this a mind eminently fertile in resources, a courage which nothing could daunt in the choice of his means, a resolution equally indomitable in their application, a genius, in short, original and daring, which bounded over the petty obstacles raised by ordinary men,—their squeamishness, and their precedents, and their forms, and their regularities,—and forced away its path through the entanglements of this base undergrowth to the worthy object ever in his view, the prosperity and the renown of his country. Far superior to the paltry objects of a grovelling ambition, and regardless alike of party and of personal considerations, he constantly set before his eyes the highest duty of a public man, to further the interests of his species. In pursuing his course towards that goal, he disregarded alike the frowns of power and the gales of popular applause; exposed himself undaunted to the vengeance of the court, while he battled against its corruptions, and confronted, unabashed, the rudest shocks of public indignation, while he resisted the dictates of pernicious agitators; and could conscientiously exclaim, with an illustrious statesman of antiquity, "Ego hoc animo semper fui ut invidiam virtute partam, gloriam non invidiam putarem."

Nothing could be more entangled than the foreign policy of this country at the time when he took the supreme direction of her affairs; nothing could be more disastrous than the aspect of her fortunes in every quarter of the globe. With a single ally in Europe, the King of Prussia, and him beset by a combination of all the continental powers in unnatural union to effect his destruction; with an army of insignificant amount, and commanded by men only desirous of grasping at the emoluments, without doing the duties or incurring the risks of their profession; with a navy that could hardly keep the sea, and whose chiefs vied with their comrades on shore in earning the character given them by the new minister, of being utterly unfit to be trusted in any enterprise accompanied with "the least appearance of danger;" with a generally prevailing dislike of both services, which at once repressed all desire of joining either, and damped all public spirit in the country, by extinguishing all hope of success, and even all love of glory; it was hardly possible for a nation to be placed in circumstances more inauspicious to military exertions; and yet war raged in every quarter of the world where our dominion extended, while the territories of our only ally, as well as those of our own sovereign in Germany, were invaded by France, and her forces by sea and land menaced our shores. In the distant possessions of the Crown the same want of enterprise and of spirit prevailed. Armies in the West were paralysed by the inaction of a captain who would hardly take the pains to write a despatch recording the nonentity of his operations; and in the East, while frightful disasters were brought upon our settlements by barbarian powers, the only military capacity that appeared in their defence was the accidental display of genius and valour by a merchant's clerk, who thus raised himself to celebrity (Mr, afterwards Lord, Clive). In this forlorn state of affairs, rendering it as impossible to think of peace as it seemed hopeless to continue the yet inevitable war, the base and sordid views of politicians kept pace with the mean spirit of the military caste; and parties were split or united, not upon any difference or agreement of public principle, but upon mere questions of patronage and share in the public spoil, while all seemed alike actuated by one only passion, the thirst alternately of power and of gain.

As soon as Mr Pitt took the helm, the steadiness of the hand that held it came to be felt in every motion of the vessel. There was no more of wavering councils, of torpid inaction, of listless expectancy, of abject despondency. His firmness gave confidence, his spirit roused courage, his vigilance secured exertion, in every department under his sway.

Pitt. Each man, from the first lord of the Admiralty down to the most humble clerk in the victualling office—each soldier, from the commander-in-chief to the most obscure contractor or commissary—now felt assured that he was acting or indolent under the eye of one who knew his duties and his means as well as his own, and who would very certainly make all defaulters, whether through misfeasance or through nonfeasance, accountable for whatever detriment the commonwealth might sustain at their hands. Over his immediate coadjutors his influence swiftly obtained an ascendant which it ever after retained uninterrupted. Upon his first proposition for changing the conduct of the war he stood single among his colleagues, and tendered his resignation should they persist in their dissent; they at once succumbed, and from that hour ceased to have an opinion of their own upon any branch of the public affairs. Nay, so absolutely was he determined to have the control of those measures of which he knew the responsibility rested upon him alone, that he insisted upon the first lord of the Admiralty not having the correspondence of his own department; and no less eminent a naval character than Lord Anson, with his junior lords, were obliged to sign the orders issued by Mr Pitt while the writing was covered over from their eyes.

The effects of this change in the whole management of the public business, and in all the plans of the government, as well as in their execution, were speedily made manifest to all the world. The German troops were sent home, and a well-regulated militia being established to defend the country, a large disposable force was distributed over the various points whence the enemy might be annoyed. France, attacked on some points and menaced on others, was compelled to retire from Germany, soon afterwards suffered the most disastrous defeats, and, instead of threatening England and her allies with invasion, had to defend herself against attack, suffering severely in several of her most important naval stations. No less than sixteen islands, and settlements, and fortresses of importance, were taken from her in America, and Asia, and Africa, including all her West Indian colonies except St Domingo, and all her settlements in the East. The whole important province of Canada was likewise conquered; and the Havannah was taken from Spain. Besides this, the seas were swept clear of the fleets that had so lately been insulting all our colonies, and even all our coasts. Many general actions were fought and gained; one among them the most decisive that had ever been fought by our navy. Thirty-six sail of the line were taken or destroyed, fifty frigates, forty-five sloops of war. So brilliant a course of uninterrupted success had never in modern times attended the arms of any nation carrying on war with other states equal to it in civilization, and nearly a match in power. But it is a more glorious feature in the unexampled administration which history has to record when it adds, that all public distress had disappeared; all discontent in any quarter, both of the colonies and parent state, had ceased; that no oppression was anywhere practised, no abuse suffered to prevail; that no encroachments were made upon the rights of the subject, no malversations tolerated in the possessors of power; and that England, for the first time and for the last time, presented the astonishing picture of a nation supporting without murmur a widely extended and costly war, and a people hitherto torn with conflicting parties so united in the service of the commonwealth that the voice of faction had ceased in the land, and any discordant whisper was heard no more. "These," said the son of his first and most formidable adversary, Walpole, when informing his correspondent abroad that the session, as usual, had ended without any kind of opposition, or even of debate, "These are the doings of Mr Pitt, and they are wondrous in our eyes."

To genius irregularity is incident, and the greatest genius is often marked by eccentricity, as if it disdained to move in the vulgar orbit. Hence he who is fitted by his nature, and trained by his habits, to be an accomplished "pilot in extremity," and whose inclinations carry him forth to seek the deep when the waves run high, may be found, if not "to steer too near the shore," yet to despise the sunken rocks which they that can only be trusted in calm weather would have more surely avoided. To this rule it cannot be said that Lord Chatham afforded any exception; and although a plot had certainly been formed to eject him from the ministry, leaving the chief control of affairs in the feeble hands of Lord Bute, whose only support was court favour, and whose only talent lay in an expertness at intrigue, yet there can be little doubt that this scheme was only rendered practicable by the hostility which the great minister's unbending habits, his contempt of ordinary men, and his neglect of everyday matters, had raised against him among all the creatures both of Downing Street and St James's. In fact his colleagues, who necessarily felt humbled by his superiority, were needlessly mortified by the constant display of it; and it would have betokened a still higher reach of understanding, as well as a purer fabric of patriotism, if he whose great capacity threw those subordinates into the shade, and before whose vigour in action they were sufficiently willing to yield, had united a little suavity in his demeanour with his extraordinary powers, nor made it always necessary for them to acknowledge as well as to feel their inferiority. It is certain that the insulting arrangement of the Admiralty to which reference has been already made, while it lowered that department in the public opinion, rendered all connected with him his personal enemies; and indeed, though there have since his days been prime ministers whom he would never have suffered to sit even as puny lords at his boards, yet were one like himself again to govern the country, the Admiralty chief, who might be far inferior to Lord Anson, would never submit to the humiliation inflicted upon that gallant and skilful captain. Mr Pitt's policy seemed formed upon the assumption that either each public functionary was equal to himself in boldness, activity, and resource, or that he was to preside over and animate each department in person; and his confidence was such in his own powers that he reversed the maxim of governing, never to force your way where you can win it, and always disdained to insinuate where he could dash in, or to persuade where he could command. It thus happened that his colleagues were but nominally coadjutors, and though they durst not thwart him, yet rendered no heart-service to aid his schemes. Indeed it has clearly appeared since his time that they were chiefly induced to yield him implicit obedience, and leave the undivided direction of all operations in his hands, by the expectation that the failure of what they were wont to sneer at as "Mr Pitt's visions" would turn the tide of public opinion against him, and prepare his downfall from a height of which they felt that there was no one but himself able to dispossess him."

The same powerful writer, having thus sketched the character of the statesman, proceeds next to delineate that of the orator, as far as this can now be done from the extremely scanty and imperfect materials which have been preserved. The fame of Lord Chatham's eloquence is, in truth, almost wholly traditional.

"There is indeed hardly any eloquence, of ancient or of modern times, of which so little that can be relied on as authentic has been preserved; unless perhaps that of Pericles, Julius Cæsar, and Lord Bolingbroke. Of the actions of the two first we have sufficient records, as we have of Lord Chatham's; of their speeches we have little that can be regarded as genuine; although, by unquestionable tradition, we know that each of them was second only to the greatest orator of their respective countries; while of

Bolingbroke we only know, from Dean Swift, that he was the most accomplished speaker of his time; and it is related of Mr Pitt (the younger), that when the conversation rolled upon lost works, and some said they should prefer restoring the books of Livy, some of Tacitus, and some a Latin tragedy, he at once decided for a speech of Bolingbroke. What we know of his own father's oratory is much more to be gleaned from contemporary panegyrics, and accounts of its effects, than from the scanty, and for the most part doubtful, remains which have reached us.

All accounts, however, concur in representing those effects to have been prodigious. The spirit and vehemence which animated its greater passages, their perfect application to the subject-matter of debate, the appositeness of his invective to the individual assailed, the boldness of the feats which he ventured upon, the grandeur of the ideas which he unfolded, the heart-stirring nature of his appeals, are all confessed by the united testimony of all his contemporaries; and the fragments which remain bear out to a considerable extent such representations; nor are we likely to be misled by those fragments, for the more striking portions were certainly the ones least likely to be either forgotten or fabricated. To these mighty attractions was added the imposing, the animating, the commanding power of a countenance singularly expressive; an eye so piercing that hardly any one could stand its glare; and a manner altogether singularly striking, original, and characteristic, notwithstanding a peculiarly defective and even awkward action. Latterly, indeed, his infirmities precluded all action; and he is described as standing in the House of Lords, leaning upon his crutch, and speaking for ten minutes together in an under-tone of voice scarcely audible, but raising his notes to their full pitch when he broke out into one of his grand bursts of invective or exclamation. But in his earlier time, his whole manner is represented as having been beyond conception animated and imposing. Indeed, the things which he effected by it principally, or at least which nothing but a most striking and commanding tone could have made it possible to attempt, almost exceed belief. Some of these sallies are indeed examples of that approach made to the ludicrous by the sublime which has been charged upon him as a prevailing fault, and represented under the name of *charlatanerie*,—a favourite phrase with his adversaries, as it in later times has been with the ignorant undervaluers of Lord Erskine. It is related that once in the House of Commons he began a speech with the words, "Sugar, Mr Speaker,"—and then, observing a smile to prevail in the audience, he paused, looking fiercely around, and with a loud voice, rising in its notes, and swelling into vehement anger, he is said to have pronounced again the word "Sugar!" three times, —and having thus quelled the House, and extinguished every appearance of levity or laughter, turned round and disdainfully asked, "Who will laugh at sugar now?" We have this anecdote on good traditional authority; that it was believed by those who had the best means of knowing Lord Chatham, is certain; and this of itself shows their sense of the extraordinary powers of his manner, and the reach of his audacity in trusting to those powers.

There can be no doubt that of reasoning,—of sustained and close argument,—his speeches had but little. His statements were desultory though striking, perhaps not very distinct, certainly not at all detailed, and as certainly every way inferior to those of his celebrated son. If he did not reason cogently, he assuredly did not compress his matter vigorously. He was anything rather than a concise or a short speaker; not that his great passages were at all diffuse, or in the least degree loaded with superfluous words; but he was prolix in the whole texture of his discourse, and he was certainly the first who introduced into our senate the practice, adopted in the American war by Mr Burke, and continued by others, of long speeches,—speeches of two and three hours, by which oratory has gained little and business less. His discourse was, however, fully informed with matter—his allusions to analogous subjects, and his reference to the history of past events were frequent—his expression of his own opinions was copious and free, and stood very generally in the place of any elaborate reasoning in their support. A noble statement of enlarged views, a generous avowal of dignified sentiments, a manly and somewhat severe contempt for all petty or mean views, whether their baseness proceeded from narrow understanding or from corrupt bias, always pervaded his whole discourse; and, more than any other orator since Demosthenes, he was distinguished by the nobleness of feeling with which he regarded, and the amplitude of survey which he cast upon, the subject-matters of debate. His invective was unsparing and hard to be endured, although he was a less eminent master of sarcasm than his son, and rather overwhelmed his antagonist with the burst of words and vehement indignation, than wounded him by the edge of ridicule, or tortured him with the gall of bitter scorn, or fixed his arrow in the wound by the barb of epigram. These things seemed as it were to betoken too much labour and too much art; more labour than was consistent with absolute scorn, more art than could stand with heartfelt rage, or entire contempt inspired by the occasion, at the moment, and on the spot. But his great passages,—those by which he has come down to us, those which gave his eloquence its peculiar character, and to which its dazzling success was owing,—were as sudden and unexpected as they were natural. Every one was taken by surprise when they rolled forth; every one felt them to be so natural that he could hardly understand why he had not thought of them himself, although into no one's imagination had they ever entered. If the quality of being natural without being obvious is a pretty correct description of felicitous expression, or what is called fine writing, it is a yet more accurate representation of fine passages or felicitous *hits* in speaking. In these all popular assemblies take boundless delight; by these, above all others, are the minds of an audience at pleasure moved or controlled. They form the grand charm of Lord Chatham's oratory; they were the distinguishing excellence of his great predecessor, and gave him at will to wield the fierce democracy of Athens, and to fulmine over Greece."

Many years ago, a small volume was published by Lord Grenville, containing letters written by the Earl of Chatham to his nephew Thomas Pitt, Lord Camelford. They are replete with excellent advice, conveyed in an easy, affectionate, and not inelegant style, having all of them been penned evidently without effort, under the simple impulse of the kindly feelings and anxious interest which they manifest throughout. At the same time, they might have been written by a person vastly inferior to Lord Chatham; and indeed one can scarcely avoid surprise at the absence of every trace of that genius, power, and originality for which the writer was so greatly distinguished.

Almon the bookseller has written *Anecdotes of the Life of the Earl of Chatham*, 3 vols. 8vo; the Rev. Mr Thackeray has illustrated the subject more accurately, as well as fully, in his *History of the Earl of Chatham*, 2 vols. 4to. None of his own writings have been given to the world, except a small volume of letters to the son of his elder brother, afterwards Lord Camelford, published some years ago by Lord Grenville; and his *Correspondence*, in 4 vols. 8vo, 1838–40. The *Correspondence* illustrates very fully his life and character, and furnishes valuable materials for the political history of his time. His wife, who died in 1803, bore him three sons and two daughters. The second son, the subject of the next article, gained a political fame capable of rivalling that of his illustrious father. (J. B—E.)

PITT, WILLIAM.

Pitt, *William*, the second son of William Pitt, Earl of Chatham, and of Lady Hester Grenville, daughter of Hester, Countess Temple, was born on the 28th of May 1759. The child inherited a name which, at the time of his birth, was the most illustrious in the civilised world, and was pronounced by every Englishman with pride, and by every enemy of England with mingled admiration and terror. During the first year of his life, every month had its illuminations and bonfires, and every wind brought some messenger charged with joyful tidings and hostile standards. In Westphalia the English infantry won a great battle which arrested the armies of Louis the Fifteenth in the midst of a career of conquest: Boscawen defeated one French fleet on the coast of Portugal: Hawke put to flight another in the Bay of Biscay: Johnson took Niagara: Amherst took Ticonderoga: Wolfe died by the most enviable of deaths under the walls of Quebec: Clive destroyed a Dutch armament in the Hoogley, and established the English supremacy in Bengal: Coote routed Lally at Wandewash, and established the English supremacy in the Carnatic. The nation, while loudly applauding the successful warriors, considered them all, on sea and on land, in Europe, in America, and in Asia, merely as instruments which received their direction from one superior mind. It was the great William Pitt, the great commoner, who had vanquished French marshals in Germany, and French admirals on the Atlantic; who had conquered for his country one great empire on the frozen shores of Ontario, and another under the tropical sun near the mouths of the Ganges. It was not in the nature of things that popularity such as he at this time enjoyed should be permanent. That popularity had lost its gloss before his children were old enough to understand that their father was a great man. He was at length placed in situations in which neither his talents for administration nor his talents for debate appeared to the best advantage. The energy and decision which had eminently fitted him for the direction of war were not needed in time of peace. The lofty and spirit-stirring eloquence, which had made him supreme in the House of Commons, often fell dead on the House of Lords. A cruel malady racked his joints, and left his joints only to fall on his nerves and on his brain. During the closing years of his life, he was odious to the court, and yet was not on cordial terms with the great body of the opposition. Chatham was only the ruin of Pitt, but an awful and majestic ruin, not to be contemplated by any man of sense and feeling without emotions resembling those which are excited by the remains of the Parthenon and of the Coliseum. In one respect the old statesman was eminently happy. Whatever might be the vicissitudes of his public life, he never failed to find peace and love by his own hearth. He loved all his children, and was loved by them; and, of all his children, the one of whom he was fondest and proudest was his second son.

The child's genius and ambition displayed themselves with a rare and almost unnatural precocity. At seven, the interest which he took in grave subjects, the ardour with which he pursued his studies, and the sense and vivacity of his remarks on books and on events, amazed his parents and instructors. One of his sayings of this date was reported to his mother by his tutor. In August 1766, when the world was agitated by the news that Mr Pitt had become Earl of Chatham, little William exclaimed, "I am glad that I am not the eldest son. I want to speak in the House of Commons like papa." A letter is extant in which Lady Chatham, a woman of considerable abilities, remarked to her lord, that their younger son at twelve had left far behind him his elder brother, who was fifteen. "The fineness," she wrote, "of William's mind makes him enjoy with the greatest pleasure what would be above the reach of any other creature of his small age." At fourteen the lad was in intellect a man. Hayley, who met him at Lyme in the summer of 1773, was astonished, delighted, and somewhat overawed, by hearing wit and wisdom from so young a mouth. The poet, indeed, was afterwards sorry that his shyness had prevented him from submitting the plan of an extensive literary work, which he was then meditating, to the judgment of this extraordinary boy. The boy, indeed, had already written a tragedy, bad of course, but not worse than the tragedies of his friend. This piece is still preserved at Chevening, and is in some respects highly curious. There is no love. The whole plot is political; and it is remarkable that the interest, such as it is, turns on a contest about a regency. On one side is a faithful servant of the Crown, on the other an ambitious and unprincipled conspirator. At length the king, who had been missing, reappears, resumes his power, and rewards the faithful defender of his rights. A reader who should judge only by internal evidence would have no hesitation in pronouncing that the play was written by some Pittite poetaster at the time of the rejoicings for the recovery of George the Third in 1789.

The pleasure with which William's parents observed the rapid development of his intellectual powers was alloyed by apprehensions about his health. He shot up alarmingly fast; he was often ill, and always weak; and it was feared that it would be impossible to rear a stripling so tall, so slender, and so feeble. Port wine was prescribed by his medical advisers; and it is said that he was, at fourteen, accustomed to take this agreeable physic in quantities which would, in our abstemious age, be thought much more than sufficient for any full-grown man. This regimen, though it would probably have killed ninety-nine boys out of a hundred, seems to have been well suited to the peculiarities of William's constitution; for at fifteen he ceased to be molested by disease, and, though never a strong man, continued, during many years of labour and anxiety, of nights passed in debate and of summers passed in London, to be a tolerably healthy one. It was probably on account of the delicacy of his frame that he was not educated like other boys of the same rank. Almost all the eminent English statesmen and orators to whom he was afterwards opposed or allied, North, Fox, Shelburne, Windham, Grey, Wellesley, Grenville, Sheridan, Canning, went through the training of great public schools. Lord Chatham had himself been a distinguished Etonian; and it is seldom that a distinguished Etonian forgets his obligations to Eton. But William's infirmities required a vigilance and tenderness such as could be found only at home. He was therefore bred under the paternal roof. His studies were superintended by a clergyman named Wilson; and those studies, though often interrupted by illness, were prosecuted with extraordinary success. Before the lad had completed his fifteenth year, his knowledge both of the ancient languages and of mathematics was such as very few men of eighteen then carried up to college. He was therefore sent, towards the close of the year 1773, to Pembroke Hall, in the university of Cambridge. So young a student required much more than the ordinary care which a college tutor bestows on undergraduates. The governor, to whom the direction of William's academical life was confided, was a bachelor of arts named Pretyman, who had been senior wrangler in the preceding

year, and who, though not a man of prepossessing appearance or brilliant parts, was eminently acute and laborious, a sound scholar, and an excellent geometrician. At Cambridge, Pretyman was, during more than two years, the inseparable companion, and indeed almost the only companion, of his pupil. A close and lasting friendship sprang up between the pair. The disciple was able, before he completed his twenty-eighth year, to make his preceptor bishop of Lincoln and dean of St Paul's; and the preceptor showed his gratitude by writing a Life of the disciple, which enjoys the distinction of being the worst biographical work of its size in the world.

Pitt, till he graduated, had scarcely one acquaintance, attended chapel regularly morning and evening, dined every day in hall, and never went to a single evening party. At seventeen, he was admitted, after the bad fashion of those times, by right of birth, without any examination, to the degree of Master of Arts. But he continued during some years to reside at college, and to apply himself vigorously, under Pretyman's direction, to the studies of the place, while mixing freely in the best academic society.

The stock of learning which Pitt laid in during this part of his life was certainly very extraordinary. In fact, it was all that he ever possessed; for he very early became too busy to have any spare time for books. The work in which he took the greatest delight was Newton's Principia. His liking for mathematics, indeed, amounted to a passion, which, in the opinion of his instructors, themselves distinguished mathematicians, required to be checked rather than encouraged. The acuteness and readiness with which he solved problems was pronounced by one of the ablest of the moderators, who in those days presided over the disputations in the schools, and conducted the examinations of the Senate-House, to be unrivalled in the university. Nor was the youth's proficiency in classical learning less remarkable. In one respect, indeed, he appeared to disadvantage when compared with even second-rate and third-rate men from public schools. He had never, while under Wilson's care, been in the habit of composing in the ancient languages; and he therefore never acquired that knack of versification which is sometimes possessed by clever boys whose knowledge of the language and literature of Greece and Rome is very superficial. It would have been utterly out of his power to produce such charming elegiac lines as those in which Wellesley bade farewell to Eton, or such Virgilian hexameters as those in which Canning described the pilgrimage to Mecca. But it may be doubted whether any scholar has ever, at twenty, had a more solid and profound knowledge of the two great tongues of the old civilised world. The facility with which he penetrated the meaning of the most intricate sentences in the Attic writers astonished veteran critics. He had set his heart on being intimately acquainted with all the extant poetry of Greece, and was not satisfied till he had mastered Lycophron's Cassandra, the most obscure work in the whole range of ancient literature. This strange rhapsody, the difficulties of which have perplexed and repelled many excellent scholars, "he read," says his preceptor, "with an ease at first sight, which, if I had not witnessed it, I should have thought beyond the compass of human intellect."

To modern literature Pitt paid comparatively little attention. He knew no living language except French; and French he knew very imperfectly. With a few of the best English writers he was intimate, particularly with Shakspeare and Milton. The debate in Pandemonium was, as it well deserved to be, one of his favourite passages; and his early friends used to talk, long after his death, of the just emphasis and the melodious cadence with which they had heard him recite the incomparable speech of Belial. He had indeed been carefully trained from infancy in the art of managing his voice, a voice naturally clear and deep-toned. His father, whose oratory owed no small part of its effect to that art, had been a most skilful and judicious instructor. At a later period, the wits of Brookes's, irritated by observing, night after night, how powerfully Pitt's sonorous elocution fascinated the rows of country gentlemen, reproached him with having been "taught by his dad on a stool."

His education, indeed, was well adapted to form a great parliamentary speaker. One argument often urged against those classical studies which occupy so large a part of the early life of every gentleman bred in the south of our island is, that they prevent him from acquiring a command of his mother tongue, and that it is not unusual to meet with a youth of excellent parts, who writes Ciceronian Latin prose and Horatian Latin Alcaics, but who would find it impossible to express his thoughts in pure, perspicuous, and forcible English. There may perhaps be some truth in this observation. But the classical studies of Pitt were carried on in a peculiar manner, and had the effect of enriching his English vocabulary, and of making him wonderfully expert in the art of constructing correct English sentences. His practice was to look over a page or two of a Greek or Latin author, to make himself master of the meaning, and then to read the passage straight forward into his own language. This practice, begun under his first teacher Wilson, was continued under Pretyman. It is not strange that a young man of great abilities, who had been exercised daily in this way during ten years, should have acquired an almost unrivalled power of putting his thoughts, without premeditation, into words well selected and well arranged.

Of all the remains of antiquity, the orations were those on which he bestowed the most minute examination. His favourite employment was to compare harangues on opposite sides of the same question, to analyse them, and to observe which of the arguments of the first speaker were refuted by the second, which were evaded, and which were left untouched. Nor was it only in books that he at this time studied the art of parliamentary fencing. When he was at home, he had frequent opportunities of hearing important debates at Westminster; and he heard them, not only with interest and enjoyment, but with a close scientific attention resembling that with which a diligent pupil at Guy's Hospital watches every turn of the hand of a great surgeon through a difficult operation. On one of these occasions, Pitt, a youth whose abilities were as yet known only to his own family and to a small knot of college friends, was introduced on the steps of the throne in the House of Lords to Fox, who was his senior by eleven years, and who was already the greatest debater, and one of the greatest orators, that had appeared in England. Fox used afterwards to relate that, as the discussion proceeded, Pitt repeatedly turned to him, and said, "But surely, Mr Fox, that might be met thus;" or, "Yes; but he lays himself open to this retort." What the particular criticisms were Fox had forgotten; but he said that he was much struck at the time by the precocity of a lad who, through the whole sitting, seemed to be thinking only how all the speeches on both sides could be answered.

One of the young man's visits to the House of Lords was a sad and memorable era in his life. He had not quite completed his nineteenth year, when, on the 7th of April 1778, he attended his father to Westminster. A great debate was expected. It was known that France had recognised the independence of the United States. The Duke of Richmond was about to declare his opinion that all thought of subjugating those states ought to be relinquished. Chatham had always maintained that the resistance of the colonies to the mother country was justifiable. But he conceived, very erroneously, that on the day on which their independence should be acknowledged the greatness

of England would be at an end. Though sinking under the weight of years and infirmities, he determined, in spite of the entreaties of his family, to be in his place. His son supported him to a seat. The excitement and exertion were too much for the old man. In the very act of addressing the peers, he fell back in convulsions. A few weeks later his corpse was borne, with gloomy pomp, from the Painted Chamber to the Abbey. The favourite child and namesake of the deceased statesman followed the coffin as chief mourner, and saw it deposited in the transept where his own was destined to lie.

His elder brother, now Earl of Chatham, had means sufficient, and barely sufficient, to support the dignity of the peerage. The other members of the family were poorly provided for. William had little more than three hundred a year. It was necessary for him to follow a profession. He had already begun to eat his terms. In the spring of 1780 he came of age. He then quitted Cambridge, was called to the bar, took chambers in Lincoln's Inn, and joined the western circuit. In the autumn of that year a general election took place; and he offered himself as a candidate for the university; but he was at the bottom of the poll. It is said that the grave doctors who then sate, robed in scarlet, on the benches of Golgotha, thought it great presumption in so young a man to solicit so high a distinction. He was, however, at the request of a hereditary friend, the Duke of Rutland, brought into Parliament by Sir James Lowther for the borough of Appleby.

The dangers of the country were at that time such as might well have disturbed even a constant mind. Army after army had been sent in vain against the rebellious colonists of North America. On pitched fields of battle the advantage had been with the disciplined troops of the mother country. But it was not on pitched fields of battle that the event of such a contest could be decided. An armed nation, with hunger and the Atlantic for auxiliaries, was not to be subjugated. Meanwhile the House of Bourbon, humbled to the dust a few years before by the genius and vigour of Chatham, had seized the opportunity of revenge. France and Spain were united against us, and had recently been joined by Holland. The command of the Mediterranean had been for a time lost. The British flag had been scarcely able to maintain itself in the British Channel. The northern powers professed neutrality; but their neutrality had a menacing aspect. In the East, Hyder had descended on the Carnatic, had destroyed the little army of Baillie, and had spread terror even to the ramparts of Fort Saint George. The discontents of Ireland threatened nothing less than civil war. In England the authority of the government had sunk to the lowest point. The King and the House of Commons were alike unpopular. The cry for parliamentary reform was scarcely less loud and vehement than in the autumn of 1830. Formidable associations, headed, not by ordinary demagogues, but by men of high rank, stainless character, and distinguished ability, demanded a revision of the representative system. The populace, emboldened by the impotence and irresolution of the government, had recently broken loose from all restraint, besieged the chambers of the legislature, hustled peers, hunted bishops, attacked the residences of ambassadors, opened prisons, burned and pulled down houses. London had presented during some days the aspect of a city taken by storm; and it had been necessary to form a camp among the trees of Saint James's Park.

In spite of dangers and difficulties abroad and at home, George the Third, with a firmness which had little affinity with virtue or with wisdom, persisted in his determination to put down the American rebels by force of arms; and his ministers submitted their judgment to his. Some of them were probably actuated merely by selfish cupidity; but their chief, Lord North, a man of high honour, amiable temper, winning manners, lively wit, and excellent talents both for business and for debate, must be acquitted of all sordid motives. He remained at a post from which he had long wished and had repeatedly tried to escape, only because he had not sufficient fortitude to resist the entreaties and reproaches of the King, who silenced all arguments by passionately asking whether any gentleman, any man of spirit, could have the heart to desert a kind master in the hour of extremity.

The opposition consisted of two parties which had once been hostile to each other, and which had been very slowly, and, as it soon appeared, very imperfectly reconciled, but which at this conjuncture seemed to act together with cordiality. The larger of these parties consisted of the great body of the Whig aristocracy. Its head was Charles, Marquess of Rockingham, a man of sense and virtue, and in wealth and parliamentary interest equalled by very few of the English nobles, but afflicted with a nervous timidity which prevented him from taking a prominent part in debate. In the House of Commons, the adherents of Rockingham were led by Fox, whose dissipated habits and ruined fortunes were the talk of the whole town, but whose commanding genius, and whose sweet, generous, and affectionate disposition, extorted the admiration and love of those who most lamented the errors of his private life. Burke, superior to Fox in largeness of comprehension, in extent of knowledge, and in splendour of imagination, but less skilled in that kind of logic and in that kind of rhetoric which convince and persuade great assemblies, was willing to be the lieutenant of a young chief who might have been his son.

A smaller section of the opposition was composed of the old followers of Chatham. At their head was William, Earl of Shelburne, distinguished both as a statesman and as a lover of science and letters. With him were leagued Lord Camden, who had formerly held the Great Seal, and whose integrity, ability, and constitutional knowledge commanded the public respect; Barré, an eloquent and acrimonious declaimer; and Dunning, who had long held the first place at the English bar. It was to this party that Pitt was naturally attracted.

On the 26th of February 1781 he made his first speech in favour of Burke's plan of economical reform. Fox stood up at the same moment, but instantly gave way. The lofty yet animated deportment of the young member, his perfect self-possession, the readiness with which he replied to the orators who had preceded him, the silver tones of his voice, the perfect structure of his unpremeditated sentences, astonished and delighted his hearers. Burke, moved even to tears, exclaimed, "It is not a chip of the old block; it is the old block itself." "Pitt will be one of the first men in Parliament," said a member of the opposition to Fox. "He is so already," answered Fox, in whose nature envy had no place. It is a curious fact, well remembered by some who were very recently living, that soon after this debate Pitt's name was put up by Fox at Brookes's.

On two subsequent occasions during that session Pitt addressed the House, and on both fully sustained the reputation which he had acquired on his first appearance. In the summer, after the prorogation, he again went the western circuit, held several briefs, and acquitted himself in such a manner that he was highly complimented by Buller from the bench, and by Dunning at the bar.

On the 27th of November the Parliament reassembled. Only forty-eight hours before had arrived tidings of the surrender of Cornwallis and his army; and it had consequently been necessary to rewrite the royal speech. Every man in the kingdom, except the King, was now convinced that it was mere madness to think of conquering the United States. In the debate on the report of the address, Pitt

spoke with even more energy and brilliancy than on any former occasion. He was warmly applauded by his allies; but it was remarked that no person on his own side of the house was so loud in eulogy as Henry Dundas, the Lord Advocate of Scotland, who spoke from the ministerial ranks. That able and versatile politician distinctly foresaw the approaching downfall of the government with which he was connected, and was preparing to make his own escape from the ruin. From that night dates his connection with Pitt, a connection which soon became a close intimacy, and which lasted till it was dissolved by death.

About a fortnight later, Pitt spoke in the committee of supply on the army estimates. Symptoms of dissension had begun to appear on the Treasury bench. Lord George Germaine, the Secretary of State who was especially charged with the direction of the war in America, had held language not easily to be reconciled with declarations made by the First Lord of the Treasury. Pitt noticed the discrepancy with much force and keenness. Lord George and Lord North began to whisper together; and Welbore Ellis, an ancient placeman who had been drawing salary almost every quarter since the days of Henry Pelham, bent down between them to put in a word. Such interruptions sometimes discompose veteran speakers. Pitt stopped, and, looking at the group, said, with admirable readiness, "I shall wait till Nestor has composed the dispute between Agamemnon and Achilles."

After several defeats, or victories hardly to be distinguished from defeats, the ministry resigned. The King, reluctantly and ungraciously, consented to accept Rockingham as first minister. Fox and Shelburne became Secretaries of State. Lord John Cavendish, one of the most upright and honourable of men, was made Chancellor of the Exchequer. Thurlow, whose abilities and force of character had made him the dictator of the House of Lords, continued to hold the great seal.

To Pitt was offered, through Shelburne, the Vice-Treasurership of Ireland, one of the easiest and most highly paid places in the gift of the Crown; but the offer was, without hesitation, declined. The young statesman had resolved to accept no post which did not entitle him to a seat in the cabinet; and a few days later, he announced that resolution in the House of Commons. It must be remembered that the cabinet was then a much smaller and more select body than at present. We have seen cabinets of sixteen. In the time of our grandfathers a cabinet of ten or eleven was thought inconveniently large. Seven was an usual number. Even Burke, who had taken the lucrative office of Paymaster, was not in the cabinet. Many therefore thought Pitt's declaration indecent. He himself was sorry that he had made it. The words, he said in private, had escaped him in the heat of speaking; and he had no sooner uttered them than he would have given the world to recall them. They, however, did him no harm with the public. The second William Pitt, it was said, had shown that he had inherited the spirit, as well as the genius, of the first. In the son, as in the father, there might perhaps be too much pride; but there was nothing low or sordid. It might be called arrogance in a young barrister, living in chambers on three hundred a year, to refuse a salary of five thousand a year, merely because he did not choose to bind himself to speak or vote for plans which he had no share in framing; but surely such arrogance was not very far removed from virtue.

Pitt gave a general support to the administration of Rockingham, but omitted, in the meantime, no opportunity of courting that Ultra-Whig party which the persecution of Wilkes and the Middlesex election had called into existence, and which the disastrous events of the war, and the triumph of republican principles in America, had made formidable both in numbers and in temper. He supported a motion for shortening the duration of Parliaments. He made a motion for a committee to examine into the state of the representation, and, in the speech by which that motion was introduced, avowed himself the enemy of the close boroughs, the strongholds of that corruption to which he attributed all the calamities of the nation, and which, as he phrased it in one of those exact and sonorous sentences of which he had a boundless command, had grown with the growth of England and strengthened with her strength, but had not diminished with her diminution or decayed with her decay. On this occasion he was supported by Fox. The motion was lost by only twenty votes in a house of more than three hundred members. The reformers never again had so good a division till the year 1831.

The new administration was strong in abilities, and was more popular than any administration which had held office since the first year of George the Third, but was hated by the King, hesitatingly supported by the Parliament, and torn by internal dissensions. The Chancellor was disliked and distrusted by almost all his colleagues. The two Secretaries of State regarded each other with no friendly feeling. The line between their departments had not been traced with precision; and there were consequently jealousies, encroachments, and complaints. It was all that Rockingham could do to keep the peace in his cabinet; and, before the cabinet had existed three months, Rockingham died.

In an instant all was confusion. The adherents of the deceased statesman looked on the Duke of Portland as their chief. The King placed Shelburne at the head of the Treasury. Fox, Lord John Cavendish, and Burke, immediately resigned their offices; and the new prime minister was left to constitute a government out of very defective materials. His own parliamentary talents were great; but he could not be in the place where parliamentary talents were most needed. It was necessary to find some member of the House of Commons who could confront the great orators of the opposition; and Pitt alone had the eloquence and the courage which were required. He was offered the great place of Chancellor of the Exchequer, and he accepted it. He had scarcely completed his twenty-third year.

The Parliament was speedily prorogued. During the recess, a negotiation for peace which had been commenced under Rockingham was brought to a successful termination. England acknowledged the independence of her revolted colonies; and she ceded to her European enemies some places in the Mediterranean and in the Gulf of Mexico. But the terms which she obtained were quite as advantageous and honourable as the events of the war entitled her to expect, or as she was likely to obtain by persevering in a contest against immense odds. All her vital parts, all the real sources of her power, remained uninjured. She preserved even her dignity; for she ceded to the House of Bourbon only part of what she had won from that House in previous wars. She retained her Indian empire undiminished; and, in spite of the mightiest efforts of two great monarchies, her flag still waved on the rock of Gibraltar. There is not the slightest reason to believe that Fox, if he had remained in office, would have hesitated one moment about concluding a treaty on such conditions. Unhappily that great and most amiable man was, at this crisis, hurried by his passions into an error which made his genius and his virtues, during a long course of years, almost useless to his country.

He saw that the great body of the House of Commons was divided into three parties, his own, that of North, and that of Shelburne; that none of those three parties was large enough to stand alone; that, therefore, unless two of them united, there must be a miserably feeble administration, or, more probably, a rapid succession of miserably feeble administrations, and this at a time when a strong government was essential to the prosperity and respecta-

bility of the nation. It was then necessary and right that there should be a coalition. To every possible coalition there were objections. But, of all possible coalitions, that to which there were the fewest objections was undoubtedly a coalition between Shelburne and Fox. It would have been generally applauded by the followers of both. It might have been made without any sacrifice of public principle on the part of either. Unhappily, recent bickerings had left in the mind of Fox a profound dislike and distrust of Shelburne. Pitt attempted to mediate, and was authorised to invite Fox to return to the service of the Crown. "Is Lord Shelburne," said Fox, "to remain prime minister?" Pitt answered in the affirmative. "It is impossible that I can act under him," said Fox. "Then negotiation is at an end," said Pitt; "for I cannot betray him." Thus the two statesmen parted. They were never again in a private room together.

As Fox and his friends would not treat with Shelburne, nothing remained to them but to treat with North. That fatal coalition which is emphatically called "The Coalition" was formed. Not three quarters of a year had elapsed since Fox and Burke had threatened North with impeachment, and had described him, night after night, as the most arbitrary, the most corrupt, the most incapable of ministers. They now allied themselves with him for the purpose of driving from office a statesman with whom they cannot be said to have differed as to any important question. Nor had they even the prudence and the patience to wait for some occasion on which they might, without inconsistency, have combined with their old enemies in opposition to the government. That nothing might be wanting to the scandal, the great orators who had, during seven years, thundered against the war, determined to join with the authors of that war in passing a vote of censure on the peace.

The Parliament met before Christmas 1782. But it was not till January 1783 that the preliminary treaties were signed. On the 17th of February they were taken into consideration by the House of Commons. There had been, during some days, floating rumours that Fox and North had coalesced; and the debate indicated but too clearly that those rumours were not unfounded. Pitt was suffering from indisposition: he did not rise till his own strength and that of his hearers were exhausted; and he was consequently less successful than on any former occasion. His admirers owned that his speech was feeble and petulant. He so far forgot himself as to advise Sheridan to confine himself to amusing theatrical audiences. This ignoble sarcasm gave Sheridan an opportunity of retorting with great felicity. "After what I have seen and heard to-night," he said, "I really feel strongly tempted to venture on a competition with so great an artist as Ben Jonson, and to bring on the stage a second Angry Boy." On a division, the address proposed by the supporters of the government was rejected by a majority of sixteen.

But Pitt was not a man to be disheartened by a single failure, or to be put down by the most lively repartee. When, a few days later, the opposition proposed a resolution directly censuring the treaties, he spoke with an eloquence, energy, and dignity, which raised his fame and popularity higher than ever. To the coalition of Fox and North he alluded in language which drew forth tumultuous applause from his followers. "If," he said, "this ill-omened and unnatural marriage be not yet consummated, I know of a just and lawful impediment; and, in the name of the public weal, I forbid the banns."

The ministers were again left in a minority, and Shelburne consequently tendered his resignation. It was accepted: but the King struggled long and hard before he submitted to the terms dictated by Fox, whose faults he detested, and whose high spirit and powerful intellect he detested still more. The first place at the board of Treasury was repeatedly offered to Pitt: but the offer, though tempting, was steadfastly declined. The young man, whose judgment was as precocious as his eloquence, saw that his time was coming, but was not come, and was deaf to royal importunities and reproaches. His Majesty, bitterly complaining of Pitt's faintheartedness, tried to break the coalition. Every art of seduction was practised on North, but in vain. During several weeks the country remained without a government. It was not till all devices had failed, and till the aspect of the House of Commons became threatening, that the King gave way. The Duke of Portland was declared First Lord of the Treasury. Thurlow was dismissed. Fox and North became Secretaries of State, with power ostensibly equal. But Fox was the real prime minister.

The year was far advanced before the new arrangements were completed; and nothing very important was done during the remainder of the session. Pitt, now seated on the opposition bench, brought the question of parliamentary reform a second time under the consideration of the Commons. He proposed to add to the House at once a hundred county members and several members for metropolitan districts, and to enact that every borough of which an election committee should report that the majority of voters appeared to be corrupt should lose the franchise. The motion was rejected by 293 votes to 149.

After the prorogation, Pitt visited the Continent for the first and last time. His travelling companion was one of his most intimate friends, a young man of his own age, who had already distinguished himself in Parliament by an engaging natural eloquence, set off by the sweetest and most exquisitely modulated of human voices, and whose affectionate heart, caressing manners, and brilliant wit, made him the most delightful of companions, William Wilberforce. That was the time of Anglomania in France; and at Paris the son of the great Chatham was absolutely hunted by men of letters and women of fashion, and forced, much against his will, into political disputation. One remarkable saying which dropped from him during this tour has been preserved. A French gentleman expressed some surprise at the immense influence which Fox, a man of pleasure, ruined by the dice-box and the turf, exercised over the English nation. "You have not," said Pitt, "been under the wand of the magician."

In November 1783 the Parliament met again. The government had irresistible strength in the House of Commons, and seemed to be scarcely less strong in the House of Lords, but was, in truth, surrounded on every side by dangers. The King was impatiently waiting for the moment at which he could emancipate himself from a yoke which galled him so severely that he had more than once seriously thought of retiring to Hanover; and the King was scarcely more eager for a change than the nation. Fox and North had committed a fatal error. They ought to have known that coalitions between parties which have long been hostile can succeed only when the wish for coalition pervades the lower ranks of both. If the leaders unite before there is any disposition to union among the followers, the probability is that there will be a mutiny in both camps, and that the two revolted armies will make a truce with each other, in order to be revenged on those by whom they think that they have been betrayed. Thus it was in 1783. At the beginning of that eventful year, North had been the recognised head of the old Tory party, which, though for a moment prostrated by the disastrous issue of the American war, was still a great power in the state. To him the clergy, the universities, and that large body of country gentlemen whose rallying cry was "Church and King," had long looked up with respect and confidence. Fox had, on the other hand, been the idol of the Whigs,

and of the whole body of Protestant dissenters. The coalition at once alienated the most zealous Tories from North, and the most zealous Whigs from Fox. The University of Oxford, which had marked its approbation of North's orthodoxy by electing him chancellor, the city of London, which had been, during two and twenty years, at war with the Court, were equally disgusted. Squires and rectors, who had inherited the principles of the cavaliers of the preceding century, could not forgive their old leader for combining with disloyal subjects in order to put a force on the sovereign. The members of the Bill of Rights Society and of the Reform Associations were enraged by learning that their favourite orator now called the great champion of tyranny and corruption his noble friend. Two great multitudes were at once left without any head, and both at once turned their eyes on Pitt. One party saw in him the only man who could rescue the King; the other saw in him the only man who could purify the Parliament. He was supported on one side by Archbishop Markham, the preacher of divine right, and by Jenkinson, the captain of the Prætorian band of the King's friends; on the other side by Jebb and Priestley, Sawbridge and Cartwright, Jack Wilkes and Horne Tooke. On the benches of the House of Commons, however, the ranks of the ministerial majority were unbroken; and that any statesman would venture to brave such a majority was thought impossible. No prince of the Hanoverian line had ever, under any provocation, ventured to appeal from the representative body to the constituent body. The ministers, therefore, notwithstanding the sullen looks and muttered words of displeasure with which their suggestions were received in the closet, notwithstanding the roar of obloquy which was rising louder and louder every day from every corner of the island, thought themselves secure.

Such was their confidence in their strength that, as soon as the Parliament had met, they brought forward a singularly bold and original plan for the government of the British territories in India. What was proposed was that the whole authority, which till that time had been exercised over those territories by the East India Company, should be transferred to seven commissioners who were to be named by Parliament, and were not to be removable at the pleasure of the Crown. Earl Fitzwilliam, the most intimate personal friend of Fox, was to be chairman of this board, and the eldest son of North was to be one of the members.

As soon as the outlines of the scheme were known, all the hatred which the coalition had excited burst forth with an astounding explosion. The question which ought undoubtedly to have been considered as paramount to every other was, whether the proposed change was likely to be beneficial or injurious to the thirty millions of people who were subject to the Company. But that question cannot be said to have been even seriously discussed. Burke, who, whether right or wrong in the conclusions to which he came, had at least the merit of looking at the subject in the right point of view, vainly reminded his hearers of that mighty population whose daily rice might depend on a vote of the British Parliament. He spoke, with even more than his wonted power of thought and language, about the desolation of Rohilcund, about the spoliation of Benares, about the evil policy which had suffered the tanks of the Carnatic to go to ruin; but he could scarcely obtain a hearing. The contending parties, to their shame it must be said, would listen to none but English topics. Out of doors the cry against the ministry was almost universal. Town and country were united. Corporations exclaimed against the violation of the charter of the greatest corporation in the realm. Tories and democrats joined in pronouncing the proposed board an unconstitutional body. It was to consist of Fox's nominees. The effect of his bill was to give, not to the Crown, but to him personally, whether in office or in opposition, an enormous power, a patronage sufficient to counterbalance the patronage of the Treasury and of the Admiralty, and to decide the elections for fifty boroughs. He knew, it was said, that he was hateful alike to King and people; and he had devised a plan which would make him independent of both. Some nicknamed him Cromwell, and some Carlo Khan. Wilberforce, with his usual felicity of expression, and with very unusual bitterness of feeling, described the scheme as the genuine offspring of the coalition, as marked with the features of both its parents, the corruption of one and the violence of the other. In spite of all opposition, however, the bill was supported in every stage by great majorities, was rapidly passed, and was sent up to the Lords. To the general astonishment, when the second reading was moved in the Upper House, the opposition proposed an adjournment, and carried it by eighty-seven votes to seventy-nine. The cause of this strange turn of fortune was soon known. Pitt's cousin, Earl Temple, had been in the royal closet, and had there been authorised to let it be known that His Majesty would consider all who voted for the bill as his enemies. The ignominious commission was performed, and instantly a troop of Lords of the Bedchamber, of Bishops who wished to be translated, and of Scotch peers who wished to be re-elected, made haste to change sides. On a later day, the Lords rejected the bill. Fox and North were immediately directed to send their seals to the palace by their Under Secretaries; and Pitt was appointed First Lord of the Treasury and Chancellor of the Exchequer.

The general opinion was, that there would be an immediate dissolution. But Pitt wisely determined to give the public feeling time to gather strength. On this point he differed from his kinsman Temple. The consequence was, that Temple, who had been appointed one of the Secretaries of State, resigned his office forty-eight hours after he had accepted it, and thus relieved the new government from a great load of unpopularity: for all men of sense and honour, however strong might be their dislike of the India Bill, disapproved of the manner in which that bill had been thrown out. Temple carried away with him the scandal which the best friends of the new government could not but lament. The fame of the young prime minister preserved its whiteness. He could declare with perfect truth that, if unconstitutional machinations had been employed, he had been no party to them.

He was, however, surrounded by difficulties and dangers. In the House of Lords, indeed, he had a majority; nor could any orator of the opposition in that assembly be considered as a match for Thurlow, who was now again Chancellor, or for Camden, who cordially supported the son of his old friend Chatham. But in the other House there was not a single eminent speaker among the official men who sate round Pitt. His most useful assistant was Dundas, who, though he had not eloquence, had sense, knowledge, readiness, and boldness. On the opposite benches was a powerful majority, led by Fox, who was supported by Burke, North, and Sheridan. The heart of the young minister, stout as it was, almost died within him. He could not once close his eyes on the night which followed Temple's resignation. But, whatever his internal emotions might be, his language and deportment indicated nothing but unconquerable firmness and haughty confidence in his own powers. His contest against the House of Commons lasted from the 17th of December 1783 to the 8th of March 1784. In sixteen divisions the opposition triumphed. Again and again the King was requested to dismiss his ministers. But he was determined to go to Germany rather than yield. Pitt's resolution never wavered. The cry of the nation in his favour became vehement and almost furious. Addresses assuring him of public support came up

daily from every part of the kingdom. The freedom of the city of London was presented to him in a gold box. He went in state to receive this mark of distinction. He was sumptuously feasted in Grocers' Hall; and the shopkeepers of the Strand and Fleet Street illuminated their houses in his honour. These things could not but produce an effect within the walls of Parliament. The ranks of the majority began to waver; a few passed over to the enemy; some skulked away; many were for capitulating while it was still possible to capitulate with the honours of war. Negotiations were opened with the view of forming an administration on a wide basis, but they had scarcely been opened when they were closed. The opposition demanded, as a preliminary article of the treaty, that Pitt should resign the Treasury; and with this demand Pitt stedfastly refused to comply. While the contest was raging, the Clerkship of the Pells, a sinecure place for life, worth three thousand a year, and tenable with a seat in the House of Commons, became vacant. The appointment was with the Chancellor of the Exchequer: nobody doubted that he would appoint himself; and nobody could have blamed him if he had done so: for such sinecure offices had always been defended on the ground that they enabled a few men of eminent abilities and small incomes to live without any profession, and to devote themselves to the service of the state. Pitt, in spite of the remonstrances of his friends, gave the Pells to his father's old adherent, Colonel Barré, a man distinguished by talent and eloquence, but poor and afflicted with blindness. By this arrangement a pension which the Rockingham administration had granted to Barré was saved to the public. Never was there a happier stroke of policy. About treaties, wars, expeditions, tariffs, budgets, there will always be room for dispute. The policy which is applauded by half the nation may be condemned by the other half. But pecuniary disinterestedness everybody comprehends. It is a great thing for a man who has only three hundred a year to be able to show that he considers three thousand a year as mere dirt beneath his feet, when compared with the public interest and the public esteem. Pitt had his reward. No minister was ever more rancorously libelled; but even when he was known to be overwhelmed with debt, when millions were passing through his hands, when the wealthiest magnates of the realm were soliciting him for marquisates and garters, his bitterest enemies did not dare to accuse him of touching unlawful gain.

At length the hard fought fight ended. A final remonstrance, drawn up by Burke with admirable skill, was carried on the 8th of March by a single vote in a full House. Had the experiment been repeated, the supporters of the coalition would probably have been in a minority. But the supplies had been voted; the Mutiny Bill had been passed; and the Parliament was dissolved.

The popular constituent bodies all over the country were in general enthusiastic on the side of the new government. A hundred and sixty of the supporters of the coalition lost their seats. The First Lord of the Treasury himself came in at the head of the poll for the University of Cambridge. His young friend, Wilberforce, was elected Knight of the great shire of York, in opposition to the whole influence of the Fitzwilliams, Cavendishes, Dundases, and Saviles. In the midst of such triumphs Pitt completed his twenty-fifth year. He was now the greatest subject that England had seen during many generations. He domineered absolutely over the cabinet, and was the favourite at once of the Sovereign, of the Parliament, and of the nation. His father had never been so powerful, nor Walpole, nor Marlborough.

This narrative has now reached a point, beyond which a full history of the life of Pitt would be a history of England, or rather of the whole civilised world; and for such a history this is not the proper place. Here a very slight sketch must suffice; and in that sketch prominence will be given to such points as may enable a reader who is already acquainted with the general course of events to form a just notion of the character of the man on whom so much depended.

If we wish to arrive at a correct judgment of Pitt's merits and defects, we must never forget that he belonged to a peculiar class of statesmen, and that he must be tried by a peculiar standard. It is not easy to compare him fairly with such men as Ximenes and Sully, Richelieu and Oxenstiern, John De Witt and Warren Hastings. The means by which those politicians governed great communities were of quite a different kind from those which Pitt was under the necessity of employing. Some talents, which they never had any opportunity of showing that they possessed, were developed in him to an extraordinary degree. In some qualities, on the other hand, to which they owe a large part of their fame, he was decidedly their inferior. They transacted business in their closets, or at boards where a few confidential councillors sate. It was his lot to be born in an age and in a country in which parliamentary government was completely established; his whole training from infancy was such as fitted him to bear a part in parliamentary government; and, from the prime of his manhood to his death, all the powers of his vigorous mind were almost constantly exerted in the work of parliamentary government. He accordingly became the greatest master of the whole art of parliamentary government that has ever existed, a greater than Montague or Walpole, a greater than his father Chatham or his rival Fox, a greater than either of his illustrious successors Canning and Peel.

Parliamentary government, like every other contrivance of man, has its advantages and its disadvantages. On the advantages there is no need to dilate. The history of England during the hundred and seventy years which have elapsed since the House of Commons became the most powerful body in the state, her immense and still growing prosperity, her freedom, her tranquillity, her greatness in arts, in sciences, and in arms, her maritime ascendency, the marvels of her public credit, her American, her African, her Australian, her Asiatic empires, sufficiently prove the excellence of her institutions. But those institutions, though excellent, are assuredly not perfect. Parliamentary government is government by speaking. In such a government, the power of speaking is the most highly prized of all the qualities which a politician can possess; and that power may exist, in the highest degree, without judgment, without fortitude, without skill in reading the characters of men or the signs of the times, without any knowledge of the principles of legislation or of political economy, and without any skill in diplomacy or in the administration of war. Nay, it may well happen that those very intellectual qualities which give a peculiar charm to the speeches of a public man may be incompatible with the qualities which would fit him to meet a pressing emergency with promptitude and firmness. It was thus with Charles Townshend. It was thus with Windham. It was a privilege to listen to those accomplished and ingenious orators. But in a perilous crisis they would have been found far inferior in all the qualities of rulers to such a man as Oliver Cromwell, who talked nonsense, or as William the Silent, who did not talk at all. When parliamentary government is established, a Charles Townshend or a Windham will almost always exercise much greater influence than such men as the great Protector of England, or as the founder of the Batavian commonwealth. In such a government, parliamentary talent, though quite distinct from the talents of a good executive or judicial officer, will be a chief qualification for executive and judicial office. From the Book of Dignities a curious list might be made out of Chancellors ignorant of the principles of equity, and First Lords of the Admiralty ignorant of the principles of navigation, of

Colonial ministers who could not repeat the names of the Colonies, of Lords of the Treasury who did not know the difference between funded and unfunded debt, and of Secretaries of the India Board who did not know whether the Mahrattas were Mahometans or Hindoos. On these grounds, some persons, incapable of seeing more than one side of a question, have pronounced parliamentary government a positive evil, and have maintained that the administration would be greatly improved if the power, now exercised by a large assembly, were transferred to a single person. Men of sense will probably think the remedy very much worse than the disease, and will be of opinion that there would be small gain in exchanging Charles Townshend and Windham for the Prince of the Peace, or the poor slave and dog Steenie.

Pitt was emphatically the man of parliamentary government, the type of his class, the minion, the child, the spoiled child, of the House of Commons. For the House of Commons he had a hereditary, an infantine love. Through his whole boyhood, the House of Commons was never out of his thoughts, or out of the thoughts of his instructors. Reciting at his father's knee, reading Thucydides and Cicero into English, analysing the great Attic speeches on the Embassy and on the Crown, he was constantly in training for the conflicts of the House of Commons. He was a distinguished member of the House of Commons at twenty-one. The ability which he had displayed in the House of Commons made him the most powerful subject in Europe before he was twenty-five. It would have been happy for himself and for his country if his elevation had been deferred. Eight or ten years, during which he would have had leisure and opportunity for reading and reflection, for foreign travel, for social intercourse and free exchange of thought on equal terms with a great variety of companions, would have supplied what, without any fault on his part, was wanting to his powerful intellect. He had all the knowledge that he could be expected to have; that is to say, all the knowledge that a man can acquire while he is a student at Cambridge, and all the knowledge that a man can acquire when he is First Lord of the Treasury and Chancellor of the Exchequer. But the stock of general information which he brought from college, extraordinary for a boy, was far inferior to what Fox possessed, and beggarly when compared with the massy, the splendid, the various treasures laid up in the large mind of Burke. After Pitt became minister, he had no leisure to learn more than was necessary for the purposes of the day which was passing over him. What was necessary for those purposes such a man could learn with little difficulty. He was surrounded by experienced and able public servants. He could at any moment command their best assistance. From the stores which they produced his vigorous mind rapidly collected the materials for a good parliamentary case: and that was enough. Legislation and administration were with him secondary matters. To the work of framing statutes, of negotiating treaties, of organising fleets and armies, of sending forth expeditions, he gave only the leavings of his time and the dregs of his fine intellect. The strength and sap of his mind were all drawn in a different direction. It was when the House of Commons was to be convinced and persuaded that he put forth all his powers.

Of those powers we must form our estimate chiefly from tradition; for of all the eminent speakers of the last age, Pitt has suffered most from the reporters. Even while he was still living, critics remarked that his eloquence could not be preserved, that he must be heard to be appreciated. They more than once applied to him the sentence in which Tacitus describes the fate of a senator whose rhetoric was admired in the Augustan age: "Haterii canorum illud et profluens cum ipso simul exstinctum est." There is, however, abundant evidence that nature had bestowed on Pitt the talents of a great orator; and those talents had been developed in a very peculiar manner, first by his education, and secondly by the high official position to which he rose early, and in which he passed the greater part of his public life.

At his first appearance in Parliament he showed himself superior to all his contemporaries in command of language. He could pour forth a long succession of round and stately periods, without premeditation, without ever pausing for a word, without ever repeating a word, in a voice of silver clearness, and with a pronunciation so articulate that not a letter was slurred over. He had less amplitude of mind and less richness of imagination than Burke, less ingenuity than Windham, less wit than Sheridan, less perfect mastery of dialectical fence, and less of that highest sort of eloquence which consists of reason and passion fused together, than Fox. Yet the almost unanimous judgment of those who were in the habit of listening to that remarkable race of men placed Pitt, as a speaker, above Burke, above Windham, above Sheridan, and not below Fox. His declamation was copious, polished, and splendid. In power of sarcasm he was probably not surpassed by any speaker, ancient or modern; and of this formidable weapon he made merciless use. In two parts of the oratorical art which are of the highest value to a minister of state he was singularly expert. No man knew better how to be luminous or how to be obscure. When he wished to be understood, he never failed to make himself understood. He could with ease present to his audience, not perhaps an exact or profound, but a clear, popular, and plausible view of the most extensive and complicated subject. Nothing was out of place; nothing was forgotten; minute details, dates, sums of money, were all faithfully preserved in his memory. Even intricate questions of finance, when explained by him, seemed clear to the plainest man among his hearers. On the other hand, when he did not wish to be explicit,—and no man who is at the head of affairs always wishes to be explicit,—he had a marvellous power of saying nothing in language which left on his audience the impression that he had said a great deal. He was at once the only man who could open a budget without notes, and the only man who, as Windham said, could speak that most elaborately evasive and unmeaning of human compositions, a King's speech, without premeditation.

The effect of oratory will always to a great extent depend on the character of the orator. There perhaps never were two speakers whose eloquence had more of what may be called the race, more of the flavour imparted by moral qualities, than Fox and Pitt. The speeches of Fox owe a great part of their charm to that warmth and softness of heart, that sympathy with human suffering, that admiration for everything great and beautiful, and that hatred of cruelty and injustice, which interest and delight us even in the most defective reports. No person, on the other hand, could hear Pitt without perceiving him to be a man of high, intrepid, and commanding spirit, proudly conscious of his own rectitude and of his own intellectual superiority, incapable of the low vices of fear and envy, but too prone to feel and to show disdain. Pride, indeed, pervaded the whole man, was written in the harsh, rigid lines of his face, was marked by the way in which he walked, in which he sate, in which he stood, and, above all, in which he bowed. Such pride, of course, inflicted many wounds. It may confidently be affirmed that there cannot be found, in all the ten thousand invectives written against Fox, a word indicating that his demeanour had ever made a single personal enemy. On the other hand, several men of note who had been partial to Pitt, and who to the last continued to approve his public conduct and to support his administration, Cumberland, for example, Boswell, and Matthias, were so much irritated by the contempt with which he

treated them, that they complained in print of their wrongs. But his pride, though it made him bitterly disliked by individuals, inspired the great body of his followers in Parliament and throughout the country with respect and confidence. They took him at his own valuation. They saw that his self-esteem was not that of an upstart who was drunk with good luck and with applause, and who, if fortune turned, would sink from arrogance into abject humility. It was that of the magnanimous man so finely described by Aristotle in the Ethics, of the man who thinks himself worthy of great things, being in truth worthy. It sprang from a consciousness of great powers and great virtues, and was never so conspicuously displayed as in the midst of difficulties and dangers which would have unnerved and bowed down any ordinary mind. It was closely connected, too, with an ambition which had no mixture of low cupidity. There was something noble in the cynical disdain with which the mighty minister scattered riches and titles to right and left among those who valued them, while he spurned them out of his own way. Poor himself, he was surrounded by friends on whom he had bestowed three thousand, six thousand, ten thousand a year. Plain Mister himself, he had made more lords than any three ministers that had preceded him. The garter, for which the first dukes in the kingdom were contending, was repeatedly offered to him, and offered in vain.

The correctness of his private life added much to the dignity of his public character. In the relations of son, brother, uncle, master, friend, his conduct was exemplary. In the small circle of his intimate associates, he was amiable, affectionate, even playful. They loved him sincerely; they regretted him long; and they would hardly admit that he who was so kind and gentle with them could be stern and haughty with others. He indulged, indeed, somewhat too freely in wine, which he had early been directed to take as a medicine, and which use had made a necessary of life to him. But it was very seldom that any indication of undue excess could be detected in his tones or gestures; and, in truth, two bottles of port were little more to him than two dishes of tea. He had, when he was first introduced into the clubs of Saint James's Street, shown a strong taste for play; but he had the prudence and the resolution to stop before this taste had acquired the strength of habit. From the passion which generally exercises the most tyrannical dominion over the young he possessed an immunity, which is probably to be ascribed partly to his temperament and partly to his situation. His constitution was feeble: he was very shy; and he was very busy. The strictness of his morals furnished such buffoons as Peter Pindar and Captain Morris with an inexhaustible theme for merriment of no very delicate kind. But the great body of the middle class of Englishmen could not see the joke. They warmly praised the young statesman for commanding his passions, and for covering his frailties, if he had frailties, with decorous obscurity, and would have been very far indeed from thinking better of him if he had vindicated himself from the taunts of his enemies by taking under his protection a Nancy Parsons or a Marianne Clark.

No part of the immense popularity which Pitt long enjoyed is to be attributed to the eulogies of wits and poets. It might have been naturally expected that a man of genius, of learning, of taste, an orator whose diction was often compared to that of Tully, the representative, too, of a great university, would have taken a peculiar pleasure in befriending eminent writers, to whatever political party they might have belonged. The love of literature had induced Augustus to heap benefits on Pompeians, Somers to be the protector of nonjurors, Harley to make the fortunes of Whigs. But it could not move Pitt to show any favour even to Pittites. He was doubtless right in thinking that, in general, poetry, history, and philosophy ought to be suffered, like calico and cutlery, to find their proper price in the market, and that to teach men of letters to look habitually to the state for their recompense is bad for the state and bad for letters. Assuredly nothing can be more absurd or mischievous than to waste the public money in bounties for the purpose of inducing people who ought to be weighing out grocery or measuring out drapery to write bad or middling books. But, though the sound rule is that authors should be left to be remunerated by their readers, there will, in every generation, be a few exceptions to this rule. To distinguish these special cases from the mass is an employment well worthy of the faculties of a great and accomplished ruler; and Pitt would assuredly have had little difficulty in finding such cases. While he was in power, the greatest philologist of the age, his own contemporary at Cambridge, was reduced to earn a livelihood by the lowest literary drudgery, and to spend in writing squibs for the Morning Chronicle years to which we might have owed an all but perfect text of the whole tragic and comic drama of Athens. The greatest historian of the age, forced by poverty to leave his country, completed his immortal work on the shores of Lake Leman. The political heterodoxy of Porson, and the religious heterodoxy of Gibbon, may perhaps be pleaded in defence of the minister by whom those eminent men were neglected. But there were other cases in which no such excuse could be set up. Scarcely had Pitt obtained possession of unbounded power when an aged writer of the highest eminence, who had made very little by his writings, and who was sinking into the grave under a load of infirmities and sorrows, wanted five or six hundred pounds to enable him, during the winter or two which might still remain to him, to draw his breath more easily in the soft climate of Italy. Not a farthing was to be obtained; and before Christmas the author of the English Dictionary and of the Lives of the Poets had gasped his last in the river fog and coal smoke of Fleet Street. A few months after the death of Johnson appeared the Task, incomparably the best poem that any Englishman then living had produced—a poem, too, which could hardly fail to excite in a well constituted mind a feeling of esteem and compassion for the poet, a man of genius and virtue, whose means were scanty, and whom the most cruel of all the calamities incident to humanity had made incapable of supporting himself by vigorous and sustained exertion. Nowhere had Chatham been praised with more enthusiasm, or in verse more worthy of the subject, than in the Task. The son of Chatham, however, contented himself with reading and admiring the book, and left the author to starve. The pension which, long after, enabled poor Cowper to close his melancholy life, unmolested by duns and bailiffs, was obtained for him by the strenuous kindness of Lord Spencer. What a contrast between the way in which Pitt acted towards Johnson and the way in which Lord Grey acted towards his political enemy Scott, when Scott, worn out by misfortune and disease, was advised to try the effect of the Italian air! What a contrast between the way in which Pitt acted towards Cowper and the way in which Burke, a poor man and out of place, acted towards Crabbe! Even Dundas, who made no pretensions to literary taste, and was content to be considered as a hard-headed and somewhat coarse man of business, was, when compared with his eloquent and classically educated friend, a Mæcenas or a Leo. Dundas made Burns an exciseman, with seventy pounds a year; and this was more than Pitt, during his long tenure of power, did for the encouragement of letters. Even those who may think that it is, in general, no part of the duty of a government to reward literary merit, will hardly deny that a government, which has much lucrative church preferment in its gift, is bound, in distributing that preferment, not to overlook divines whose writings have rendered great service to the cause of religion. But it seems never to have occurred to Pitt that he lay

under any such obligation. All the theological works of all the numerous bishops whom he made and translated are not, when put together, worth fifty pages of the Horæ Paulinæ, of the Natural Theology, or of the View of the Evidences of Christianity. But on Paley the all-powerful minister never bestowed the smallest benefice. Artists Pitt treated as contemptuously as writers. For painting he did simply nothing. Sculptors, who had been selected to execute monuments voted by Parliament, had to haunt the antechambers of the Treasury during many years before they could obtain a farthing from him. One of them, after vainly soliciting the minister for payment during fourteen years, had the courage to present a memorial to the King, and thus obtained tardy and ungracious justice. Architects it was absolutely necessary to employ; and the worst that could be found seem to have been employed. Not a single fine public building of any kind or in any style was erected during his long administration. It may be confidently affirmed that no ruler whose abilities and attainments would bear any comparison with his has ever shown such cold disdain for what is excellent in arts and letters.

His first administration lasted seventeen years. That long period is divided by a strongly marked line into two almost exactly equal parts. The first part ended and the second began in the autumn of 1792. Throughout both parts Pitt displayed in the highest degree the talents of a parliamentary leader. During the first part he was a fortunate, and, in many respects, a skilful administrator. With the difficulties which he had to encounter during the second part he was altogether incapable of contending: but his eloquence and his perfect mastery of the tactics of the House of Commons concealed his incapacity from the multitude.

The eight years which followed the general election of 1784 were as tranquil and prosperous as any eight years in the whole history of England. Neighbouring nations which had lately been in arms against her, and which had flattered themselves that, in losing her American colonies, she had lost a chief source of her wealth and of her power, saw, with wonder and vexation, that she was more wealthy and more powerful than ever. Her trade increased. Her manufactures flourished. Her exchequer was full to overflowing. Very idle apprehensions were generally entertained, that the public debt, though much less than a third of the debt which we now bear with ease, would be found too heavy for the strength of the nation. Those apprehensions might not perhaps have been easily quieted by reason. But Pitt quieted them by a juggle. He succeeded in persuading first himself, and then the whole nation, his opponents included, that a new sinking fund, which, so far as it differed from former sinking funds, differed for the worse, would, by virtue of some mysterious power of propagation belonging to money, put into the pocket of the public creditor great sums not taken out of the pocket of the tax-payer. The country, terrified by a danger which was no danger, hailed with delight and boundless confidence a remedy which was no remedy. The minister was almost universally extolled as the greatest of financiers. Meanwhile both the branches of the House of Bourbon found that England was as formidable an antagonist as she had ever been. France had formed a plan for reducing Holland to vassalage. But England interposed, and France receded. Spain interrupted by violence the trade of our merchants with the regions near the Oregon. But England armed, and Spain receded. Within the island there was profound tranquillity. The King was, for the first time, popular. During the twenty-three years which had followed his accession he had not been loved by his subjects. His domestic virtues were acknowleged. But it was generally thought that the good qualities by which he was distinguished in private life were wanting to his political character. As a Sovereign, he was resentful, unforgiving, stubborn, cunning. Under his rule the country had sustained cruel disgraces and disasters; and every one of those disgraces and disasters was imputed to his strong antipathies, and to his perverse obstinacy in the wrong. One statesman after another complained that he had been induced by royal caresses, entreaties, and promises, to undertake the direction of affairs at a difficult conjuncture, and that, as soon as he had, not without sullying his fame and alienating his best friends, served the turn for which he was wanted, his ungrateful master began to intrigue against him, and to canvass against him. Grenville, Rockingham, Chatham, men of widely different characters, but all three upright and high-spirited, agreed in thinking that the Prince under whom they had successively held the highest place in the government was one of the most insincere of mankind. His confidence was reposed, they said, not in those known and responsible counsellors to whom he had delivered the seals of office, but in secret advisers who stole up the back stairs into his closet. In Parliament, his ministers, while defending themselves against the attacks of the opposition in front, were perpetually, at his instigation, assailed on the flank or in the rear by a vile band of mercenaries who called themselves his friends. These men constantly, while in possession of lucrative places in his service, spoke and voted against bills which he had authorised the First Lord of the Treasury or the Secretary of State to bring in. But from the day on which Pitt was placed at the head of affairs there was an end of secret influence. His haughty and aspiring spirit was not to be satisfied with the mere show of power. Any attempt to undermine him at Court, any mutinous movement among his followers in the House of Commons, was certain to be at once put down. He had only to tender his resignation; and he could dictate his own terms. For he, and he alone, stood between the King and the Coalition. He was therefore little less than Mayor of the Palace. The nation loudly applauded the King for having the wisdom to repose entire confidence in so excellent a minister. His Majesty's private virtues now began to produce their full effect. He was generally regarded as the model of a respectable country gentleman, honest, goodnatured, sober, religious. He rose early: he dined temperately: he was strictly faithful to his wife: he never missed church; and at church he never missed a response. His people heartily prayed that he might long reign over them; and they prayed the more heartily because his virtues were set off to the best advantage by the vices and follies of the Prince of Wales, who lived in close intimacy with the chiefs of the opposition.

How strong this feeling was in the public mind appeared signally on one great occasion. In the autumn of 1788 the King became insane. The opposition, eager for office, committed the great indiscretion of asserting that the heir apparent had, by the fundamental laws of England, a right to be Regent with the full powers of royalty. Pitt, on the other hand, maintained it to be the constitutional doctrine that, when a Sovereign is, by reason of infancy, disease, or absence, incapable of exercising the regal functions, it belongs to the estates of the realm to determine who shall be the vicegerent, and with what portion of the executive authority such vicegerent shall be entrusted. A long and violent contest followed, in which Pitt was supported by the great body of the people with as much enthusiasm as during the first months of his administration. Tories with one voice applauded him for defending the sick-bed of a virtuous and unhappy Sovereign against a disloyal faction and an undutiful son. Not a few Whigs applauded him for asserting the authority of Parliaments and the principles of the Revolution, in opposition to a doctrine which seemed to have too much affinity with the servile theory of indefeasible hereditary right. The middle class, always zealous on the side of decency and

the domestic virtues, looked forward with dismay to a reign resembling that of Charles II. The palace, which had now been, during thirty years, the pattern of an English home, would be a public nuisance, a school of profligacy. To the good King's repast of mutton and lemonade, despatched at three o'clock, would succeed midnight banquets, from which the guests would be carried home speechless. To the backgammon board at which the good King played for a little silver with his equerries, would succeed faro tables from which young patricians who had sate down rich would rise up beggars. The drawing-room, from which the frown of the Queen had repelled a whole generation of frail beauties, would now be again what it had been in the days of Barbara Palmer and Louisa de Querouaille. Nay, severely as the public reprobated the Prince's many illicit attachments, his one virtuous attachment was reprobated more severely still. Even in grave and pious circles his Protestant mistresses gave less scandal than his Popish wife. That he must be Regent nobody ventured to deny. But he and his friends were so unpopular that Pitt could, with general approbation, propose to limit the powers of the Regent by restrictions to which it would have been impossible to subject a Prince beloved and trusted by the country. Some interested men, fully expecting a change of administration, went over to the opposition. But the majority, purified by these desertions, closed its ranks, and presented a more firm array than ever to the enemy. In every division Pitt was victorious. When at length, after a stormy interregnum of three months, it was announced, on the very eve of the inauguration of the Regent, that the King was himself again, the nation was wild with delight. On the evening of the day on which His Majesty resumed his functions, a spontaneous illumination, the most general that had ever been seen in England, brightened the whole vast space from Highgate to Tooting, and from Hammersmith to Greenwich. On the day on which he returned thanks in the cathedral of his capital, all the horses and carriages within a hundred miles of London were too few for the multitudes which flocked to see him pass through the streets. A second illumination followed, which was even superior to the first in magnificence. Pitt with difficulty escaped from the tumultuous kindness of an innumerable multitude which insisted on drawing his coach from Saint Paul's Churchyard to Downing Street. This was the moment at which his fame and fortune may be said to have reached the zenith. His influence in the closet was as great as that of Carr or Villiers had been. His dominion over the Parliament was more absolute than that of Walpole or Pelham had been. He was at the same time as high in the favour of the populace as ever Wilkes or Sacheverell had been. Nothing did more to raise his character than his noble poverty. It was well known that, if he had been dismissed from office after more than five years of boundless power, he would hardly have carried out with him a sum sufficient to furnish the set of chambers in which, as he cheerfully declared, he meant to resume the practice of the law. His admirers, however, were by no means disposed to suffer him to depend on daily toil for his daily bread. The voluntary contributions which were awaiting his acceptance in the city of London alone would have sufficed to make him a rich man. But it may be doubted whether his haughty spirit would have stooped to accept a provision so honourably earned and so honourably bestowed.

To such a height of power and glory had this extraordinary man risen at twenty-nine years of age. And now the tide was on the turn. Only ten days after the triumphant procession to Saint Paul's, the States-General of France, after an interval of a hundred and seventy-four years, met at Versailles.

The nature of the great Revolution which followed was long very imperfectly understood in this country. Burke saw much further than any of his contemporaries; but whatever his sagacity descried was refracted and discoloured by his passions and his imagination. More than three years elapsed before the principles of the English administration underwent any material change. Nothing could as yet be milder or more strictly constitutional than the minister's domestic policy. Not a single act indicating an arbitrary temper or a jealousy of the people could be imputed to him. He had never applied to Parliament for any extraordinary powers. He had never used with harshness the ordinary powers entrusted by the constitution to the executive government. Not a single state prosecution which would even now be called oppressive had been instituted by him. Indeed, the only oppressive state prosecution instituted during the first eight years of his administration was that of Stockdale, which is to be attributed, not to the government, but to the chiefs of the opposition. In office, Pitt had redeemed the pledges which he had, at his entrance into public life, given to the supporters of parliamentary reform. He had, in 1785, brought forward a judicious plan for the improvement of the representative system, and had prevailed on the King, not only to refrain from talking against that plan, but to recommend it to the Houses in a speech from the throne.[1] This attempt failed: but there can be little doubt that, if the French Revolution had not produced a violent reaction of public feeling, Pitt would have performed, with little difficulty and no danger, that great work which, at a later period, Lord Grey could accomplish only by means which for a time loosened the very foundations of the commonwealth. When the atrocities of the slave trade were first brought under the consideration of Parliament, no abolitionist was more zealous than Pitt. When sickness prevented Wilberforce from appearing in public, his place was most efficiently supplied by his friend the minister. A humane bill, which mitigated the horrors of the middle passage, was, in 1788, carried by the eloquence and determined spirit of Pitt, in spite of the opposition of some of his own colleagues; and it ought always to be remembered to his honour that, in order to carry that bill, he kept the Houses sitting, in spite of many murmurs, long after the business of the government had been done, and the Appropriation Act passed. In 1791 he cordially concurred with Fox in maintaining the sound constitutional doctrine, that an impeachment is not terminated by a dissolution. In the course of the same year the two great rivals contended side by side in a far more important cause. They are fairly entitled to divide the high honour of having added to our statute-book the inestimable law which places the liberty of the press under the protection of juries. On one occasion, and one alone, Pitt, during the first half of his long administration, acted in a manner unworthy of an enlightened Whig. In the debate on the Test Act, he stooped to gratify the master whom he served, the university which he represented, and the great body of clergymen and country gentlemen on whose support he rested, by talking, with little heartiness, indeed, and with no asperity, the language of a Tory. With this single exception, his conduct from the end of 1783 to the middle of 1792 was that of an honest friend of civil and religious liberty.

Nor did anything, during that period, indicate that he loved war, or harboured any malevolent feeling against any neighbouring nation. Those French writers who have

[1] The speech with which the King opened the session of 1785 concluded with an assurance that His Majesty would heartily concur in every measure which could tend to secure the true principles of the constitution. These words were at the time understood to refer to Pitt's Reform Bill.

represented him as a Hannibal sworn in childhood by his father to bear eternal hatred to France, as having, by mysterious intrigues and lavish bribes, instigated the leading Jacobins to commit those excesses which dishonoured the Revolution, as having been the real author of the first coalition, know nothing of his character or of his history. So far was he from being a deadly enemy to France, that his laudable attempts to bring about a closer connection with that country by means of a wise and liberal treaty of commerce brought on him the severe censure of the opposition. He was told in the House of Commons that he was a degenerate son, and that his partiality for the hereditary foes of our island was enough to make his great father's bones stir under the pavement of the Abbey.

And this man, whose name, if he had been so fortunate as to die in 1792, would now have been associated with peace, with freedom, with philanthropy, with temperate reform, with mild and constitutional administration, lived to associate his name with arbitrary government, with harsh laws harshly executed, with alien bills, with gagging bills, with suspensions of the Habeas Corpus Act, with cruel punishments inflicted on some political agitators, with unjustifiable prosecutions instituted against others, and with the most costly and most sanguinary wars of modern times. He lived to be held up to obloquy as the stern oppressor of England, and the indefatigable disturber of Europe. Poets, contrasting his earlier with his later years, likened him sometimes to the apostle who kissed in order to betray, and sometimes to the evil angels who kept not their first estate. A satirist of great genius introduced the fiends of Famine, Slaughter, and Fire, proclaiming that they had received their commission from One whose name was formed of four letters, and promising to give their employer ample proofs of gratitude. Famine would gnaw the multitude till they should rise up against him in madness. The demon of Slaughter would impel them to tear him from limb to limb. But Fire boasted that she alone could reward him as he deserved, and that she would cling round him to all eternity. By the French press and the French tribune every crime that disgraced and every calamity that afflicted France was ascribed to the monster Pitt and his guineas. While the Jacobins were dominant, it was he who had corrupted the Gironde, who had raised Lyons and Bordeaux against the Convention, who had suborned Paris to assassinate Lepelletier, and Cecilia Regnault to assassinate Robespierre. When the Thermidorian reaction came, all the atrocities of the Reign of Terror were imputed to him. Collot D'Herbois and Fouquier Thinville had been his pensioners. It was he who had hired the murderers of September, who had dictated the pamphlets of Marat and the Carmagnoles of Barrere, who had paid Lebon to deluge Arras with blood, and Carrier to choke the Loire with corpses.

The truth is, that he liked neither war nor arbitrary government. He was a lover of peace and freedom, driven, by a stress against which it was hardly possible for any will or any intellect to struggle, out of the course to which his inclinations pointed, and for which his abilities and acquirements fitted him, and forced into a policy repugnant to his feelings and unsuited to his talents.

The charge of apostasy is grossly unjust. A man ought no more to be called an apostate because his opinions alter with the opinions of the great body of his contemporaries than he ought to be called an oriental traveller because he is always going round from west to east with the globe and everything that is upon it. Between the spring of 1789 and the close of 1792, the public mind of England underwent a great change. If the change of Pitt's sentiments attracted peculiar notice, it was not because he changed more than his neighbours; for in fact he changed less than most of them; but because his position was far more conspicuous than theirs, because he was, till Bonaparte appeared, the individual who filled the greatest space in the eyes of the inhabitants of the civilised world. During a short time the nation, and Pitt, as one of the nation, looked with interest and approbation on the French Revolution. But soon vast confiscations, the violent sweeping away of ancient institutions, the domination of clubs, the barbarities of mobs maddened by famine and hatred, produced a reaction here. The court, the nobility, the gentry, the clergy, the manufacturers, the merchants, in short, nineteen twentieths of those who had good roofs over their heads and good coats on their backs, became eager and intolerant Antijacobins. This feeling was at least as strong among the minister's adversaries as among his supporters. Fox in vain attempted to restrain his followers. All his genius, all his vast personal influence, could not prevent them from rising up against him in general mutiny. Burke set the example of revolt; and Burke was in no long time joined by Portland, Spencer, Fitzwilliam, Loughborough, Carlisle, Malmesbury, Windham, Elliot. In the House of Commons, the followers of the great Whig statesman and orator diminished from about a hundred and sixty to fifty. In the House of Lords he had but ten or twelve adherents left. There can be no doubt that there would have been a similar mutiny on the ministerial benches, if Pitt had obstinately resisted the general wish. Pressed at once by his master and by his colleagues, by old friends and by old opponents, he abandoned, slowly and reluctantly, the policy which was dear to his heart. He laboured hard to avert the European war. When the European war broke out, he still flattered himself that it would not be necessary for this country to take either side. In the spring of 1792 he congratulated the Parliament on the prospect of long and profound peace, and proved his sincerity by proposing large remissions of taxation. Down to the end of that year he continued to cherish the hope that England might be able to preserve neutrality. But the passions which raged on both sides of the Channel were not to be restrained. The republicans who ruled France were inflamed by a fanaticism resembling that of the Mussulmans, who, with the Koran in one hand and the sword in the other, went forth, conquering and converting, eastward to the Bay of Bengal, and westward to the Pillars of Hercules. The higher and middle classes of England were animated by zeal not less fiery than that of the Crusaders who raised the cry of *Deus vult* at Clermont. The impulse which drove the two nations to a collision was not to be arrested by the abilities or by the authority of any single man. As Pitt was in front of his fellows, and towered high above them, he seemed to lead them. But in fact he was violently pushed on by them, and, had he held back but a little more than he did, would have been thrust out of their way or trampled under their feet.

He yielded to the current: and from that day his misfortunes began. The truth is that there were only two consistent courses before him. Since he did not choose to oppose himself, side by side with Fox, to the public feeling, he should have taken the advice of Burke, and should have availed himself of that feeling to the full extent. If it was impossible to preserve peace, he should have adopted the only policy which could lead to victory. He should have proclaimed a Holy War for religion, morality, property, order, public law, and should have thus opposed to the Jacobins an energy equal to their own. Unhappily he tried to find a middle path; and he found one which united all that was worst in both extremes. He went to war: but he would not understand the peculiar character of that war. He was obstinately blind to the plain fact, that he was contending against a state which was also a sect, and that the new quarrel between England and France was of quite a different kind from the old quarrels about colonies in

America and fortresses in the Netherlands. He had to combat frantic enthusiasm, boundless ambition, restless activity, the wildest and most audacious spirit of innovation; and he acted as if he had had to deal with the harlots and fops of the old Court of Versailles, with Madame De Pompadour and the Abbé de Bernis. It was pitiable to hear him, year after year, proving to an admiring audience that the wicked Republic was exhausted, that she could not hold out, that her credit was gone, that her assignats were not worth more than the paper of which they were made; as if credit was necessary to a government of which the principle was rapine, as if Alboin could not turn Italy into a desert till he had negotiated a loan at five per cent., as if the exchequer bills of Attila had been at par. It was impossible that a man who so completely mistook the nature of a contest could carry on that contest successfully. Great as Pitt's abilities were, his military administration was that of a driveller. He was at the head of a nation engaged in a struggle for life and death, of a nation eminently distinguished by all the physical and all the moral qualities which make excellent soldiers. The resources at his command were unlimited. The Parliament was even more ready to grant him men and money than he was to ask for them. In such an emergency, and with such means, such a statesman as Richelieu, as Louvois, as Chatham, as Wellesley, would have created in a few months one of the finest armies in the world, and would soon have discovered and brought forward generals worthy to command such an army. Germany might have been saved by another Blenheim; Flanders recovered by another Ramilies; another Poitiers might have delivered the Royalist and Catholic provinces of France from a yoke which they abhorred, and might have spread terror even to the barriers of Paris. But the fact is, that, after eight years of war, after a vast destruction of life, after an expenditure of wealth far exceeding the expenditure of the American war, of the Seven Years' War, of the war of the Austrian Succession, and of the war of the Spanish Succession united, the English army, under Pitt, was the laughing-stock of all Europe. It could not boast of one single brilliant exploit. It had never shown itself on the Continent but to be beaten, chased, forced to reembark, or forced to capitulate. To take some sugar island in the West Indies, to scatter some mob of half naked Irish peasants, such were the most splendid victories won by the British troops under Pitt's auspices.

The English navy no mismanagement could ruin. But during a long period whatever mismanagement could do was done. The Earl of Chatham, without a single qualification for high public trust, was made, by fraternal partiality, First Lord of the Admiralty, and was kept in that great post during two years of a war in which the very existence of the state depended on the efficiency of the fleet. He continued to doze away and trifle away the time which ought to have been devoted to the public service, till the whole mercantile body, though generally disposed to support the government, complained bitterly that our flag gave no protection to our trade. Fortunately he was succeeded by George Earl Spencer, one of those chiefs of the Whig party who, in the great schism caused by the French Revolution, had followed Burke. Lord Spencer, though inferior to many of his colleagues as an orator, was decidedly the best administrator among them. To him it was owing that a long and gloomy succession of days of fasting, and, most emphatically, of humiliation, was interrupted, twice in the short space of eleven months, by days of thanksgiving for great victories.

It may seem paradoxical to say that the incapacity which Pitt showed in all that related to the conduct of the war is, in some sense, the most decisive proof that he was a man of very extraordinary abilities. Yet this is the simple truth. For assuredly one-tenth part of his errors and disasters would have been fatal to the power and influence of any minister who had not possessed, in the highest degree, the talents of a parliamentary leader. While his schemes were confounded, while his predictions were falsified, while the coalitions which he had laboured to form were falling to pieces, while the expeditions which he had sent forth at enormous cost were ending in rout and disgrace, while the enemy against whom he was feebly contending was subjugating Flanders and Brabant, the Electorate of Mentz and the Electorate of Treves, Holland, Piedmont, Liguria, Lombardy, his authority over the House of Commons was constantly becoming more and more absolute. There was his empire. There were his victories, his Lodi and his Arcola, his Rivoli and his Marengo. If some great misfortune, a pitched battle lost by the allies, the annexation of a new department to the French Republic, a sanguinary insurrection in Ireland, a mutiny in the fleet, a panic in the city, a run on the bank, had spread dismay through the ranks of his majority, that dismay lasted only till he rose from the Treasury bench, drew up his haughty head, stretched his arm with commanding gesture, and poured forth, in deep and sonorous tones, the lofty language of inextinguishable hope and inflexible resolution. Thus, through a long and calamitous period, every disaster that happened without the walls of Parliament was regularly followed by a triumph within them. At length he had no longer an opposition to encounter. Of the great party which had contended against him during the first eight years of his administration more than one half now marched under his standard, with his old competitor the Duke of Portland at their head; and the rest had, after many vain struggles, quitted the field in despair. Fox had retired to the shades of St Anne's Hill, and had there found, in the society of friends whom no vicissitude could estrange from him, of a woman whom he tenderly loved, and of the illustrious dead of Athens, of Rome, and of Florence, ample compensation for all the misfortunes of his public life. Session followed session with scarcely a single division. In the eventful year 1799, the largest minority that could be mustered against the government was twenty-five.

In Pitt's domestic policy there was at this time assuredly no want of vigour. While he offered to French Jacobinism a resistance so feeble that it only encouraged the evil which he wished to suppress, he put down English Jacobinism with a strong hand. The Habeas Corpus Act was repeatedly suspended. Public meetings were placed under severe restraints. The government obtained from Parliament power to send out of the country aliens who were suspected of evil designs; and that power was not suffered to be idle. Writers who propounded doctrines adverse to monarchy and aristocracy were proscribed and punished without mercy. It was hardly safe for a republican to avow his political creed over his beefsteak and his bottle of port at a chop-house. The old laws of Scotland against sedition, laws which were considered by Englishmen as barbarous, and which a succession of governments had suffered to rust, were now furbished up and sharpened anew. Men of cultivated minds and polished manners were, for offences which at Westminster would have been treated as mere misdemeanours, sent to herd with felons at Botany Bay. Some reformers, whose opinions were extravagant, and whose language was intemperate, but who had never dreamed of subverting the government by physical force, were indicted for high treason, and were saved from the gallows only by the righteous verdicts of juries. This severity was at the time loudly applauded by alarmists whom fear had made cruel, but will be seen in a very different light by posterity. The truth is, that the Englishmen who wished for a revolution were, even in number, not formidable, and, in everything but number, a faction utterly contemptible, without

arms, or funds, or plans, or organisation, or leader. There can be no doubt that Pitt, strong as he was in the support of the great body of the nation, might easily have repressed the turbulence of the discontented minority by firmly yet temperately enforcing the ordinary law. Whatever vigour he showed during this unfortunate part of his life was vigour out of place and season. He was all feebleness and languor in his conflict with the foreign enemy who was really to be dreaded, and reserved all his energy and resolution for the domestic enemy who might safely have been despised.

One part only of Pitt's conduct during the last eight years of the eighteenth century deserves high praise. He was the first English minister who formed great designs for the benefit of Ireland. The manner in which the Roman Catholic population of that unfortunate country had been kept down during many generations seemed to him unjust and cruel; and it was scarcely possible for a man of his abilities not to perceive that, in a contest against the Jacobins, the Roman Catholics were his natural allies. Had he been able to do all that he wished, it is probable that a wise and liberal policy would have averted the rebellion of 1798. But the difficulties which he encountered were great, perhaps insurmountable; and the Roman Catholics were, rather by his misfortune than by his fault, thrown into the hands of the Jacobins. There was a third great rising of the Irishry against the Englishry, a rising not less formidable than the risings of 1641 and 1689. The Englishry remained victorious; and it was necessary for Pitt, as it had been necessary for Oliver Cromwell and William of Orange before him, to consider how the victory should be used. It is only just to his memory to say that he formed a scheme of policy, so grand and so simple, so righteous and so humane, that it would alone entitle him to a high place among statesmen. He determined to make Ireland one kingdom with England, and, at the same time, to relieve the Roman Catholic laity from civil disabilities, and to grant a public maintenance to the Roman Catholic clergy. Had he been able to carry these noble designs into effect, the Union would have been an Union indeed. It would have been inseparably associated in the minds of the great majority of Irishmen with civil and religious freedom; and the old Parliament in College Green would have been regretted only by a small knot of discarded jobbers and oppressors, and would have been remembered by the body of the nation with the loathing and contempt due to the most tyrannical and the most corrupt assembly that had ever sate in Europe. But Pitt could execute only one half of what he had projected. He succeeded in obtaining the consent of the Parliaments of both kingdoms to the Union: but that reconciliation of races and sects, without which the Union could exist only in name, was not accomplished. He was well aware that he was likely to find difficulties in the closet. But he flattered himself that, by cautious and dexterous management, those difficulties might be overcome. Unhappily, there were traitors and sycophants in high place who did not suffer him to take his own time and his own way, but prematurely disclosed his scheme to the king, and disclosed it in the manner most likely to irritate and alarm a weak and diseased mind. His Majesty absurdly imagined that his coronation oath bound him to refuse his assent to any bill for relieving Roman Catholics from civil disabilities. To argue with him was impossible. Dundas tried to explain the matter, but was told to keep his Scotch metaphysics to himself. Pitt, and Pitt's ablest colleagues, resigned their offices. It was necessary that the King should make a new arrangement. But by this time his anger and distress had brought back the malady which had, many years before, incapacitated him for the discharge of his functions. He actually assembled his family, read the Coronation oath to them, and told them that, if he broke it, the Crown would immediately pass to the House of Savoy. It was not until after an interregnum of several weeks that he regained the full use of his small faculties, and that a ministry after his own heart was at length formed.

The materials out of which he had to construct a government were neither solid nor splendid. To that party, weak in numbers, but strong in every kind of talent, which was hostile to the domestic and foreign policy of his late advisers, he could not have recourse. For that party, while it differed from his late advisers on every point on which they had been honoured with his approbation, cordially agreed with them as to the single matter which had brought on them his displeasure. All that was left to him was to call up the rear ranks of the old ministry to form the front ranks of a new ministry. In an age pre-eminently fruitful of parliamentary talents, a cabinet was formed containing hardly a single man who, in parliamentary talents, could be considered as even of the second rate. The most important offices in the state were bestowed on decorous and laborious mediocrity. Henry Addington was at the head of the Treasury. He had been an early, indeed a hereditary, friend of Pitt, and had by Pitt's influence been placed, while still a young man, in the chair of the House of Commons. He was universally admitted to have been the best speaker that had sate in that chair since the retirement of Onslow. But nature had not bestowed on him very vigorous faculties; and the highly respectable situation which he had long occupied with honour had rather unfitted than fitted him for the discharge of his new duties. His business had been to bear himself evenly between contending factions. He had taken no part in the war of words; and he had always been addressed with marked deference by the great orators who thundered against each other from his right and from his left. It was not strange that when, for the first time, he had to encounter keen and vigorous antagonists, who dealt hard blows without the smallest ceremony, he should have been awkward and unready, or that the air of dignity and authority which he had acquired in his former post, and of which he had not divested himself, should have made his helplessness laughable and pitiable. Nevertheless, during many months, his power seemed to stand firm. He was a favourite with the King, whom he resembled in narrowness of mind, and to whom he was more obsequious than Pitt had ever been. The nation was put into high good humour by a peace with France. The enthusiasm with which the upper and middle classes had rushed into the war had spent itself. Jacobinism was no longer formidable. Everywhere there was a strong reaction against what was called the atheistical and anarchical philosophy of the eighteenth century. Bonaparte, now First Consul, was busied in constructing out of the ruins of old institutions a new ecclesiastical establishment and a new order of knighthood. That nothing less than the dominion of the whole civilised world would satisfy his selfish ambition was not yet suspected; nor did even wise men see any reason to doubt that he might be as safe a neighbour as any prince of the House of Bourbon had been. The treaty of Amiens was therefore hailed by the great body of the English people with extravagant joy. The popularity of the minister was for the moment immense. His want of parliamentary ability was, as yet, of little consequence: for he had scarcely any adversary to encounter. The old opposition, delighted by the peace, regarded him with favour. A new opposition had indeed been formed by some of the late ministers, and was led by Grenville in the House of Lords, and by Windham in the House of Commons. But the new opposition could scarcely muster ten votes, and was regarded with no favour by the country. On Pitt the ministers relied as on their firmest support. He had not, like some of his colleagues, retired in anger. He had expressed the

Pitt, William.

greatest respect for the conscientious scruple which had taken possession of the royal mind; and he had promised his successors all the help in his power. In private his advice was at their service. In Parliament he took his seat on the bench behind them; and, in more than one debate, defended them with powers far superior to their own. The King perfectly understood the value of such assistance. On one occasion, at the palace, he took the old minister and the new minister aside. "If we three," he said, "keep together, all will go well."

But it was hardly possible, human nature being what it is, and, more especially, Pitt and Addington being what they were, that this union should be durable. Pitt, conscious of superior powers, imagined that the place which he had quitted was now occupied by a mere puppet which he had set up, which he was to govern while he suffered it to remain, and which he was to fling aside as soon as he wished to resume his old position. Nor was it long before he began to pine for the power which he had relinquished. He had been so early raised to supreme authority in the state, and had enjoyed that authority so long, that it had become necessary to him. In retirement his days passed heavily. He could not, like Fox, forget the pleasures and cares of ambition in the company of Euripides or Herodotus. Pride restrained him from intimating, even to his dearest friends, that he wished to be again minister. But he thought it strange, almost ungrateful, that his wish had not been divined, that it had not been anticipated, by one whom he regarded as his deputy.

Addington, on the other hand, was by no means inclined to descend from his high position. He was, indeed, under a delusion much resembling that of Abon Hassan in the Arabian tale. His brain was turned by his short and unreal Caliphate. He took his elevation quite seriously, attributed it to his own merit, and considered himself as one of the great triumvirate of English statesmen, as worthy to make a third with Pitt and Fox.

Such being the feelings of the late minister and of the present minister, a rupture was inevitable; and there was no want of persons bent on making that rupture speedy and violent. Some of these persons wounded Addington's pride by representing him as a lacquey, sent to keep a place on the Treasury bench till his master should find it convenient to come. Others took every opportunity of praising him at Pitt's expense. Pitt had waged a long, a bloody, a costly, an unsuccessful war. Addington had made peace. Pitt had suspended the constitutional liberties of Englishmen. Under Addington those liberties were again enjoyed. Pitt had wasted the public resources. Addington was carefully nursing them. It was sometimes but too evident that these compliments were not unpleasing to Addington. Pitt became cold and reserved. During many months he remained at a distance from London. Meanwhile his most intimate friends, in spite of his declarations that he made no complaint, and that he had no wish for office, exerted themselves to effect a change of ministry. His favourite disciple, George Canning, young, ardent, ambitious, with great powers and great virtues, but with a temper too restless and a wit too satirical for his own happiness, was indefatigable. He spoke; he wrote; he intrigued; he tried to induce a large number of the supporters of the government to sign a round robin desiring a change; he made game of Addington and of Addington's relations in a succession of lively pasquinades. The minister's partisans retorted with equal acrimony, if not with equal vivacity. Pitt could keep out of the affray only by keeping out of politics altogether; and this it soon became impossible for him to do. Had Napoleon, content with the first place among the sovereigns of the Continent, and with a military reputation surpassing that of Marlborough or of Turenne, devoted himself to the noble task of making France happy by mild administration and wise legislation, our country might have long continued to tolerate a government of fair intentions and feeble abilities. Unhappily, the treaty of Amiens had scarcely been signed, when the restless ambition and the insupportable insolence of the First Consul convinced the great body of the English people that the peace, so eagerly welcomed, was only a precarious armistice. As it became clearer and clearer that a war for the dignity, the independence, the very existence of the nation was at hand, men looked with increasing uneasiness on the weak and languid cabinet which would have to contend against an enemy who united more than the power of Lewis the Great to more than the genius of Frederick the Great. It is true that Addington might easily have been a better war minister than Pitt, and could not possibly have been a worse. But Pitt had cast a spell on the public mind. The eloquence, the judgment, the calm and disdainful firmness which he had, during many years, displayed in Parliament, deluded the world into the belief that he must be eminently qualified to superintend every department of politics; and they imagined, even after the miserable failures of Dunkirk, of Quiberon, and of the Helder, that he was the only statesman who could cope with Bonaparte. This feeling was nowhere stronger than among Addington's own colleagues. The pressure put on him was so strong, that he could not help yielding to it: yet, even in yielding, he showed how far he was from knowing his own place. His first proposition was, that some insignificant nobleman should be First Lord of the Treasury and nominal head of the administration, and that the real power should be divided between Pitt and himself, who were to be secretaries of state. Pitt, as might have been expected, refused even to discuss such a scheme, and talked of it with bitter mirth. "Which secretaryship was offered to you?" his friend Wilberforce asked. "Really," said Pitt, "I had not the curiosity to inquire." Addington was frightened into bidding higher. He offered to resign the Treasury to Pitt, on condition that there should be no extensive change in the government. But Pitt would listen to no such terms. Then came a dispute such as often arises after negotiations orally conducted, even when the negotiators are men of strict honour. Pitt gave one account of what had passed; Addington gave another; and though the discrepancies were not such as necessarily implied any intentional violation of truth on either side, both were greatly exasperated.

Meanwhile the quarrel with the First Consul had come to a crisis. On the 16th of May 1803, the King sent a message calling on the House of Commons to support him in withstanding the ambitious and encroaching policy of France; and on the 22d, the House took the message into consideration.

Pitt had now been living many months in retirement. There had been a general election since he had spoken in Parliament, and there were two hundred members who had never heard him. It was known that on this occasion he would be in his place, and curiosity was wound up to the highest point. Unfortunately, the short-hand writers were, in consequence of some mistake, shut out on that day from the gallery, so that the newspapers contained only a very meagre report of the proceedings. But several accounts of what passed are extant; and of those accounts, the most interesting is contained in an unpublished letter written by a very young member, John William Ward, afterwards Earl of Dudley. When Pitt rose, he was received with loud cheering. At every pause in his speech there was a burst of applause. The peroration is said to have been one of the most animated and magnificent ever heard in Parliament. "Pitt's speech," Fox wrote a few days later, "was admired very much, and very justly. I think it was the best he ever made in that style." The debate was

adjourned; and on the second night Fox replied in an oration which, as the most zealous Pittites were forced to acknowledge, left the palm of eloquence doubtful. Addington made a pitiable appearance between the two great rivals; and it was observed that Pitt, while exhorting the Commons to stand resolutely by the executive government against France, said not a word indicating esteem or friendship for the prime minister.

War was speedily declared. The First Consul threatened to invade England at the head of the conquerors of Belgium and Italy, and formed a great camp near the Straits of Dover. On the other side of those Straits the whole population of our island was ready to rise up as one man in defence of the soil. At this conjuncture, as at some other great conjunctures in our history, the conjuncture of 1660, for example, and the conjuncture of 1688, there was a general disposition among honest and patriotic men to forget old quarrels, and to regard as a friend every person who was ready, in the existing emergency, to do his part towards the saving of the state. A coalition of all the first men in the country would, at that moment, have been as popular as the coalition of 1783 had been unpopular. Alone in the kingdom the King looked with perfect complacency on a cabinet in which no man superior to himself in genius was to be found, and was so far from being willing to admit all his ablest subjects to office that he was bent on excluding them all.

A few months passed before the different parties which agreed in regarding the government with dislike and contempt came to an understanding with each other. But in the spring of 1804 it became evident that the weakest of ministries would have to defend itself against the strongest of oppositions, an opposition made up of three oppositions, each of which would, separately, have been formidable from ability, and which, when united, were also formidable from number. The party which had opposed the peace, headed by Grenville and Windham, and the party which had opposed the renewal of the war, headed by Fox, concurred in thinking that the men now in power were incapable of either making a good peace or waging a vigorous war. Pitt had, in 1802, spoken for peace against the party of Grenville, and had, in 1803, spoken for war against the party of Fox. But of the capacity of the cabinet, and especially of its chief, for the conduct of great affairs, he thought as meanly as either Fox or Grenville. Questions were easily found on which all the enemies of the government could act cordially together. The unfortunate First Lord of the Treasury, who had, during the earlier months of his administration, been supported by Pitt on one side, and by Fox on the other, now had to answer Pitt, and to be answered by Fox. Two sharp debates, followed by close divisions, made him weary of his post. It was known, too, that the Upper House was ever more hostile to him than the Lower, that the Scotch representative peers wavered, that there were signs of mutiny among the Bishops. In the cabinet itself there was discord, and, worse than discord, treachery. It was necessary to give way: the ministry was dissolved; and the task of forming a government was entrusted to Pitt.

Pitt was of opinion that there was now an opportunity, such as had never before offered itself, and such as might never offer itself again, of uniting in the public service, on honourable terms, all the eminent talents of the kingdom. The passions to which the French Revolution had given birth were extinct. The madness of the innovator and the madness of the alarmist had alike had their day. Jacobinism and Anti-jacobinism had gone out of fashion together. The most liberal statesman did not think that season propitious for schemes of parliamentary reform; and the most conservative statesman could not pretend that there was any occasion for gagging bills and suspensions of the Habeas Corpus Act. The great struggle for independence and national honour occupied all minds; and those who were agreed as to the duty of maintaining that struggle with vigour might well postpone to a more convenient time all disputes about matters comparatively unimportant. Strongly impressed by these considerations, Pitt wished to form a ministry including all the first men in the country. The Treasury he reserved for himself; and to Fox he proposed to assign a share of power little inferior to his own.

The plan was excellent: but the King would not hear of it. Dull, obstinate, unforgiving, and, at that time, half mad, he positively refused to admit Fox into his service. Anybody else, even men who had gone as far as Fox, or further than Fox, in what His Majesty considered as Jacobinism, Sheridan, Grey, Erskine, should be graciously received; but Fox never. During several hours Pitt laboured in vain to reason down this senseless antipathy. That he was perfectly sincere there can be no doubt; but it was not enough to be sincere; he should have been resolute. Had he declared himself determined not to take office without Fox, the royal obstinacy would have given way, as it gave way, a few months later, when opposed to the immutable resolution of Lord Grenville. In an evil hour Pitt yielded. He flattered himself with the hope that, though he consented to forego the aid of his illustrious rival, there would still remain ample materials for the formation of an efficient ministry. That hope was cruelly disappointed. Fox entreated his friends to leave personal considerations out of the question, and declared that he would support, with the utmost cordiality, an efficient and patriotic ministry from which he should be himself excluded. Not only his friends, however, but Grenville and Grenville's adherents, answered with one voice, that the question was not personal, that a great constitutional principle was at stake, and that they would not take office while a man eminently qualified to render service to the commonwealth was placed under a ban merely because he was disliked at Court. All that was left to Pitt was to construct a government out of the wreck of Addington's feeble administration. The small circle of his personal retainers furnished him with a very few useful assistants, particularly Dundas, who had been created Viscount Melville, Lord Harrowby, and Canning.

Such was the inauspicious manner in which Pitt entered on his second administration. The whole history of that administration was of a piece with the commencement. Almost every month brought some new disaster or disgrace. To the war with France was soon added a war with Spain. The opponents of the minister were numerous, able, and active. His most useful coadjutors he soon lost. Sickness deprived him of the help of Lord Harrowby. It was discovered that Lord Melville had been guilty of highly culpable laxity in transactions relating to public money. He was censured by the House of Commons, driven from office, ejected from the Privy Council, and impeached of high crimes and misdemeanours. The blow fell heavy on Pitt. It gave him, he said in Parliament, a deep pang; and, as he uttered the word pang, his lip quivered; his voice shook; he paused; and his hearers thought that he was about to burst into tears. Such tears shed by Eldon would have moved nothing but laughter. Shed by the warm-hearted and open-hearted Fox, they would have moved sympathy, but would have caused no surprise. But a tear from Pitt would have been something portentous. He suppressed his emotion, however, and proceeded with his usual majestic self-possession.

His difficulties compelled him to resort to various expedients. At one time Addington was persuaded to accept office with a peerage; but he brought no additional strength to the government. Though he went through the form of reconciliation, it was impossible for him to forget the past.

While he remained in place he was jealous and punctilious; and he soon retired again. At another time Pitt renewed his efforts to overcome his master's aversion to Fox; and it was rumoured that the King's obstinacy was gradually giving way. But, meanwhile, it was impossible for the minister to conceal from the public eye the decay of his health and the constant anxiety which gnawed at his heart. His sleep was broken. His food ceased to nourish him. All who passed him in the Park, all who had interviews with him in Downing Street, saw misery written in his face. The peculiar look which he wore during the last months of his life was often pathetically described by Wilberforce, who used to call it the Austerlitz look.

Still the vigour of Pitt's intellectual faculties, and the intrepid haughtiness of his spirit, remained unaltered. He had staked everything on a great venture. He had succeeded in forming another mighty coalition against the French ascendancy. The united forces of Austria, Russia, and England might, he hoped, oppose an insurmountable barrier to the ambition of the common enemy. But the genius and energy of Napoleon prevailed. While the English troops were preparing to embark for Germany, while the Russian troops were slowly coming up from Poland, he, with rapidity unprecedented in modern war, moved a hundred thousand men from the shores of the Ocean to the Black Forest, and compelled a great Austrian army to surrender at Ulm. To the first faint rumours of this calamity Pitt would give no credit. He was irritated by the alarms of those around him. "Do not believe a word of it," he said: "it is all a fiction." The next day he received a Dutch newspaper containing the capitulation. He knew no Dutch. It was Sunday; and the public offices were shut. He carried the paper to Lord Malmesbury, who had been minister in Holland; and Lord Malmesbury translated it. Pitt tried to bear up; but the shock was too great; and he went away with death in his face.

The news of the battle of Trafalgar arrived four days later, and seemed for a moment to revive him. Forty-eight hours after that most glorious and most mournful of victories had been announced to the country came the Lord Mayor's day; and Pitt dined at Guildhall. His popularity had declined. But on this occasion the multitude, greatly excited by the recent tidings, welcomed him enthusiastically, took off his horses in Cheapside, and drew his carriage up King Street. When his health was drunk, he returned thanks in two or three of those stately sentences of which he had a boundless command. Several of those who heard him laid up his words in their hearts; for they were the last words that he ever uttered in public: "Let us hope that England, having saved herself by her energy, may save Europe by her example."

This was but a momentary rally. Austerlitz soon completed what Ulm had begun. Early in December Pitt had retired to Bath, in the hope that he might there gather strength for the approaching session. While he was languishing there on his sofa arrived the news that a decisive battle had been fought and lost in Moravia, that the coalition was dissolved, that the Continent was at the feet of France. He sank down under the blow. Ten days later, he was so emaciated that his most intimate friends hardly knew him. He came up from Bath by slow journeys, and, on the 11th of January 1806, reached his villa at Putney. Parliament was to meet on the 21st. On the 20th was to be the parliamentary dinner at the house of the First Lord of the Treasury in Downing Street; and the cards were already issued. But the days of the great minister were numbered. The only chance for his life, and that a very slight chance, was, that he should resign his office, and pass some months in profound repose. His colleagues paid him very short visits, and carefully avoided political conversation. But his spirit, long accustomed to dominion, could not, even in that extremity, relinquish hopes which everybody but himself perceived to be vain. On the day on which he was carried into his bedroom at Putney, the Marquess Wellesley, whom he had long loved, whom he had sent to govern India, and whose administration had been eminently able, energetic, and successful, arrived in London after an absence of eight years. The friends saw each other once more. There was an affectionate meeting, and a last parting. That it was a last parting Pitt did not seem to be aware. He fancied himself to be recovering, talked on various subjects cheerfully, and with an unclouded mind, and pronounced a warm and discerning eulogium on the Marquess's brother Arthur. "I never," he said, "met with any military man with whom it was so satisfactory to converse." The excitement and exertion of this interview were too much for the sick man. He fainted away; and Lord Wellesley left the house, convinced that the close was fast approaching.

And now members of Parliament were fast coming up to London. The chiefs of the opposition met for the purpose of considering the course to be taken on the first day of the session. It was easy to guess what would be the language of the King's speech, and of the address which would be moved in answer to that speech. An amendment condemning the policy of the government had been prepared, and was to have been proposed in the House of Commons by Lord Henry Petty, a young nobleman who had already won for himself that place in the esteem of his country which, after the lapse of more than half a century, he still retains. He was unwilling, however, to come forward as the accuser of one who was incapable of defending himself. Lord Grenville, who had been informed of Pitt's state by Lord Wellesley, and had been deeply affected by it, earnestly recommended forbearance; and Fox, with characteristic generosity and good nature, gave his voice against attacking his now helpless rival. "Sunt lacrymæ rerum," he said, "et mentem mortalia tangunt." On the first day, therefore, there was no debate. It was rumoured that evening that Pitt was better. But on the following morning his physicians pronounced that there were no hopes. The commanding faculties of which he had been too proud were beginning to fail. His old tutor and friend, the Bishop of Lincoln, informed him of his danger, and gave such religious advice and consolation as a confused and obscured mind could receive. Stories were told of devout sentiments fervently uttered by the dying man. But these stories found no credit with anybody who knew him. Wilberforce pronounced it impossible that they could be true; "Pitt," he added, "was a man who always said less than he thought on such topics." It was asserted in many after-dinner speeches, Grub Street elegies, and academic prize poems and prize declamations, that the great minister died exclaiming, "Oh my country!" This is a fable; but it is true that the last words which he uttered, while he knew what he said, were broken exclamations about the alarming state of public affairs. He ceased to breathe on the morning of the 23d of January 1806, the twenty-fifth anniversary of the day on which he first took his seat in Parliament. He was in his forty-seventh year, and had been, during near nineteen years, First Lord of the Treasury, and undisputed chief of the administration. Since parliamentary government was established in England, no English statesman has held supreme power so long. Walpole, it is true, was First Lord of the Treasury during more than twenty years, but it was not till Walpole had been some time First Lord of the Treasury that he could be properly called Prime Minister.

It was moved in the House of Commons that Pitt should be honoured with a public funeral and a monument. The motion was opposed by Fox in a speech which deserves to be studied as a model of good taste and good feeling,

The task was the most invidious that ever an orator undertook: but it was performed with a humanity and delicacy which were warmly acknowledged by the mourning friends of him who was gone. The motion was carried by 288 votes to 89.

The 22d of February was fixed for the funeral. The corpse having lain in state during two days in the Painted Chamber, was borne with great pomp to the northern transept of the Abbey. A splendid train of princes, nobles, bishops, and privy councillors followed. The grave of Pitt had been made near to the spot where his great father lay, near also to the spot where his great rival was soon to lie. The sadness of the assistants was beyond that of ordinary mourners. For he whom they were committing to the dust had died of sorrows and anxieties of which none of the survivors could be altogether without a share. Wilberforce, who carried the banner before the hearse, described the awful ceremony with deep feeling. As the coffin descended into the earth, he said, the eagle face of Chatham from above seemed to look down with consternation into the dark house which was receiving all that remained of so much power and glory.

All parties in the House of Commons readily concurred in voting forty thousand pounds to satisfy the demands of Pitt's creditors. Some of his admirers seemed to consider the magnitude of his embarrassments as a circumstance highly honourable to him; but men of sense will probably be of a different opinion. It is far better, no doubt, that a great minister should carry his contempt of money to excess than that he should contaminate his hands with unlawful gain. But it is neither right nor becoming in a man to whom the public has given an income more than sufficient for his comfort and dignity to bequeath to that public a great debt, the effect of mere negligence and profusion. As First Lord of the Treasury and Chancellor of the Exchequer, Pitt never had less than six thousand a year, besides an excellent house. In 1792 he was forced by his royal master's friendly importunity to accept for life the office of Warden of the Cinque Ports, with near four thousand a year more. He had neither wife nor child: he had no needy relations: he had no expensive tastes: he had no long election bills. Had he given but a quarter of an hour a week to the regulation of his household, he would have kept his expenditure within bounds. Or, if he could not spare even a quarter of an hour a week for that purpose, he had numerous friends, excellent men of business, who would have been proud to act as his stewards. One of those friends, the chief of a great commercial house in the city, made an attempt to put the establishment in Downing Street to rights; but in vain. He found that the waste of the servants' hall was almost fabulous. The quantity of butcher's meat charged in the bills was nine hundredweight a week. The consumption of poultry, of fish, of tea, was in proportion. The character of Pitt would have stood higher if, with the disinterestedness of Pericles and of De Witt, he had united their dignified frugality.

The memory of Pitt has been assailed, times innumerable, often justly, often unjustly; but it has suffered much less from his assailants than from his eulogists. For, during many years, his name was the rallying cry of a class of men with whom, at one of those terrible conjunctures which confound all ordinary distinctions, he was accidentally and temporarily connected, but to whom, on almost all great questions of principle, he was diametrically opposed. The haters of parliamentary reform called themselves Pittites, not choosing to remember that Pitt made three motions for parliamentary reform, and that, though he thought that such a reform could not safely be made while the passions excited by the French Revolution were raging, he never uttered a word indicating that he should not be prepared at a more convenient season to bring the question forward a fourth time. The toast of Protestant ascendency was drunk on Pitt's birthday by a set of Pittites who could not but be aware that Pitt had resigned his office because he could not carry Catholic emancipation. The defenders of the Test Act called themselves Pittites, though they could not be ignorant that Pitt had laid before George the Third unanswerable reasons for abolishing the Test Act. The enemies of free trade called themselves Pittites, though Pitt was far more deeoly imbued with the doctrines of Adam Smith than either Fox or Grey. The very negro-drivers invoked the name of Pitt, whose eloquence was never more conspicuously displayed than when he spoke of the wrongs of the negro. This mythical Pitt, who resembles the genuine Pitt as little as the Charlemagne of Ariosto resembles the Charlemagne of Eginhard, has had his day. History will vindicate the real man from calumny disguised under the semblance of adulation, and will exhibit him as what he was, a minister of great talents, honest intentions, and liberal opinions, pre-eminently qualified, intellectually and morally, for the part of a parliamentary leader, and capable of administering with prudence and moderation the government of a prosperous and tranquil country, but unequal to surprising and terrible emergencies, and liable, in such emergencies, to err grievously, both on the side of weakness and on the side of violence. (T. B. M.)

PITTACUS, one of "the seven wise men of Greece," was born at Mitylene in Lesbos, B.C. 652. His father's name was Hyrrhadius or Caicus. With the assistance of the sons of Alcæus, he delivered his country from the oppression of the tyrant Melanchrus; and, in the war which the Athenians waged against Lesbos, he appeared at the head of his countrymen, and challenged to single combat Phrynon, the enemy's general. As the event of the war seemed to depend upon this combat, Pittacus had recourse to artifice, and, when engaged, entangled his adversary in a net which he had concealed under his shield, and easily despatched him. He was amply rewarded for this victory, and his countrymen, sensible of his merit, unanimously appointed him governor of their city, with unlimited authority. In this capacity Pittacus behaved with the greatest moderation and prudence; and after he had governed his fellow-citizens with the strictest justice, and enforced the most salutary laws, he voluntarily resigned the sovereign power, after having enjoyed it for ten years; observing, that the virtues and innocence of private life were incompatible with the power and influence of a sovereign. His disinterestedness gained him many admirers; and when the Mitylenians wished to reward his public services by presenting him with an immense tract of territory, he refused to accept more land than could be contained within the space to which a javelin could be thrown. He died in the seventieth year of his age, about 582 B.C., after he had spent the last ten years of his life in literary ease and peaceful retirement. Numerous anecdotes of his clemency, wisdom, and contempt of wealth are related by Diogenes Laërtius, Plutarch, Ælian, and other writers. The former mentions various communications between him and Crœsus, and preserves a short letter, said to have been written by Pittacus, declining an invitation to Sardis. Pittacus composed, according to Diogenes, 600 elegiac verses, of which only a few lines remain. (See Bergk, *Poet. Lyr. Græc.*)

PITTENWEEM, a royal and parliamentary burgh and seaport of Scotland, in the county of Fife, on the north shore of the Firth of Forth, about a mile W. of Anstruther, and 24 N.N.E. of Edinburgh. It is an old town, and con-

Pitts || Pittsburgh.

sists of two main streets, with others crossing them. There are here a town-hall, with a small prison, an ancient parish church, a United Presbyterian and an Episcopal church. The inhabitants are chiefly engaged in fishing and curing fish. Pittenweem unites with East and West Anstruther, Crail, Cupar-Fife, Kilrenny, and St Andrews in returning a member to the House of Commons. Pop. (1851), of the parish, 1473; of the parliamentary burgh, 1450.

PITTS, WILLIAM, was born in London in 1790, and brought up by his father to his own business, that of an engraver. At the age of nineteen he was married, and was employed by Flaxman in chasing the shield of Achilles. Pitts was also employed on the Wellington shield, which was executed under the immediate inspection of Stothard. Afterwards Pitts engraved two series of designs from Virgil and Ossian. William Pitts was an unassuming artist, and altogether unskilled in winning his way to popularity and fortune. How far this had any reason in impelling him to the fatal deed which he is known to have committed, it is difficult to judge. He destroyed himself with poison on the 16th of April 1840.

The following is a list of his chief productions, arranged according to their dates:—"The Deluge," 1823; "Samson Slaying the Lion," the "Creation of Eve," and "Herod's Cruelty," 1824; "A Chariot Race," "Pleiades," and "Shield of Æneas," 1828; the "Rape of Proserpine," and the "Nuptials of Perithous," 1824; the "Brunswick Shield," 1830; the "Apotheoses of Spenser, Shakspeare, and Milton," 1831; the "Shield of Hercules," 1834; a long bas-relief or frieze of all the English sovereigns from the Conquest, 1837; a design for a masonic trophy, 1839; the "Triumph of Ceres," 1840; the "Kemble Tribute," and a vase executed for her Majesty as a sponsal present by her, of exquisite design as to its general form, and poetically embellished with groups in relief signifying Birth, Infancy, Instruction, Education, and Love.

PITTSBURGH, or PITTSBURG, a town of the United States of North America, state of Pennsylvania, stands at the head of the Ohio river, which is formed here by the confluence of the swift-flowing Alleghany from the N., and the deep and still Monongahela from the S., 252 miles W. by N. of Harrisburg, and 357 W. of Philadelphia. It is built on a triangular plain between the two rivers, and bounded on the E. by several hills. On the N. bank of the Alleghany stand Alleghany city and Manchester; and to the S. of the Monongahela, South Pittsburgh and Birmingham; all which suburbs form virtually one town with Pittsburgh itself, with which they are connected by bridges and steam ferries. The city proper is regularly laid out, the older portion, consisting of streets parallel and at right angles to the Monongahela, and the more recent streets being similarly arranged along the Alleghany; so that the various streets meet obliquely, and resemble in this respect the lower part of New York. The houses are generally of brick, many of them handsome, especially towards the E. end, where there are numerous delightful residences. The neighbouring country is picturesque and beautiful; and the only drawback to Pittsburgh as a place of residence, is the dense clouds of smoke which issue from the many chimneys, and hang over the town and vicinity. Among the public buildings, one of the most conspicuous is the court-house, which stands on a hill near the E. end of the town. It is in the Grecian style, with a portico in front, and a dome 148 feet high. The custom-house, which includes also the post-office, the two new market-houses, and a large theatre, are all fine buildings. The churches in Pittsburgh and its suburbs are about ninety in number, and many of them are of great beauty. The Roman Catholic cathedral, the Episcopal church of St Peter, and the First Presbyterian church, are the most conspicuous. Of the educational establishments in Pittsburgh, the most important are the theological seminary of the Associated Reform Church, with three professors and thirty-five students in 1856–7; and that of the Presbyterian Church, situated in Alleghany Town, with two professors and forty-eight students in 1856–7. The Western University of Pennsylvania, which formerly existed here, was destroyed by fire in 1845, and has not since been restored. Besides the institutions already named, the town contains upwards of fifty schools of various kinds, attended by about 12,000 pupils. The town and suburbs also contain several literary associations, hospitals, banks, hotels, &c.; and numerous newspapers and other periodicals are published. Pittsburgh is chiefly important as a manufacturing and commercial town, in which respect it is rapidly increasing; and from its great natural advantages, will probably soon become one of the greatest cities in the world. The immense supplies of excellent coal, which are obtained in the vicinity with comparatively little labour and expense, not only supply a profitable article of export, but afford fuel for the numerous mills and factories in the town. Besides coal, various ores, timber, and agricultural produce can be easily obtained in the neighbourhood in the utmost profusion. Pittsburgh contained in 1850 16 iron-works of various kinds, employing 2161 hands, consuming annually 4,152,300 bushels of coal, 900 cords of wood, and 65,896 tons of iron; and producing 52,932 tons of iron and steel in various forms. In the same year there were 30 large and several smaller foundries, producing goods to the value of L.400,000 annually; 33 glass-works; 5 white-lead factories; 5 large and several smaller cotton-factories, with a capital of L.300,000, and producing annually L.320,000 worth of goods; a copper rolling-mill; a copper smelting-house; and manufactories of gun-barrels, saws, axes, agricultural implements, &c. The whole number of manufactories in Pittsburgh, according to the census of 1850, was 819, and in Alleghany city 120; employing 10,253 hands, and producing annually goods to the value of L.2,475,710. This calculation, however, is thought to be much understated; and it is probable that in 1853 the value of manufactured goods was as much as L.5,000,000. The total amount of coal consumed in the same year for manufactures and other purposes was 22,305,000 bushels. Besides this, large quantities of coal are exported from Pittsburgh, amounting in 1853 to 14,403,921 bushels. In commerce as well as in manufactures, Pittsburgh occupies an important place among American towns; and for this it is indebted in a great degree to the advantages of its situation, at the foot of the western slope of the Alleghanies, and at the meeting of three navigable rivers, which afford easy communication, over many thousand miles of water, to the W.; while at the same time it is within a convenient distance of the great lakes to the N., and of the large cities on the Atlantic, with both of which it communicates by railway and canal. Thus not only the entire trade of Pennsylvania, but large quantities of goods from New York, pass through Pittsburgh to the cities and regions of the West. The principal harbour is on the Monongahela, which is deeper than the Alleghany. The building of steamers is extensively carried on at Pittsburgh, where they can be constructed better and more cheaply than at the western ports. The number of steam-vessels launched in 1854 was upwards of 80, many of them of great size and power. The aggregate tonnage of Pittsburgh, June 30, 1852, was 64,157, of which 57,783 were steamers. Pittsburgh is thus, in the amount of its steam navigation, the third city in the States, being surpassed only by New Orleans and New York in this respect. There were exported by canal from Pittsburgh in 1852, 17,577,187 lb. of iron, 7,361,436 lb. of steel, 39,586,694 lb. of bacon, 20,490,918 lb. of unmanufactured tobacco, 1,670,922 lb. of cotton, &c.;

and among the articles imported by canal in the same year were,—50,564,566 lb. of iron, 17,457,753 lb. of hardware, 17,885,702 lb. of groceries, 17,102,061 lb. of coffee, and 237,616 lb. of leather. Of the entire trade of the town there are no statistics: it is, however, great and rapidly increasing, the trade with the lakes having doubled itself every year since 1844. The site of Pittsburgh was first visited by Europeans in 1753, when, as the French were proceeding to take possession of the country along the Alleghany and Ohio, Washington was sent by Governor Dinwiddie of Virginia to reconnoitre their movements. He reached the confluence of the Alleghany and Monongahela, and recommended it as a good site for a fort. In the next year, accordingly, a party was sent out to erect one; but before it was completed they were obliged to surrender it to a superior body of French, who took possession, and completed the fort—an act of aggression which led to the war with the French that raged simultaneously in all the quarters of the globe. In 1755 General Braddock made an unsuccessful attempt to regain the fort; but in 1758 it was taken by General Forbes, and named Fort Pitt in honour of the first great minister of that name. The fort was besieged by the Indians in 1765; and in the same year the town of Pittsburgh was founded. In 1806 it was incorporated as a borough; and in 1816 chartered as a city. The bridges over the Alleghany and Monongahela were constructed in 1819, and the Pennsylvania Canal was opened in 1829. Since then the town has been rapidly and steadily increasing in size and prosperity; and though in 1845 a fire destroyed more than 1100 buildings and L.140,000 worth of property, yet within a year the vacant space was nearly all rebuilt, and the town soon recovered from the calamity. Pop. (1850), Pittsburgh proper, 46,601; Alleghany city, 21,261; Birmingham, 3742; city and district (1850), 86,771; (1853) 110,241.

PIURA, a town of Peru, capital of a province of that name, in the department of Truxillo, on the left bank of the river Piura, 240 miles N.N.W. of Truxillo. It is built for the most part of brick, and the streets are narrow and unpaved. There is a public square in the middle of the town. The town contains several churches, government offices, and a college attended by 120 pupils. Some trade is carried on in maize, cotton, sugar, fruit, &c. Piura was the first Spanish settlement in Peru. It originally stood near the sea, but was removed to its present site on account of the unhealthiness of its former one. Pop. about 10,000.

PIUS I. succeeded Hyginus as bishop of Rome in 142, and died in 157.

Pius II., *Æneas Sylvius Piccolomini*, was born on the 18th of October 1405, at Corsigni in the Sienese, the name of which he afterwards changed into that of *Pienza*. Æneas was carefully educated, and made considerable proficiency in the belles-lettres. After having finished his studies at Siena, he in 1431 went to the council of Basil with Cardinal Capranica, surnamed *De Fermo*, because he was intrusted with the government of that church. Æneas, who acted as his secretary, was then only twenty-six years of age. He afterwards acted in the same capacity to some other prelates, and to Cardinal Albergati. The council of Basil honoured him with different commissions, in order to recompense him for the zeal with which he had defended that assembly against Pope Eugenius IV. He was afterwards secretary to Frederic III., who decreed to him the poetical crown, and sent him as ambassador to Rome, Milan, Naples, Bohemia, and other places. Nicholas V. advanced him to the bishopric of Trieste, which he quitted some time afterwards for that of Siena. At last, after having distinguished himself as nuncio on various occasions, he was invested with the Roman purple by Calixtus III., whom he succeeded two years afterwards, on the 27th of August 1458. Pius II., now advanced to the Holy See, exemplified the proverb, "Honores mutant mores." From the commencement of his pontificate he appeared to be jealous of the papal prerogatives. In 1460 he issued a bull declaring appeals from the Pope to a council to be null, erroneous, detestable, and contrary to the sacred canons. That bull, however, did not prevent the procurator-general of the Parliament of Paris from appealing to a council in defence of the Pragmatic Sanction, which the Pope had strenuously opposed. Pius was then at Mantua, whither he had gone to engage the Catholic princes to unite in a war against the Turks. The greater part of them had agreed to furnish troops or money; but others refused both, particularly France, which from that moment incurred his Holiness's aversion. But his aversion abated under Louis XI., whom in 1461 he persuaded to abolish the Pragmatic Sanction, which the Parliament of Paris had with so much vigour supported.

The following year, 1462, was rendered famous by a controversy which took place between the Cordeliers and Dominicans, whether or not the blood of Jesus Christ was separated from his body whilst he lay in the sepulchre. It was also made a question whether it was separated from his divinity. The Cordeliers affirmed that it was, but the Dominicans were of an opposite opinion. As usually happens in such disputes, the disputants called each other heretics; and this obliged the Pontiff to issue a bull, forbidding them, under pain of censure, to brand one another with such odious epithets. The bull, which his Holiness published on the 26th of April, retracting what he had written to the council of Basil when he was its secretary, if it somewhat impeached his consistency, was at least highly honourable to his frankness and candour. "If you find, then, anything contrary to her doctrine, either in our dialogues, in our letters, or in other of our works, despise these opinions, reject them, and adopt our present sentiments. Believe me rather now that I am an old man, than when I addressed you in my earlier days; esteem a sovereign Pontiff more than a private person; except against Æneas Sylvius, but receive Pius II." It might perhaps be objected to his Holiness, that it was his dignity alone which had made him alter his opinion. He anticipates that objection by giving a short account of his life and actions, with the whole history of the council of Basil, to which he went with Cardinal Capranica in 1431; "but," says he, "I was then a young man, and without any experience, like a bird just come from its nest." In the meantime, the Turks were threatening Christendom. Pius, ever zealous in the defence of religion against the infidels, formed the resolution of fitting out a fleet at the expense of the church, and of passing over into Asia himself, to animate the Christian princes by his example. He repaired to Ancona with a design to embark; but he there fell sick from the fatigue of the journey, and expired on the 16th of August 1464, aged fifty-nine.

Pius was one of the most learned men of his time, and also one of the most zealous pontiffs; but being of an ambitious disposition, he sometimes sacrificed to that weakness. His principal works are,—*Memoirs of the Council of Basil, from the Suspension of Eugenius to the Election of Felix; The History of the Bohemians, from their Origin to the year* 1458; *Two books on Cosmography; The History of Frederic III.*, published in 1785, in folio; *A Treatise on the Education of Children; A Poem upon the Passion of Jesus Christ; A Collection of Four Hundred and Thirty-Two Letters*, printed at Milan 1473; *The Memoirs of his own Life*, published by John Gobelin Personne, his secretary, and printed at Rome in 1584, in 4to; *Historia Rerum Ubicumque Gestarum*, of which only the first part was published at Venice in 1477, in folio. His works were printed at Helmstadt in 1700, in folio, with a Life prefixed

Pius III., whose original name was *Antonio Todeschini*

succeeded Alexander VI. in 1503, and died in the course of twenty-five days afterwards.

Pius IV., whose real name was *Giovanni Angelo Medici* or *Medichino*, was originally of Milan, and was elected pope in 1559. The principal event in his pontificate was the conclusion of the long-protracted council of Trent, which took place in 1563, two years before his death.

Pius V., who was originally called *Michele Ghislieri*, was born at Boschi, in the north of Italy, in 1504, and succeeded Pius IV. in 1566. He mounted the papal chair with a reputation which foreboded no leniency towards the enemies of the Church. His character had become encrusted with a hard severity amid the gloom and asceticism of a Dominican convent. His enmity against heretics had been whetted to the keenest edge in the discharge of the functions of inquisitor. He had also cultivated a commanding eloquence, which could efficiently second his most thorough-going measures. Accordingly, Pius forthwith organized a rigorous system of policy for the reformation and strengthening of the Church. His first endeavour was to prove himself a rigid disciplinarian to the corrupt priesthood. He enforced the stringent rules of convent life upon the loose-living monks; he drove the non-resident clergy home to their benefices; he stript off the gaudy trappings and overthrew the luxurious tables of the worldly-minded cardinals. The same ardent zeal turned Pius into a firebrand against heretics. The pile was lighted under Carnesecchi, a Florentine nobleman who had dared to investigate the opinions of the Reformers. The same punishment was administered to Palearius, a celebrated writer who had asserted in one of his works that the Inquisition was a sword drawn against learning. It was not even thought beyond the sphere of the Popedom to kindle and fan the flame of war in 1568 against the Protestants in France. Nor was Pius less arrogant in claiming supremacy over the kings of the earth. In 1568 he issued his famous bull entitled *In Cœnâ Domini*, anathematizing every one who should dare to question, limit, or abjure the absolute authority of the Holy See, both in matters sacred and secular. In the following year he hurled the thunders of excommunication against Elizabeth, Queen of England, and absolved her subjects from their allegiance. A project for effectually humbling the Turks was also occupying his mind when he died of stone in 1572.

Pius VI., whose original name was *Giovanni Angelo Braschi*, was born at Cesena in 1717, and succeeded Clement XIV. in 1774. Elegant, devoted to letters, fond of the fine arts, and a well-wisher of progress, the new Pope inaugurated his rule with a series of enlightened and liberal-minded measures. The port of Ancona was adorned and improved by the addition of a beautiful lighthouse; the draining of the Pontine Marshes was undertaken, and carried on towards completion; the museum of the Vatican was extended to receive a new supply of the precious relics of antiquity; fountains and palaces were erected to revive the splendour of the Eternal City; and artists and scholars were summoned from all parts of Italy to recall the brilliant times of Leo X. Pius VI., however, though a successful promoter of the arts of peace, had not sufficient political sagacity to foresee and avert the attacks that were about to be made upon his authority. Accordingly the rest of his pontificate was involved in a long series of troubles. In 1780 the Emperor Joseph II. began to curtail the wealth and power of the Church. The example spread; and in 1787 the King of Naples abolished for ever certain feudal homages which were due to the court of Rome. Immediately afterwards followed the revolt of the Grand Duke of Tuscany from the spiritual supremacy of the Popedom. At length this ecclesiastical insurrection found its climax amid the general overthrow and destruction of the French Revolution. In that crisis the Pontiff's own possessions, and those of the Church within the kingdom of France, were confiscated by the National Assembly. On his protesting against these and other radical measures, his effigy, arrayed in all the pontifical insignia, was burnt by the mob in the garden of the Palais Royal. The murder of Basseville, the French ambassador in 1793, by the Roman populace, widened the breach beyond all hope of settlement by negotiation; and in 1797 the papal territories were invaded by the troops of republican France. A submission, and an agreement to pay a fine of thirty millions of livres to the invaders were only the means of exciting new troubles. Compelled to impoverish his subjects in order to raise the contribution, he caused a general feeling of discontent. An insurrection was the consequence; the French general Duphot was slain in the midst of the tumult; and the French army returned under Berthier to take more summary measures. In 1798 the Pontiff was dethroned, his property was confiscated, and he was obliged to leave Rome under the escort of a body of cavalry. Even in his state of degradation there was no rest to be found. He was removed from Siena to Florence, from Florence to France, until, in August 1799, he died at Valence, on the Rhone.

Pius VII., whose real name was *Gregorio Luigi Barnaba Chiaramonti*, was born of a noble family at Cesena in 1742, and was declared the successor of Pius VI. on the 14th March 1800. He had not long occupied the chair of St Peter when Napoleon set himself to turn the Popedom into a mere tool for his own ambition. Accordingly the new Pontiff began to be assailed with a series of the most arrogant exactions. In 1804 he was summoned to Paris to crown the French usurper. In the following year his port of Ancona was furtively seized by French troops. A command was then issued that he should shut up his dominions and close his harbours against all the enemies of France. In vain he remonstrated, asserting that he was the vicar of the Prince of Peace, and ought to stand aloof from all political dissensions. The bold aggressors, without waiting for what had been asked, gradually occupied the seaports; and, entering Rome in 1808, took the government into their own hands. In vain he had recourse to his last weapon, the bull of excommunication. The irreverent invaders entered the Quirinal Palace on the 6th July 1809, and carried him off, first to Grenoble, and then to Savona. Pius VII. was now more closely pressed than ever by Napoleon. In 1812 he was conveyed to Fontainebleau, that he might be awed into submission by the vicinity of the French capital. There also every stratagem was employed to make him subservient to the ambitious projects of the French potentate. He was plied successively with blandishments, taunts, and menaces, until, on the 25th January 1813, he was prevailed upon to sign a concordat. Then, when immediately afterwards he retracted his concessions, no attention was paid to him. It was not until, in 1814, the allied forces had overthrown Bonaparte, that he was restored to his place and power. The rest of the life of Pius VII. was chiefly devoted to social and political improvements. He died from an accident in August 1823.

Pius VIII., who was originally called *Francesco Xaviero Castiglioni*, was born near Ancona in 1761, became pope on the death of Leo XII. in 1829, and died in 1830.

PIZZO, Il, a town of Naples, in the province of Calabria Ultra II., stands on the Gulf of St Eufemia, 6 miles N.N.E. of Monteleone. It has a small harbour, and some coasting trade, in which, and in fishing, the inhabitants are mostly employed. It was at Pizzo that Murat, the ex-King of Naples, landed with a few followers, October 8, 1815, with the view of recovering his kingdom. He was immediately taken prisoner, and shot in the Castle of Pizzo on the 13th. His remains lie in the middle aisle of the church, which was erected partly by his own liberality. Pop. 5700.

PLACENTIA. See Piacenza.

Placentia, or *Plasentia*, a town of Spain, Estremadura, in the province of Caceres, nearly encircled by the clear river Xerte, in a beautiful valley between the snowy Sierras de Bejar and de la Vera, 120 miles W.S.W. of Madrid. The ancient walls of the town, with their strong semicircular towers, the ruined castle, the long aqueduct raised on 80 arches, and the three picturesque bridges that cross the river, combine with the scenery to give Placentia a very beautiful aspect. The cathedral, built in 1498, is a fine Gothic edifice, though some parts are unfinished, and others have been altered for the worse. It contains several fine pictures and monuments. There are here several other churches, convents, a bishop's palace, a large town-house, several schools, and a college (*seminario conciliar*), connected with the university of Salamanca. Oil, soap, leather, hats, woollen, linen, and hempen stuffs are manufactured. Placentia was plundered by Soult in 1809, a calamity from which it has never recovered. Pop. 6800.

PLAGIARY, the purloiner of another man's works. Amongst the Romans *plagiarius* was properly a person who bought, sold, or retained a freeman for a slave; and was so called because, by the Flavian law, such persons were condemned *ad plagas*, or to be whipped. A plagiary, in the modern sense of the term, is one who borrows without acknowledgment, in literary composition, the thoughts or words of another, and the theft is styled *plagiarism*.

PLAGUE. The terms *pest*, *pestilence*, and *plague* were long employed in Great Britain, as were the corresponding terms in other languages, both in ancient and in modern times, to denote simply a disease attacking a great number of persons simultaneously and in succession, and destroying a large proportion of those whom it attacked; in short, a widely-diffused and malignant epidemic. At the present day these terms are restricted to signify a particular form of disease, of frequent occurrence in the countries bordering on the eastern extremity of the Mediterranean, the Levant, and Archipelago, but occasionally appearing also in countries more or less remote from these regions.

Symptoms by which the plague is characterized.

The disease in question, the plague of the Levant, as it is often termed, exhibits, not in every individual case, but in a large proportion of those affected, in the progress of its epidemic prevalence, two classes of symptoms, the *constitutional* and the *local*. Under the constitutional symptoms may be comprehended those indicatory of fever of a malignant or typhoid character, with various concomitant phenomena that are in wont to attend fever of this character in different regions of the globe; the local consist chiefly of glandular swellings, or buboes, as they are termed, and of malignant or gangrenous boils, or carbuncles.

Relations of the constitutional and local symptoms.

These two classes of symptoms stand variously related to one another in different individual cases; and even, there seems reason to believe, in different periods of the same epidemic. Dr Patrick Russell, in his *Treatise of the Plague*, in which he has given the results of his own extensive observation of this disease during its epidemic prevalence in Aleppo in the years 1760, 1761, and 1762, mentions one class of patients who seldom or never had buboes or carbuncles; and another class, in a few of whom, when the disease proved quickly fatal, these symptoms were likewise absent. "These two eruptions," he says, "are equally diagnostics of the true plague; their presence, separately or in conjunction, leaves the nature of the distemper unequivocal; but fatal has been the error of rashly, from their absence, pronouncing a distemper not to be the plague which in the sequel has depopulated regions, and which early precaution might probably have prevented from spreading." Dr Louis Frank also mentions, that though the appearance of buboes is the most constant and characteristic symptom of the plague, yet he has seen many affected with this disease in whom buboes were altogether wanting, or appeared only at the period of death. As cases of this kind are particularly liable to occur at the commencement of an epidemic, a considerable number of persons may, it is obvious, come to be affected before the pestilential character of the disease is ascertained, or even suspected, particularly in regions in which the plague is of rare occurrence.

But as the constitutional symptoms of plague may occur without the local, so the local may occur with little fever or constitutional disturbance of any kind. Dr Russell, under his fifth class of cases, to which he refers those of slight infection, in which all the infected recovered, and which, he says, "was very numerous," mentions that in these the access was often attended with so little apparent disorder that the eruptions gave the first alarm, "the buboes were often the first symptom of infection;" and the fever, which came on afterwards, was frequently so slight as not to confine the sick to the house: others found themselves indisposed for two or three days, but were not sensible of any febrile heat whatever. In these cases, and in some others in which the fever ran somewhat higher, but without the concurrence of alarming symptoms, "all the infected had buboes or carbuncles, and very often both eruptions concurred in the same subject. Persons not confined by indisposition were often, by the inguinal buboes, prevented from walking abroad."

In cases of plague in which both the constitutional and the local symptoms manifest themselves, there is considerable difference in the relative time of their appearance. "In a very large proportion of the sick," Dr Russell informs us, "the buboes made their appearance in the course of the first day; but in many instances they did not appear before the second or third day, or even later."

In the few remarks we purpose to offer relative to the plague, we shall consider some points of its natural history, as it presents itself,—1*st*, In the countries in which it is of frequent occurrence; and, 2*d*, In those countries in which it rarely shows itself.

As occurring on the borders of the Levant, &c.

I. In the countries bordering on the Levant and Archipelago the plague is liable to present itself either in single, or, as they are termed by medical men, *sporadic* cases; or in a great number of cases simultaneously or in succession, so as to constitute an *epidemic*.

Its sporadic occurrence.

It is stated, indeed, by Dr Patrick Russell, that "in the intervals between the plagues of Aleppo,"—that is to say, between the successive epidemic prevalences of this disease,—"the city remains absolutely free; and the plague is never sporadic there, except in its beginning and decline; it never subsists for any length of time in a few scattered cases without consequence." But this statement is not conformable with the reports of others. M. Pugnet, who accompanied Bonaparte's expedition to Egypt, affirms, in his *Mémoire sur les Fièvres du mauvais caractère du Lévant*, that that country is seldom absolutely free from the plague during several successive years, and that in almost every month of every year there occur a number of cases, though these are not noted when they do not occasion its epidemic prevalence. Sir James M'Grigor, who had the medical charge of the army which was brought from India to Egypt in 1801, in like manner expresses his belief that "the contagion of plague is seldom or never out of Egypt." Dr Murdoch Mackenzie, in his "Letters concerning the Plague at Constantinople," published in the *Philosophical Transactions*, vol. xlvii., remarks that, during the twenty years he had lived at Constantinople and Smyrna, there had scarcely been a year, excepting three, in which the plague did not threaten more or less, with little or no perceptible difference in the character of the season to explain it.

Various estimates have been given of the frequency of plague epidemics in the principal towns of Egypt, Syria,

Plague.

Frequency of its epidemic prevalence.

and Turkey. Prosper Alpinus, who resided in Egypt between 1580 and 1584, refers to a belief of its recurring in that country every seventh year, but represents this belief as being incorrect. Dr Alexander Russell mentions it as the common opinion of the inhabitants of Aleppo, that they are visited with the plague about once in ten years; which opinion, he observes, seems in some measure to be founded on experience. Dr Mackenzie, writing from Constantinople in 1763, says that "the plague is now more frequent in the Levant than it was when I first came into this country about thirty years ago; for then they were almost strangers to it in Aleppo and Tripoli of Syria, and they had it but seldom at Smyrna; whereas now they have it frequently at Aleppo, and summer and winter in Smyrna, which," he adds, "must be owing to the great communication by commerce all over the Levant, and more extended into the country villages than it used to be."

Disappearance during a particular part of the year.

When the plague assumes an epidemic character in the countries in which it is common, the epidemic frequently continues for several years; not, however, uninterruptedly, for in general it is observed that for a part of the year the disease in a great measure, or altogether, disappears, breaking out again after an interval of various duration. In the same way, in non-epidemic seasons sporadic cases of plague are seldom or never met with during a particular portion of the year. It seems reasonable to conclude that this disappearance of plague, or great abatement in its prevalence, during a particular portion of the year, must be connected with some peculiar condition of the weather then prevailing, and consequently that the period must be liable to variations, not only in different countries, but also to some extent in the same country in different years.

Season at which this occurs.

Dr L. Frank mentions his having been assured that at Cairo the time of year in which the operation of the plague-poison is suspended uniformly commences with the summer solstice (21st June), as stated by Prosper Alpinus with regard both to that city and Egypt generally; but that at Alexandria, Rosetta, and Damietta,—that is, in the towns along the coast,—the plague terminates about the feast of St John (24th June), though not uniformly every year, as it sometimes continues till about the middle of July. In respect to the period of the plague's terminating at Cairo, Dr P. Russell mentions that several accounts which, on making strict inquiry, he received from persons long resident in that city, Europeans as well as natives, all concurred in the fact of the plague's declining rapidly in June, but not ceasing entirely; and he particularly refers to information which he had received of the Europeans having remained, in 1759, shut up till the middle of July, "which was considered as very extraordinary." Dr Russell also remarks, that in most places in the Levant a popular tradition is to be found of the extinction of the plague at a certain fixed period, which varies, however, at different places. At Aleppo, he adds, it is fixed nearly a month later than at Cairo. His brother, Dr A. Russell, states that at Aleppo the plague comes to its height in June, decreases greatly in July, and certainly disappears in August. Dr P. Russell, in reference to the same epidemic, says,—"The natives all agreed in declaring the plague had never before been so formidable in the winter; and many went so far as to affirm that it was the first instance of the plague's having been ever known at all at that season. In 1753 it began the last day of May, and continued uninterruptedly till the middle of September 1754.

Season of its re-appearance.

Admitting that, in general, though certainly not universally, plague disappears in Egypt soon after the 21st of June, in Syria about a month later, and probably at a still more advanced period of the year in Asia Minor and Turkey, is there any constancy in regard of its re-appearance? Sir J. M'Grigor mentions that the month of November, or more usually of December, is the time of year in which the plague is wont to re-appear in Egypt, and that, according to the observation of the natives, when it breaks out before December, they have always a generally prevailing and very destructive disease. According to Pugnet, there are three periods in the prevalence of the plague in Egypt,—its *invasion*, which occupies the months of December, January, and February; its *acme*, which occupies March, April, and May; and its *extinction*, which occurs suddenly during the second half of June. Frank says that, according to the general accounts, the plague seldom occurs in Egypt in the months of September, October, November, December, and January, but usually appears in the months of February, March, and April; and he adds, conformably with Sir J. M'Grigor's statement, that "it is well ascertained, that when it begins in September or October, it is more terrible than if it appears later, because it then continues for a longer time, and is the cause of greater mortality. Perhaps, also, the pestilential miasma becomes more deadly." At Aleppo, according to Dr A. Russell, the plague is constantly moderated during the winter, and grows more violent as the spring advances. Mr Hayes mentions the months of March and April as the period at which the plague usually begins at Smyrna. Timone states, in regard to the plague at Constantinople, that it is pretty soundly lulled by the cold of winter, emitting, however, here and there sparks during that season as well as in spring; it increases in summer, and rages with the greatest violence in August. The spread of the infection is not stopped by the coldish north winds blowing at stated times of the summer; but if the south winds blow during that season, constantly and of sufficient warmth, they suppress the plague.

We shall presently have occasion to see the application of these facts relative to the periods at which the plague subsides and revives in Egypt, Syria and Turkey, to the explanations that have been proposed of the causes or agencies by which this disease is produced.

Nature of the agent by which it is produced.

Great difference of opinion has subsisted as to the nature of the agent which, by its operation on the animal economy, produces this form of disease; whether the plague is generated by a particular state of the atmosphere, itself the result of the reciprocal action of various concurrent agents, and which is sufficient to produce the disease in a large proportion of those who are exposed to its influence, as is the case in respect of ague or intermittent fever; or whether the disease is communicated from person to person through the medium of some impalpable effluvium from the body, as in the cases of measles and scarlet fever? Whether, in the language of medical men, the plague depends on terrestrial or atmospheric miasm, improperly named infection by some, or upon human contagion.

The quarantine laws.

The laws of quarantine, so far as they refer to the plague, obviously proceed on the supposition that this disease is capable of being communicated by person to person; and also that the plague-poison is capable of being imbibed by substances that have come in contact with the bodies of those affected, or that have been exposed to the air which they breathe; of remaining attached to such substances for a considerable space of time, when excluded from free ventilation; of mixing with the atmosphere when exposed to it, and infecting those who breathe it; or of communicating the disease to persons who touch or handle the articles to which it is attached. The inconvenience with which the enforcement of the quarantine laws is necessarily attended, particularly to those engaged in commerce, has naturally rendered many anxious for their repeal or modification. The grounds upon which those who have represented them as unnecessary have rested their case may be referred to the two following,—1*st*, That the plague always depends on miasm, and consequently, where the circumstances necessary for the production of plague-miasm concur, the disease will happen in spite of all quarantine regulations; and 2*d*, That

Plague.

supposing the disease to be contagious, there are climates in which its contagion cannot be received and propagated, and consequently, as regards these, quarantine laws must be superfluous.

Dependence on contagion satisfactorily established.

The evidence in favour of the contagious character of the plague in Egypt, Syria, Turkey, &c., and of its dissemination both by person and by fomites, as deduced from the places and individuals that escape, as well as from the places and individuals that become affected, is so ample and complete as to leave room for doubt only in minds preoccupied with theoretical dogmata or considerations of personal advantage. Accordingly, the opinion adverse to the contagious character of plague in these countries seems to be now very generally abandoned by those who can be regarded as impartial and competent judges of the fact. When a select committee was appointed by the House of Commons in 1819 to consider the validity of the doctrine of contagion in the plague, all the medical men examined, with the exception of two, were in favour of the received doctrine, that the plague is a disease communicable by contagion. One of these anti-contagionists in plague was Dr Charles Maclean, the other Dr Mitchell. Of the medical officers of the French and English armies in Egypt between 1799 and 1802, who have published an account of the diseases which presented themselves to their observation during that campaign, Assalini seems to have been the only one who came to the conclusion that the plague is not a truly contagious disease, and that it is produced solely by local causes.

Whether also dependent on terrestrial miasma.

By some, however, it has been supposed that both terrestrial miasm and human contagion are concerned in spreading the plague, the disease being first generated by miasm, but subsequently diffusing itself by contagion, both in the districts in which the miasm is produced, and in countries to which it does not extend, and in which it cannot be supposed to be generated. Amongst those holding this doctrine there has been a difference of opinion as to the number of districts in which the supposed plague-miasm may be produced. Some conceive that there is one particular portion of the globe only in which the circumstances essential for the development of plague-miasm occur in combination,—an opinion readily adopted by the different nations and provinces among whom the disease frequently prevails, though they differ very much as to the parent soil, each being desirous to transfer that odium from itself to its neighbour. M. Fodéré, who, though he had never personally seen the plague, had bestowed much pains in studying its history, maintains that the plague is a production of the soil of Lower Egypt alone,—that is to say, of the combination of the waters of the Nile, and of the materials brought down by that river, with the vegetable earth of the delta, when, after the inundation, the heat causes these waters to be volatilized, and gives rise to the production of an immense multitude of insects and of reptiles. When the disease has once been produced in the human body by this miasm, he has no doubt as to its being capable of being communicated from person to person. He holds, therefore, that in Lower Egypt the plague is both an endemic and a contagious disease; whilst, when it occurs in Upper Egypt, in Syria, and the other countries of Turkey, and in Europe, it is simply a contagious disease, being transported to them from Lower Egypt.

Dependence on atmospheric conditions;

Others, again, are of opinion, that in Egypt, as elsewhere, the plague always requires a human effluvium for its production and communication; but that the propagation of this contagious effluvium is greatly influenced by, if not dependent upon, particular conditions of the atmosphere. This unknown condition of the atmosphere is supposed either to cause the effluvia of non-pestilential diseases to assume a pestilential character, or the plague-effluvium to be generated of a peculiarly virulent character, or to render the human body more susceptible of its action. The influence of the atmosphere in promoting and in checking plague seems sufficiently established by the circumstances already stated relative to the variations in its prevalence in the different seasons of the year; but in what manner or by what qualities the atmosphere exerts this influence, is a matter of the greatest uncertainty.

Plague.

on temperature;

Some authors have been of opinion that it is simply the *temperature* of the atmosphere which determines the prevalence of plague in the countries along the shores of the Mediterranean; that the atmosphere may be either too hot or too cold for its propagation. Thus Dr A. Russell mentions that the season wherein the plague always ceases at Aleppo is that in which the heats are the most excessive. "Extreme heat," he says, "seems to check the progress of the disease; for though, during the few first hot days, the mortality, as well as the number of those newly infected, increase, yet a few days' longer continuance of that weather greatly diminishes the number of the sick." Mr Dawes, in mentioning August and September as the months in which the plague usually, though not constantly, ceases at Aleppo, notices them as being the hottest months in the year. Conformably with the same view, the occurrence of the hot winds is conceived by some to be the agent which puts a stop to the prevalence of the plague in Egypt. From the statements of Timone, and of several other authors, as we have already seen, it appears that, at Constantinople, the cold of winter generally exercises a great influence in suppressing or diminishing the extension of this disease. Dr James Frank, who was upon the expedition with Sir Ralph Abercromby in the year 1800, and had the first establishment of the Plague Hospital at Aboukir, says, in his evidence before the committee of the House of Commons in 1819,—"The great cold of Constantinople puts an end to it, and the great heat of Cairo puts an end to it." And to the same effect, Mr Edward Hayes, a native of Smyrna, and who had resided there nearly forty-four years, on being asked by the committee, "When does the plague generally subside in your country?" replied, "When the great cold or the great heat destroys it."

on heat and moisture conjointly.

M. Pugnet, again, affirms that the prevalence of the plague in Egypt is always proportional to the *moisture* of the atmosphere taken in connection with its *heat*, whether the moisture shall depend on a greater than usual inundation of the Nile, or on the fall of rain; and explains by these different sources of moisture the plague making its appearance in different districts of Egypt in different years. The circumstance of the heat bearing either a very great or a very small proportion to the moisture of the atmosphere is, according to Pugnet, unfavourable to the extension of plague; but at the same time he holds that, besides moisture and heat, the germ of the disease, as he terms the contagious principle, is requisite for its development. In noticing that most of those who have travelled in Egypt say the plague is brought there from Greece, and those who have travelled in Greece pretend that that country only receives it from Egypt, M. Pugnet remarks,—"I think that the defenders of Egypt and those of Greece are equally in the right; the plague comes no less from Egypt than from Greece, or from Greece than from Egypt. It has established itself a durable focus in these two opposite points; and when one of them seems to become extinguished, the other revives it."

Supposed connection with the overflowing of the Nile.

Dr L. Frank, who, after sojourning with the French army in Egypt, subsequently resided for a year in Tunis, and travelled for six years over the continent of Greece, principally for the purpose of investigating everything connected with the plague, is adverse to the idea of the production of the pestilential poison being in any way connected with the overflowing of the Nile. The Nile begins to decrease in September, and in December all the waters dis-

Plague.

appear from the inundated surface. Consequently, he argues, if the putrefaction of stagnant waters could produce the plague, this disease should manifest itself chiefly in the months of October, November, and December, whilst, in fact, it very rarely occurs in these months. Frank conceives, with Alpinus, that it is in the character of the *winds* that the cause of the prevalence or cessation of the plague in Egypt is to be looked for; the unhealthy season corresponding with the part of the year during which the winds and weather are variable, and the healthy season with the period during which the north wind blows steadily,—that is, from June to September.

Dependence on the prevailing winds.

Those who, in admitting the contagious character of the plague, have argued in favour of the possibility of its poison being engendered independently of human effluvia, and simply from the reciprocal action of the atmosphere and the earth upon one another, seem to have been led to this view by their believing that the plague-poison is wholly extinguished during a certain portion of the year, and consequently, that for the reproduction of the disease there must be a reproduction, or *generatio de novo*, as medical men term it, of the poison.

Supposition of plague-poison being reproduced from time to time.

When, by the return of the period of the year which is unfavourable to its dissemination, the plague ceases, one of two things may happen: it may remain absent from the country or district for a succession of years, or it may recur with the period of the year which is compatible with its propagation. Now it does not appear to be necessary, in either of these cases, to admit the supposition of a fresh generation of pestilential poison from terrestrial miasmata. In the case of the shorter interval, the epidemic may have slumbered, but not died; in short, there may have occurred sporadic cases of the disease in sufficient number to maintain the stock. When, again, a more considerable interval elapses between the cessation of the plague and its re-appearance at a particular place, a fresh importation may have taken place from regions in which it has been prevailing epidemically during its absence from the country under observation.

Besides being maintained by sporadic cases during the non-epidemic season of the year, the contagion of the plague may also be maintained in the form of *fomites;* that is, attached to substances that have been in contact with the bodies of patients, or exposed to the air which they breathe. Dr Russell mentions that at Aleppo, in 1762, several instances occurred of the revival of plague in houses which had suffered the year before, attended with circumstances highly suspicious of the contagion having been preserved several months for want of cleansing. It has very generally been believed, also, that by fomites the contagion of plague may be carried to regions very remote from that in which these substances acquired it. When the articles to which the pestiferous poison has attached itself are freely exposed to ventilation, it does not seem to be retained for any considerable length of time; but when, on the contrary, they are excluded from open communication with the air, there is good ground for suspecting that the poison may remain attached to them for a long space of time. Indeed we are not acquainted with any natural limit to its continuance besides that of the free exposure of the fomites to the air.

Circumstances diminishing the probability of infection.

In considering the plague to be capable, at least during a certain portion of the year, of being diffused by contagion, it is not necessarily inferred that all persons who approach within a given distance of a person labouring under the disease must become affected with it. There seem to be a variety of circumstances that diminish the probability of infection, with some of which we are more or less acquainted, whilst of others we are entirely ignorant.

1*st*, It has been supposed that exposure during one period of the epidemic is attended with less risk of infection than exposure during another. 2*d*, That exposure to a mild case of plague is attended with less risk of infection than exposure to one of a very malignant character. 3*d*, That a person who is exposed to plague-contagion by degrees runs less risk of infection than one who is suddenly brought within the sphere of its operation. 4*th*, That persons possessing equanimity of mind, of temperate habits, &c., run less risk than those who are in opposite circumstances.

Individual peculiarities in respect of the susceptibility or non-susceptibility of plague-contagion are very singular and unaccountable, but not more so than are observed in respect of other contagious diseases. A person whose exposure to the affected has been slight and of short continuance may be seized with the disease; whilst another who has undergone a very great degree of exposure remains free. And a person who has remained free during close and long-continued exposure, may ultimately become affected, without any change of circumstances, extrinsic or intrinsic, which it is possible to detect.

Dr L. Frank conceives that the proportion of persons who pass their life in Egypt without experiencing an attack of plague is greater than the proportion of persons who never experience an attack of small-pox, which he reckons as scarcely one in ten thousand.

Possibility of recurrence in the same individual.

It has been much disputed whether having once passed through plague renders a person unsusceptible of re-infection; and if it does not afford absolute security against more than one attack, in what proportion of cases a second or more frequent recurrence takes place. Some authors have denied the reality, if not the possibility, of a second attack of plague; others have related, as very singular events, single cases which had been noticed in particular epidemics; whilst others, again, represent such occurrences as by no means rare. Dr Mackenzie mentions his having been assured by the Greek padré who took care of the Greek hospital at Smyrna for fifty years that he had had the plague twelve different times during that period; and it is very certain, adds Dr Mackenzie, that he died of it in 1736. The abbé who took care of the Frank Hospital at Pera assured Dr M. that he had had the disease at Constantinople and at Smyrna four different times.

Latent period of infection.

In various respects it is extremely desirable to know what length of time may elapse between a person's exposure to plague-poison and the appearance of the disease. On the decision of this question it is obvious that duration of personal quarantine should be founded. Dr P. Russell mentions that at Aleppo he met with no instance of the disease appearing later than the ninth or tenth day after the day of shutting up, in those who adopted that precaution. Sir J. M'Grigor, in noticing that in different people, and under different circumstances, there is the greatest variety in respect of the time the matter of the pestilential contagion takes before it comes into action, mentions one case in which ten days seemed to be the shortest period that could possibly have intervened; and another in which a person continued well till the seventeenth day after being placed in quarantine.

In other countries than those of the Levant.

II. The few remarks which we have room to offer relative to the plague as occurring occasionally in other regions than those bordering on the Levant and Archipelago, must bear reference chiefly to the question whether, admitting the plague to be a contagious disease in the countries we have hitherto alluded to, there is any reason to apprehend the possibility of its being introduced into the British Isles; or whether the quarantine laws as regards the plague might be safely abolished. To justify such a measure, it would, it appears to us, be necessary to establish the correctness of one or other of the following propositions:—

Possibility of plague occurring in the British Isles.

1*st*, That it is impossible, in the nature of things, that

the plague should exist in the British Isles, and that, in point of fact, it never existed in them; 2*d*, That if it ever existed in these islands, it was indigenous, not imported, and consequently could not have been prevented by quarantine laws; or, 3*d*, That if it ever was imported into these islands, it was under circumstances which cannot recur.

1*st*, Our opinion as to whether a particular disease can occur in any country may rest upon two grounds; the first, our belief as to the conditions on which its prevalence in the countries it is known to infest may depend; and the second, our knowledge as to whether it has ever prevailed in the country in former times. These two considerations may reflect mutual light on each other. If we are very certain as to the conditions requisite for the existence of the particular disease, and are told that it has occurred in a country which we know not to fulfil these, we will disbelieve the correctness of the statement. And, conversely, if we are perfectly satisfied that the disease has prevailed in a country which does not fulfil the conditions we are disposed to consider requisite for its existence, our opinion as to these conditions must be modified. In respect of the plague, it is plain, from the discrepancies which we have seen to prevail in the explanations given of the causes by which it is produced and propagated in Egypt, &c., that the reality of its existence is exposed to much less dubiety than the explanation of the conditions on which that existence depends.

The fact already mentioned, of the very wide signification that used to be attached to the term plague or pest, renders it necessary indeed that, in judging whether a particular epidemic was really plague or not, we should not trust to the mere name which it received, but inquire into the symptoms which it actually exhibited. But, with symptoms so very characteristic as those that attend true plague, or rather, as we have already said, a large proportion of the cases that occur in the course of a plague-epidemic, a very slight description of a *pestilence* must suffice for determining as to its identity with genuine plague. Accordingly, we have experienced considerable surprise, in looking over the evidence taken by the committee of the House of Commons in 1819, at the number of witnesses who either positively denied that the so-called plague in London of 1665 (to omit previous epidemics to which that title was applied) was really that disease, or expressed much doubt on the subject. If the general statement of Sydenham to that effect left any room for doubt on this head, the minute description of Dr Hodges, and particularly that portion of it that relates to the more peculiar symptoms, including buboes, carbuncles, &c., is more than sufficient, we should have thought, to remove all doubt from the minds of the most sceptical.

Whether indigenous or imported.

2*d*, As to the plague of 1665 having been indigenous, and not imported, we have a very explicit statement of Dr Hodges as to its having been brought from Turkey to Holland, and from Holland to England. Attempts have indeed been made to point out discrepancies in his explanation of its first appearance and propagation in England: but to us the objections appear inconclusive, and the deficiencies in the chain of proofs such as might occur in tracing the diffusion of a disease universally recognised as contagious. The non-recurrence of the plague in this country since that period is certainly not more easy to explain on the supposition of the epidemic in question having been indigenous, than on that of its having been imported.

3*d*, The circumstances favourable to the reception and dissemination of plague-contagion, which may be supposed to have existed in 1665, but to be now extinct and incapable of recurring, may be of different kinds. The beneficial change may be in the character of the climate, in the condition of the soil, or in the habits of the people. But if our immunity has depended on a change in the climate, who can be responsible for the continuance of this change? What the climate has been, it may, for anything we know, become again. And as to any immunity that could be supposed to result from a change in the habits of society, and particularly from the superior attention paid to cleanliness and ventilation in our cities, from the introduction of public sewers, &c., to which much importance has been attached, we must confess our apprehensions that any seeds of disease which depend for their development upon filth will not perish for want of a hotbed in many districts of the larger cities of the three kingdoms.

Treatment of the plague.

When a person who has been exposed to the contagion of plague begins to feel unwell, it is proper to remove from his stomach all undigested matter by means of an emetic, taking care that it do not produce excessive nausea after the evacuation; and this, if it happens, is to be allayed by administering effervescing draughts, or a small quantity of laudanum. It will be proper also to empty the bowels by some mild but effectual purgative, avoiding diarrhœa. A gentle perspiration has appeared in some cases to carry off the disease; and we may attempt this by antimonial medicines, or the diluted acetate of ammonia. The mineral and vegetable acids will also be found useful; diminishing the heat of the body by prudent sponging with vinegar and water; giving medicines to allay irritation and procure sleep, as camphor and opium; frequently changing the bed and body linen of the patient, and quickly removing all offensive matters from his apartment.

Prevention of the plague.

The great means of spreading the plague is by contact with infected persons, or the contact of substances to which the pestilential infection adheres, as clothes, cotton, furniture, papers, and the like. When the plague has broken out in a place, every effort must be made, by means of lazarettoes or plague-hospitals, to separate completely between the sick and the healthy. Great attention should be paid to ventilation, and the sound, should on such occasions keep to windward of the sick. Anything worn about the person, if it gives confidence to the individual, will be of service in enabling him to resist contagion; hence camphor, vinegar, or any aromatic, may sometimes act as a preventive. Friction of the body with oil has obtained the reputation of a positive antidote; and whatever may be its ultimate virtue, it certainly should not be neglected. (J. T—N.)

PLAN, in general, denotes the representation of some object drawn upon a plane, such as maps, charts, ichnographies, and the like. The term *plan*, however, is particularly used for a draught of a building, such as it appears, or is intended to appear, on the ground, showing the extent, division, and distribution of its area or ground-plot into apartments, rooms, passages, &c. A geometrical plan is that in which the solid and vacant parts are represented in their natural proportions. The raised plan of a building is the same with what is otherwise called an *elevation* or *orthography*. A perspective plan is that exhibited by degradations or diminutions, according to the rules of perspective.

PLANE, in *Geometry*, denotes a plain surface, or one that lies evenly between its bounding lines; and as a right line is the shortest extension from one point to another, so a plane surface is the shortest extension from one line to another. In astronomy, conic sections, &c., the term *plane* is frequently used for an imaginary surface, supposed to cut and pass through solid bodies; and on this foundation is built the whole doctrine of conic sections. In mechanics, planes are either horizontal,—that is, parallel to the horizon, —or inclined to it. In optics the planes of reflection and refraction are those drawn through the incident and reflected or refracted rays. In perspective we meet with the perspective plane, which is supposed to be pellucid,

and perpendicular to the horizon; the horizontal plane, supposed to pass through the spectator's eye, parallel to the horizon; and the geometrical plane, likewise parallel to the horizon, in which the object to be represented is supposed to be placed. The plane of projection in the stereographic projection of the sphere, is that on which the projection is made, corresponding to the perspective plane.

PLANET (πλανήτης, *a wanderer*), a celestial body revolving round the sun as a centre.

PLANETARY MACHINES. The establishment of mechanical and physical science on an experimental basis, in the sixteenth and seventeenth centuries, is an event, or rather a series of events, for which the world cannot be sufficiently grateful. The splendid discoveries which were from time to time announced, and the various machines constructed for their illustration, directed men's minds strongly to mechanical pursuits. The results were of great value to civilization; and even when the objects sought for were frivolous, they were not altogether useless, as in the construction of *clocks* which, in addition to their ordinary duties, were made to undertake many wonderful and unnecessary things; *automata* of various kinds, which accomplished objects equally wonderful and unnecessary; and *planetary machines* for representing the motions of the heavenly bodies. The value of these things consisted in gratifying the public taste for ingenious toys, in fostering mechanical skill, and in supplying clever combinations, which have subsequently been reproduced in really useful automatic machines.

The term *orrery* is sometimes applied to planetary machines, and the origin of this word is stated by Desaguliers to have arisen from the following circumstances:—About the year 1700 Graham contrived a movement for exhibiting the motion of the earth about the sun, together with the moon revolving about the earth. This machine was sent to an instrument-maker's, for the purpose of being packed up with some other instruments about to be forwarded to Prince Eugene; but the maker having copied it, sold his copy to the Earl of Orrery, who it appears showed it to Steele, and he, referring to it in one of his lucubrations, called it an *orrery*,—a name which was at once adopted, and has since been retained.

Graham's machine, however, was by no means the first of its kind. The Chinese are said to have constructed planetary machines 2000 years before the Christian era. Archimedes and Posidonius also constructed them; and Cicero makes use of both machines in his argument on design in creation. (*De Nat. Deor.*, lib. ii., cap. 34 and 35.) During many centuries, planetary machines consisted of moveable spheres, with the earth in the centre,—a construction which continued in use until about fifteen years after the death of Copernicus, when the last celebrated example of a machine illustrative of that system was placed in the library of the Pantheon at Paris. Huyghens and Römer also constructed machines for illustrating the Copernican system. Huyghens first introduced a systematic method of calculating the necessary wheel-work for the machine which he named the *automaton*. This long continued to be a pattern in the construction of orreries; as was also Römer's instrument, intended chiefly to exhibit the orbital motions of the planets. Römer also invented a machine for representing the motions of Jupiter's satellites about their primary, together with the motions of the latter about the sun. In 1679 he presented a machine of this kind to the English astronomer Flamsteed. Among other great names which have been concerned in the construction of planetary machines, must be mentioned those of Dr Thomas Young and the Rev. W. Pearson, who furnished the plan for the planetarium of the Royal Institution of London.

Planetary machines have been variously named according to the objects intended to be attained by them. Thus we have the *planetarium*, which represents the orbital motions of the planets about the sun; the *tellurium* and the *lunarium*, for exhibiting the motion of the moon about the earth, and that of the earth about the sun, together with the principal phenomena which accompany the changes in their relative positions,—such as the succession of day and night, and the variable length of both according to the season of the year; the eclipses of the sun and moon; variations in the moon's latitude, velocity, and distance from the earth; the progressive motion of her apogee, and the retrogradation of her nodes, &c. The *satellite machine* by Römer, already referred to, is the last of the four planetary machines to which distinct names have been given corresponding to the phenomena they are intended to exhibit; but they are all generally included under the term *orrery*.

The most important part of an orrery is the mechanism of the planetarium, for exhibiting the paths of the planets about the sun, and their relative periodic times, together with the motions of the satellites about their primaries. The former object is usually attained by means of a system of upright concentric tubes of different lengths, the innermost being the longest; to the upper extremity of each is attached a radius vector, which revolves once during each revolution of the tube; the lower ends of the tubes form the arbors of as many toothed wheels, which are driven either by pinions adjusted to a vertical axle called the *annual arbor*, or they are moved by those pinions through the intervention of a train of wheels. The calculation of the relative number of teeth to be given to the wheels and pinions, in order to produce the required motions, belongs to that part of mechanics which treats of wheel-work.

It is not necessary to dwell at greater length on the construction of a machine which is at best a clumsy, useless, and expensive toy. As science advances, the instruments of research become more and more perfect; and although, as the great German chemist expresses it, it is not the instrument that does the work, but the mind of the inventor (*Das Instrument macht ja das Werk nicht, sondern der menschliche Geist*), still the instruments of the day will fairly represent the science of the day, and in this science the planetary machine has no place. That this machine never did, and never can, represent the truth as it is in nature, will be evident from the following computation, which we borrow from a great living astronomer:—"Choose any well levelled field or bowling-green. On it place a globe two feet in diameter; this will represent the sun: Mercury will be represented by a grain of mustard-seed, on the circumference of a circle 164 feet in diameter for its orbit; Venus, a pea, on a circle 284 feet in diameter; the earth also a pea, on a circle of 430 feet; Mars, a rather large pin's head, on a circle of 654 feet; Juno, Ceres, Vesta, and Pallas, grains of sand, in orbits of from 1000 to 1200 feet; Jupiter, a moderate-sized orange, in a circle nearly half a mile across; Saturn, a small orange, on a circle of four-fifths of a mile; and Uranus, a full-sized cherry or small plum, upon the circumference of a circle more than a mile and a half in diameter. As to getting correct notions on this subject by drawing circles on paper, or, still worse, from those very childish toys called orreries, it is out of the question." (Herschel's *Astronomy*, 1848.) (C. T.)

PLANISPHERE signifies a projection of the sphere and its various circles upon a plane.

PLANT. See BOTANY.

PLANTAGENET, the surname of the kings of England from Henry II. to Richard III. inclusive. Fulk, the first Earl of Anjou, stung with remorse for some wicked action, went, as a work of atonement, in pilgrimage to Jerusalem, where, being soundly scourged with broom twigs, which grew plentifully on the spot, he afterwards took the surname of *Plantagenet*, which was retained by his posterity.

PLANTING.

Planting, or the culture of trees, is a branch of agriculture necessarily of much more recent date than either the culture of grain and herbage plants, or the breeding and rearing of cattle. The culture of those plants which in every country supply the food of mankind, whether directly, or by nourishing the domestic animals used for food by man, must have exclusively occupied his attention for many ages; whilst the timber which was employed in houses, ships, and machines, or for fuel, was found in the native woods. Hence, though we hear of the culture of fruit-trees, and occasionally also of ornamental trees and shrubs, amongst the Egyptians, Greeks, and Romans, the cultivation of timber-trees on a large scale by art only took place in modern times. In the days of Charlemagne, the greater part of France and Germany was covered with immense forests; and one of the benefits conferred on France by that prince, was the rooting up of portions of these forests here and there throughout the country, and substituting in their room orchards or vineyards. Artificial plantations appear to have been formed in Germany sooner than in any other country, and apparently as early as the fifteenth century. In Britain they took place, though but sparingly, nearly a century afterwards. Planting, however, was by no means general in England till the beginning of the seventeenth century, when, in consequence of the extensive transfers of property which took place in the preceding century, on the seizure of the church-lands by Henry VIII., much timber was sold by the new owners, in order to make good their payments. The quantity of timber thus thrown into the market lowered its price considerably, insomuch, as Hollingshed informs us, that the builders of cottages, who had formerly employed willow, and other cheap and common woods, now built them of as good oak as their lords. The demand for timber thus constantly increasing, and a demand for an extended surface of farming land going on at the same time, the natural forests became everywhere greatly circumscribed, till at last timber for naval purposes and house-building began to be imported, and the proprietors of land to think, first of protecting their native woods from the inroads of cattle; afterwards of enclosing pieces of waste ground, and allowing them to become covered with young trees from seeds carried thither by the wind or other accidental circumstances; and ultimately of sowing acorns and mast in such enclosures, or of filling them with young plants collected in the woods; a practice which exists in Sussex, and some other parts of England, even at the present day. Planting received a great stimulus in Britain soon after the breaking out of the late general war, partly in consequence of a real or supposed scarcity of timber fit for naval purposes, and partly owing to the high price to which the article for general use rose, in consequence of the increased expense of obtaining supplies from other countries. Since the peace, the rage for planting, with a view to profit, has subsided; but there is still a universal taste for cultivating trees and shrubs, with a combined view to ornament and use; and there is also an increased and increasing taste for the introduction of trees and shrubs from foreign countries.

Having in this slight manner noticed the origin of planting, we shall next give a brief outline of its present practice in Britain; noticing in succession: 1. A general view of the different properties possessed by trees; 2. selections suitable for different purposes; 3. the nursery culture of trees; and, 4. the culture of trees in plantations.

It is necessary to premise, that in this article we confine ourselves entirely to trees which are well known in Britain, and quite hardy; and to the formation of such plantations as are made with a view to their timber-produce. Fruit-trees and fruit-shrubs, flowering shrubs of every kind, and ornamental plantations, we consider as belonging to gardening, and as already disposed of under the article Horticulture.

I.—*General View of the different Properties possessed by Trees which may be cultivated in Britain.*

The sort of trees which it is desirable to plant, is necessarily the first point which a proprietor will take into consideration before he commences a plantation. Trees differ from one another in many particulars: in magnitude; in slowness or rapidity of growth; in their suitableness for poor soils or rich soils, moist grounds or dry grounds, elevated exposed situations, or low and sheltered plains; in the texture, colour, and durability of their timber; in their delicacy or hardiness in any given climate; in their being difficult or easy to propagate and rear; in retaining their leaves all the year, or dropping them every autumn; in producing showy flowers or fruits; and in a great variety of other particulars. In regard to magnitude, those trees which, in the latitude of Britain, and in the same parallels of latitude throughout the northern hemisphere, attain the greatest height, are the spruce and silver fir, the larch, and the Scotch pine; and these also are the trees which, in most parts of Britain, produce the greatest quantity of timber in their trunks relatively to that contained in their branches, and that in the shortest time. The poplar, the willow, and some species of elm, are rapid-growing trees, and produce a great bulk of head in a short period; but the timber of these trees is not all contained in one straight trunk, as in the case of the pines and firs, a considerable portion of it being distributed among the branches. Hence, where the speedy production of timber is the main object of planting, the pines and firs above mentioned are decidedly the trees that ought to be preferred. The production of timber, however, is not always the sole object of planting. Effect, or, in other words, the production of the appearance of woodiness on an estate, is perhaps oftener the object than mere timber. For this purpose the Scotch and English elms, the white, black, and black Italian poplars, the Huntingdon willow, and in some situations the birch, and in others, such as on the sea-shore, the sycamore, are the most desirable trees. Where the object is to clothe a sterile surface of dry sand, the birch and the Scotch pine are among the best trees that we have; and if the situation be exposed to the sea-breeze, the common and the Norway maple may be substituted for the birch and the pine; and, in the warmer parts of the island, the evergreen oak. For moist soils which cannot be drained, there are trees that have the remarkable property of sending their horizontal roots along the surface of the ground; among these are the white, the trembling, and the Ontario poplars; and, for the marshes of the warmer parts of the island, the deciduous cypress. There are trees which will grow near water, in situations where their roots can enter into it, but which will not grow in undrained soil, such as the different species of willow, and most of the poplars. It is a remarkable fact, that there is no tree in any part of the world which is truly aquatic; that is, which will spring up from the bottom of a pond or river. Had there been such trees created, there could then have been neither rivers nor lakes, and the whole of the terrestrial globe must necessarily have been either in a state of marsh or mountain.

In general it may be observed, that trees are not so absolute in their choice of soils as for each species to require one of a different nature; on the contrary, on almost any kind of soil not beyond the average in point of moisture, dryness, or tenacity, all the known species of trees and shrubs may be grown to a tolerably mature size and age. In some soils, however, they will thrive better than in others; and the timber produced generally varies in quality according to the soil. Thus a rich soil, while it contributes to the rapid growth of the pine and fir tribe, renders their timber less durable; and the same law holds good, more or less, with regard to every other species of tree.

The influence of climate on trees is incomparably greater than that of soil; for, whilst any tree may be said to grow on any soil, every tree may be said to have its particular climate; that is, a climate in which, the soil and other circumstances being suitable, it will attain its greatest bulk, and its timber endure the longest. Hence, when we take the geographical and physical range of any particular species of tree, the oak, for example, we shall find that there is what may be called a central climate, where, when on suitable soil, it attains its largest size; and that as it recedes from this climate, whether by latitude or elevation, either into one which is colder, or one that is hotter, it gradually diminishes in size, till it at last appears in the form of a shrub. Thus the common oak, which in Britain attains its largest size in Sussex and Hampshire, dwindles into a shrub on the mountains of the Highlands of Scotland, and also in the north of Africa; its degeneracy being occasioned in the one case by extreme cold, and in the other by extreme heat. Even within the range of the climate of Britain, the absolute character of trees, relatively to climate, is made obvious. The English or narrow-leaved elm, which is supposed to be a native of Asia Minor, and also of China, attains a large size in the neighbourhood of London, producing a great bulk of timber in a short period, and ripening its seeds; while north of York it does not thrive, and in Scotland it is considered only as an ornamental tree. The Lombardy poplar, which is known in the central counties of England to attain 100 feet in height in forty or fifty years, is nowhere seen of a timber-like size in Scotland; and it may be observed of the sweet chestnut and the walnut, that though they are grown both for their fruit and their timber in many parts of England, yet that they cannot be profitably employed for either purpose north of Newcastle.

Climate, relatively to trees, may be considered in regard to its average temperature throughout the year, to its temperature in summer and winter and in spring and autumn, and to its degree of atmospheric moisture. A high average temperature is no proof that a climate is suitable for trees; but a high summer temperature is suitable for many kinds, though the temperature of the winter may be very low. Thus the oaks and many other trees of North America, attaining there a prodigious size, survive a winter as cold as that of St Petersburg, where no native oaks of any kind are ever found; but the oaks of North America enjoy a very high temperature during summer, which rapidly develops their foliage and young shoots, and fully matures the latter, so as to enable them to withstand the most rigorous frosts of winter. In England the average temperature of the year is as great as that of the oak countries of the United States; but our summers are comparatively cold, moist, and gloomy; and though our winters are so much milder than those of America, yet the spongy, unripened, young shoots are always more or less injured by the frost. Another disadvantage of a country having a mild winter is, that the trees of those countries which have a very severe winter come into leaf earlier in the spring than the indigenous trees of the mild climate; and frosts being more or less prevalent at that season, they are proportionably liable to injury from that cause.

Evergreen trees form a very important division of the ligneous kingdom; and of these there are two classes, very distinct relatively to climate and temperature. The first of these classes comprises the needle-leaved trees, such as the pine and fir tribe, which will endure a degree of cold as great as that in which any deciduous tree will thrive; and the second, the broad-leaved evergreen trees, such as the holly, the box, the laurustinus, the laurel, the evergreen oak, the cork-tree, and the evergreen mangolia, all of which are trees of comparatively mild climates, and which are always found in a natural state on islands, or on continents at low elevations, and at no great distance from the sea: hence the very considerable number of evergreen trees which will endure the open air in Britain, compared with those which stand through the winter in the same parallel of latitude on the continent.

Of the trees cultivated in Great Britain, only a small proportion are indigenous. A considerable number are natives of other parts of Europe, and about two thirds of the whole are from North America. Of these North American trees there is scarcely one that is worth cultivating in Britain for its timber; and the reason seems to be, chiefly, that our climate is not sufficiently hot and light in summer to bring that timber to maturity. The truly useful timber-trees of Britain are those which are indigenous, such as the oak, the ash, the broad-leaved elm, the Scotch pine, &c.: or those which are found in the same hemisphere and in the same parallels of latitude, such as the larch, the spruce fir, the silver fir, &c. Of all the trees which are cultivated in Europe, that which is most to be depended on for the strength and durability of its timber is the common oak; and next, and perhaps equal to it, is the larch. The trunk of the oak-tree, when freed from the soft or outer wood, and thoroughly seasoned by exposure to the atmosphere, will endure an unknown period of time in buildings and machines; and, even when split up into thin laminæ, and put up in the open air as fencing, without any painting or other preparation, it has been known to last for upwards of a century. The common European oak is found to be more durable as timber than any of the American oaks, even when grown in America, unless we except the live oak; and there is perhaps no timber in the world equal to it for ship-building, excepting the teak-wood of India. The most generally useful timber grown in Britain is the Scotch pine; but as this timber is also imported from the north of Europe, and a substitute for it from North America in great quantities, it is not planted in Britain nearly so extensively as it otherwise would be. The timber of the larch is undoubtedly of greater durability than that of the Scotch pine; but being apt to warp, and not being so easily worked, it is less convenient for the purposes of house-carpentry and joinery. The timber of the common ash is valuable in the construction of agricultural instruments and machines, and it is one of the few woods which are almost as valuable when young as when of mature age. The wood of the broad-leaved elm is strong and durable, but that of the English and Dutch elms is much less so. The wood of the poplar, and that of the willow, when exposed to constant atmospherical changes, speedily decay; but when thoroughly seasoned, and afterwards kept perfectly dry, they will last for centuries. In general, it may be observed, that every description of timber, when at maturity, if thoroughly seasoned, and preserved in an atmosphere tolerably uniform in point of dryness, will last a long period.

The great majority of trees which are planted in Britain may be considered as ornamental; for though the timber of all of them is more or less useful, yet, if the mere production of timber were the main object of planting, all trees except the oak, the larch, the Scotch pine, and two or three others, would be rejected, either on account of their

slow growth, or of the inferior quality of the timber which they produce in our climate. Trees may be considered as ornamental, from their general shape, from their foliage, from their flowers or fruit, or from their rarity. In order that the shapes of trees may be displayed to advantage, it is necessary that they should stand singly; and when this is the case with some species of trees, such, for example, as the different species of the pine and fir tribe, their shapes become strikingly different from what they are when grown in masses. The Scotch pine, when drawn up in close forests, produces a clean, straight trunk, free from branches for the greater part of its height; but when by chance or design it stands singly, it throws out gigantic branches on every side, and becomes one of the most irregular and picturesque-headed of trees. But of all the trees which assume ornamental shapes in consequence of standing singly or nearly so, the most remarkable is the cedar of Lebanon. When this tree is grown in masses, it shoots up with a straight, clean trunk, and terminates in a small, spiry top; but when planted alone, and allowed to spread its branches on every side, it throws out its gigantic arms in successive tiers, and forms an irregular pyramidal mass, unequalled for grandeur, singularity, and picturesque beauty, by any other tree of the temperate regions of either hemisphere. All trees indeed become comparatively the same naked poles with scanty tops when grown in masses, and all assume irregular and picturesque forms when grown singly. Hence, whenever trees are grown chiefly for the purpose of displaying their shapes, they ought to be placed at such a distance from each other as that their branches may not touch; which in practice is effected by scattering them in groups in parks or pleasure-grounds, or planting them in hedgerows. Trees which are valued as ornamental chiefly for their foliage, fruit, or flowers, will obviously display these to the best advantage when standing singly; but for such an object isolation is much less necessary, as the ornamental foliage will be displayed even when the plantation is in masses, and seen at a distance; and the flowers and fruits by planting the trees in the margins of plantations of other sorts.

II.—*Selections of Trees for particular purposes.*

The object of the preceding remarks is to communicate some general ideas on the subject of selection, and on the properties of particular species; and we shall next pursue the same subject more in detail, by giving the names of the principal trees deserving of culture in Britain, thrown into groups characterized by some property common to the whole.

Needle-leaved or Resinous Trees are characterized by straight erect trunks, regularly furnished with branches in tiers, which never, except under particular circumstances, acquire the size of timber. They never send up shoots from the collar or stool when cut over by the surface. The leaves are narrow, or needle-shaped, without veins, and they are evergreen. The seeds are produced in cones, and the whole plant is more or less resinous. They belong to the Gymnosperms of the natural system, which form an order intermediate between the Dicotyledoneæ, and the Monocotyledoneæ.

Larix Europæa, *Dec.*, is the most valuable species for its timber, which is of great durability, both in its young and mature state. Young larches, five feet or six feet high, and the spray of larch-trees of any age, last a very long period, when intertwined with larch stakes, so as to form a dead fence. Young trees from ten feet to fifteen feet in height are found, in the neighbourhood of Farnham and other places, to form the most durable hop-poles; and the durability of the mature timber, in every department, both in civil and naval architecture, has been placed beyond all doubt, by the experience of John duke of Atholl, as recorded in the Transactions of the Highland Society of Scotland, vol. xi. p. 165; and Loudon's *Arboretum Britannicum*, vol. iv. p. 2387. The bark of the larch is also of considerable value in tanning; and the leaves being deciduous, the tree is more favourable to the growth of grass under its shade, than any other species of pine or fir. The larch is readily increased by seeds which are ripened in abundance in Britain; and it prospers best in cool, argillaceous soil, moist rather than dry, and placed at a considerable elevation above the level of the sea. The larch is subject to various diseases, and, in certain soils, to the decay of the heart-wood; but very little is known at present, either of the cause of these diseases, or of their prevention or cure. The larch cultivated in Britain is a native of the Tyrol, and of the Alps of Switzerland; but there are some other species or varieties, natives of Siberia and North America, which, however, are considered as scarcely worth culture as forest-trees.

The Scotch pine, Pinus sylvestris, *L.*, is, next to the larch, the most valuable needle-leaved tree grown in Britain. Its timber forms the yellow deal of the Baltic and Norway; and it is unequalled by any species of pine or fir timber contained in any other part of Europe, or North America. The best Scotch-pine timber grown in Britain is produced in the native Highland forests; but there is reason to believe that artificial plantations, on soils and situations as nearly similar as practicable, would produce timber of nearly equal value. It has been the practice for many years past to decry the Scotch pine grown in Britain as a timber-tree; and as we have now no difficulty in importing deal from the north of Europe, this condemnation has been assented to by many without due consideration. If, however, we could import no pine or fir deal from any other country, and were obliged to grow it ourselves, we would ask where is the tree that would produce it in so short a time, and of so good a quality, as the Scotch pine? This tree is readily increased from seeds, which, unfortunately, as is the case with several other trees, are produced in the greatest abundance on stunted trees, or, at all events, on trees not remarkable for their large size, or the durability of their timber. Hence it becomes desirable to select the seeds from the best varieties, and this is now done systematically by the principal Scotch nurserymen. The Highland variety, with horizontal branches, P. sylvestris horizontalis, *Arb. Brit.*, is the variety at present of highest repute. The Scotch pine is a native of the continent of Europe, but not of any part of America.

The spruce fir, Abies excelsa, *Dec.*, is, as a British timber-tree, next in value to the Scotch pine. The young plants and the spray are almost as durable as those of the larch; the trunk grows straighter, more erect and slender, than in that tree, and when used with the bark on, as poles or as fence-wood, it is equally durable. The spruce makes much better hop-poles than the larch; but as the trunk of full-grown trees seldom attains a diameter of above one or two feet at the ground, even in countries where it is a native, the trunk can very seldom be profitably sawn up into boards. The great value of the tree is for poles of every kind, from those fit for the hop, up to the masts for the smaller ships. In most parts of Europe, all the poles used in the scaffolding employed in erecting buildings are formed of this tree. The spruce fir ripens seeds abundantly in Britain, from which plants are as readily raised as in the case of the Scotch pine and the larch. It prefers a soft soil, rather moist, and only attains a great height in sheltered situations; but it will grow to a size fit for hop-poles or fencing in a short time, and anywhere. Like the Scotch pine, it is subject to few diseases. The spruce fir is a native of the north of Germany, Sweden, Russia, and Norway, but not of Britain or of North America. There are three or

four species of spruce natives of the latter country, but they are of no value as timber-trees.

The pinaster, Pinus Pinaster, *Ait.*, is by no means adapted for general culture in Britain, and therefore scarcely merits to be ranked among our needle-leaved timber-trees. In some parts of England, however, particularly in Norfolk, considerable plantations of this tree have been raised; and it is found in deep sandy soil to produce a considerable bulk of timber in a short time. It has also the advantage of thriving better when exposed to the sea-breeze than any other pine or fir. The wood is not so durable as that of the Scotch pine; but it is of the same colour, and may be employed in the joinery of ordinary apartments. In general, however, it is by no means sufficiently strong for the roofing, joists, and other carpentry of dwelling-houses. A great use of the tree in France, and particularly in the neighbourhood of Bordeaux, where it is extensively grown on the sandy wastes, is for the production of resin, tar, and pitch, which are obtained by incisions made in the trunk, and by subjecting the wood to the action of fire. Seeds of this tree are ripened in England; but they may be obtained in any quantity, at a very moderate rate, from Bordeaux. The young plants require more care in transplanting than those of most other pines and firs, being furnished with a stronger tap-root than any of them. The pinaster is a native of the south of Europe and north of Asia, but not of America. It has been introduced, however, into most countries, probably from the large size and handsome appearance of the cones. Accordingly, specimens of this tree have been sent home from China, New Zealand, St Helena, North America, &c.; and the produce of the seeds from these places are commonly, but improperly, treated by nurserymen as varieties.

The silver fir, Picea pectinata, *Arb. Brit.*, in favourable soils and situations produces a great bulk of timber in a comparatively short period; but the timber is much less strong and durable than that of either the spruce fir or the Scotch pine. The tree is of slow growth for the first ten or twelve years of its existence, and the leading shoot is at that age very apt to be injured by spring frosts; nevertheless, even in the north and west of Scotland it has been known to attain to the height of 100 feet in sixty or seventy years. The timber is white, and makes excellent flooring for bed-rooms. The tree ripens seeds in Britain, though more sparingly than the spruce fir, and plants are easily raised. It is in general healthy, though the points of the shoots are occasionally destroyed by frost or by insects. The silver fir is a native of Central Germany, and of the Alps of Italy and Spain; but of no other country. There are other species of Picea, natives of North America and Nepaul; but relatively to Britain they can only be considered as ornamental trees.

Other needle leaved trees might be enumerated as attaining a timber-like size in the climate of England; but there is not one of them that we think can be ranked in value along with those already mentioned as timber-trees. Of the American pines, that of which we have had most experience in this country is the Weymouth pine, Pinus Strobus, *L.*, which furnishes the white pine-wood of American commerce; but this wood, grown in any given situation in Britain, is far inferior to that of the Scotch pine grown in the same locality; and there are only a few situations in England where the Weymouth pine will produce the same bulk of timber as the Scotch pine in the same period. The other American pines, as timber-trees adapted for Britain, scarcely deserve notice. Pinus tæda, serotina, and rigida, have attained a timber size in a few places in England; but the time they have required to do this, even under the most favourable circumstances, precludes the hope of their ever becoming British timber-trees. Several Californian species of pine have recently been introduced; but half a century will be required to enable us to judge of their suitableness for this country. The Californian spruce fir, Abies Douglasii, is the most promising needle-leaved tree that has been introduced from that country; but it remains to be proved whether we shall ever be able to rank it with the common spruce. Of Nepaul pines there are two species, P. excelsa and P. Lambertiana, which resemble the Weymouth pine; and there is a spruce fir, Abies Smithiana, *Arb. Brit.*, A. Morinda, *Hort.*, which promises to be as hardy as the Norway spruce; but the other pines and firs of the Himalayas are all rather tender. The cedar of Lebanon, if planted in masses, like the larch or the Scotch pine, would, in good free soil, produce abundance of timber, but of far inferior strength and durability to what the Scotch pine would produce similarly treated. However ornamental, therefore, this tree may be, it cannot be recommended as fit to be cultivated for its timber. There are some European pines and firs which deserve to be noticed, as possibly containing some trees among them that might be cultivated as timber. Among these are the Corsican pine, Pinus laricio, *Poir.*, including several varieties, among which, as we think, may be reckoned the black pine of Austria, Pinus Austriaca, *Hoss*, as well as the Pyrenean pine, Pinus Pyrenaica, *La Peyrouse*, P. Hispanica, *Cook*. All these species or varieties appear to thrive in the climate of London; and there is a Corsican pine in the arboretum at Kew which is upwards of eighty feet high. Whether the rate of growth, and the strength and durability of the timber, will ultimately prove equal to that of the Scotch pine, appears to us doubtful. We think, however, that in point of bulk of timber, the Corsican pine would equal the Pinaster. The Cembrian pine, P. Cembra, *L.*, of which there are two varieties, one a native of Switzerland and the other of Siberia, grows as rapidly even in Scotland as it does in its native localities; but it is of extremely slow growth everywhere, and not worth cultivating as a timber-tree. Specimens in the climate of London, which have been nearly 100 years planted, have trunks only forty or fifty feet high, and from a foot to eighteen inches in diameter at the ground. The yew-tree, Taxus baccata, *L.*, though it attains its full perfection in this country, being indigenous, yet, from its slow growth, and the little demand for its timber, it cannot be recommended to the planter whose main object is profit. The arbor vitæ, evergreen cypress, deciduous cypress, and juniper, all belong to the needle-leaved division of trees; but none of them are worth cultivation with a view to profit.

Broad-leaved Trees, in contradistinction to needle-leaved, are classed, according to their timber, in two subdivisions, hard-wooded trees, and soft-wooded trees. They are characterized by large trunks and widely-spreading woody branches, and broad leaves with branching veins; they send up shoots from the collar or stool when cut over by the ground; and they are deciduous. They belong to the Dicotyledoneæ of the natural system.

The *hard-wooded Timber-trees of Britain* are characterized by the comparative hardness and durability of their wood, and consist chiefly of the oak, ash, elm, beech, sweet chestnut, walnut, and locust or false acacia.

The British oak may be considered as including two species or subspecies, the stalked fruited, or most common oak, Quercus Robur pedunculata, *Arb. Brit.*, and the stalkless fruited, or less common oak, Quercus Robur sessiliflora, *Arb. Brit.* The latter species or subspecies is found to grow more erect and more rapidly than the other, more particularly if the soil be good and deep. The two sorts are found indiscriminately mixed together in many parts of England, as in Woburn Park, Bedfordshire, and in various parts of Sussex; in other places one species exclusively prevails, as at Tiberton Park, near Hereford, where there

are some of the largest oaks in England, on a deep, loamy soil, and almost all Q. R. sessiliflora. At Welbeck, in Nottinghamshire, on the other hand, there are a great many oaks, almost exclusively Q. R. pedunculata. In all the places mentioned, the trees are the remains of native forests. Though the wood of the oak is the strongest and most durable of that of all British timber-trees, the tree is not always that which the planter would make choice of with a view to profit, on account of the slowness of its growth. It has, however, this advantage, that as it bears a higher price than any other British timber, so it will pay better at a distance from the market; and thus, while oak will pay after conveying it fifty or sixty miles to a seaport, elm will scarcely pay at half that distance, and the soft woods at still less. Oak plantations are also more valuable than others when in a young state, on account of the value of their bark. From the value of oak as ship-timber, the price of trees fit for that purpose is always considerable; though what is paid for the largest trunks employed in naval architecture will not remunerate any one for the number of years they must have stood on the ground. Accordingly we find that the governments both of France and England grow this description of timber exclusively in national forests. The wood of the oak has also the advantage of being applicable to a greater number of uses than that of most other trees. Houses, ships, furniture, and machines, may be formed almost entirely of oak, and consequently there is a ready sale for this kind of timber almost everywhere; hence the oak may be more planted in Britain than any other hard-wooded tree. It is easily raised from acorns, which ought to be collected from the tallest and handsomest trees. The British, or naval oak, as it may perhaps be more properly called, is a native of Britain and most parts of Europe, but not of Asia, Africa, or North America. There are several subordinate varieties, but none worth notice as timber-trees, excepting the kinds which we have noticed.

The ash, Fraxinus excelsior, *L.*, is in most parts of Britain next in value as a timber-tree to the oak. The wood is chiefly used in the manufacture of agricultural implements, such as ploughs, handles to spades, mattocks, handles to carpenters' implements, carts, waggons, threshing-machines, &c. Young ash-trees, and ash poles and suckers, are also much in demand for crate-ware, hoops, whip-handles, walking-sticks, and especially for hop-poles. Before the general introduction of cast iron in machinery, ash-wood was much more in demand than it is at present. The tree requires a good, deep, loamy soil, dry rather than moist; and a situation naturally sheltered, such as the steep banks of glens, rivers, or lakes. As the value of the timber depends chiefly on its toughness and elasticity, the tree is best grown in groves or masses, in consequence of which, where the soil is good, the growth is rapid, and the trunk is drawn up free from large side-branches. The tree is easily propagated from its seeds or keys. It is a native of Central Europe, but of no other part of the world. There are several species of ash natives of North America, and one or two of Europe; but these are of no value in this country, excepting as ornamental trees.

Of the elm there are two species, the English or narrow-leaved elm, Ulmus campestris, *L.*, and the Scotch or broad-leaved elm, Ulmus montana, *L.* Between these two species there are several varieties, or hybrids, such as the Dutch elm and the Huntingdon elm, the latter by far the most valuable timber-tree of the genus. The narrow-leaved elm can hardly be considered as a timber-tree in Scotland, but in the central districts of England its rapid growth, straight trunk, and ample spreading head, constitute it a magnificent tree; and the timber is useful for some important purposes in ship-building, as well as in the construction of machines and agricultural buildings. The Scotch elm is a hardy tree, of rapid growth; but, unless planted in masses, it seldom produces a straight handsome trunk. Its timber is much more durable than that of the English elm, or of any of the hybrids between the species. It was formerly much used in agricultural carpentry, in rural machinery, and in common household furniture. The Scotch elm produces abundance of seeds, which, if sown as soon as they are gathered, often come up the same year; but the English elm and the hybrids produce seeds very sparingly, and are almost always propagated by layers, or by grafting on the Scotch elm. One remarkable difference between the English and Scotch elms it may be useful to notice, viz. that the latter never throws up suckers from its roots; and it is therefore peculiarly valuable as a stock for the English elm, and for those varieties or hybrids between the species which do throw up suckers. There are some other species and varieties of European elms, and several kinds of American elms, but none of them are deserving of culture in Britain as timber-trees.

The beech, Fagus sylvatica, *L.*, acquires a large size, particularly on chalky or sandy soils. It is a very handsome tree in every stage of its growth, but the timber is not remarkable either for strength or durability. It was formerly much used in mill-work and turnery; but its principal use at present is in the manufacture of chairs, bedsteads, and a variety of minor articles. It is a native of England, and of various parts of the continent of Europe. There are some varieties, particularly the purple beech; and there are one or two species natives of North America, but none of them deserve notice as timber-trees. It is propagated by its mast, which it produces plentifully in fine seasons.

The hornbeam, Carpinus Betulus, *L.*, is an indigenous tree, which attains the same height, but not the same diameter of trunk, as the beech, to which it bears a general resemblance, but is in every respect greatly inferior. It is propagated by its nuts, which it produces in abundance. This tree and the beech were formerly highly valued for making lofty hedges, on account of their retaining their leaves great part of the winter.

The sweet chestnut, Castanea vesca, *Gærtn.*, is generally ranked next to the beech as a timber-tree; but in that character it has little or no merit. The tree is magnificent in appearance, rivalling, when full grown, the British oak; but it differs essentially from that tree in its timber not increasing in value as it increases in age. In Britain, and also in France, it was formerly believed that the roofs of the oldest cathedrals, and of Westminster Hall and other buildings, were of chestnut; and it was thought, in consequence, that the tree had formerly been more abundant, both in Britain and on the Continent, than it is at present. Subsequent inquiry, however, proves all this to be a mistake; and Daubenton and various others have shown that the timber called chestnut in old buildings is referable to the chestnut oak, Quercus Robur sessiliflora, *Arb. Brit.* It is worthy of remark, that some of the ancient writers describe a grove of chestnuts as extending northwards from London, and abounding in wild beasts; and that the remains of the indigenous woods at Hampstead, in the Earl of Mansfield's grounds, are of the chestnut oak. The timber of the sweet chestnut, when not more than of forty or fifty years' growth, forms very durable posts for fences and gates; being, according to some, more durable in this capacity than oak itself; but whenever the trunk of the tree becomes of larger dimensions than six or eight inches in diameter, the timber is found to be shaky; and at eighteen inches or two feet in diameter it has already begun to decay at the heart. In a young state, when the stems are not above two inches in diameter at the ground, the chestnut is found to make durable hoops for casks and props for vines; and of a larger size it makes good hop-poles, though the stem tapers rather too much for that purpose. It is a native of Asia, the north of Africa, and of North America; and some think it a na-

tive of Britain. In the south of England, in fine seasons, it ripens abundance of fruit, from which plants are easily raised. There are a number of varieties, both in Britain and on the Continent, which are highly valued for the qualities of their fruit; but none of these, nor any of the American kinds, are worthy of being cultivated for their timber.

The common sycamore, Acer Pseudo-Platanus, *L.*, is a tree of the second rank, seldom attaining the height of any of those that have been hitherto mentioned. It has, however, the merit of withstanding the sea and mountain breezes better than most other timber-trees; and its wood is valued in turnery, and for a variety of minor purposes. It produces abundance of seeds, which, like those of the ash, are called keys, and it is easily raised in the nursery; but it does little good in plantations, unless the soil be good and tolerably dry. It will neither thrive on very stiff clays, nor on dry sands or chalks. There are several species of Acer, natives of Europe and North America; and that which comes nearest to A. Pseudo-Platanus, as a timber-tree, appears to be the A. obtusatum, *Arb. Brit.*, a native of Hungary and Calabria, but it has not yet been tried in plantations made with a view to profit. The Norway maple, A. platanöides, *L.*, is a hardy and very interesting tree; but neither it, nor any of the other species, either from America or Europe, seem to deserve cultivation for their timber. If we made any exception, it would be in favour of the common field-maple, Acer campestre, *L.*, which forms a very curious wood for the cabinet-maker.

The common birch, Betula alba, *L.*, is another tree of the second rank, which is worthy of culture in inferior soils and situations, more especially as coppice-wood. The spray, in some parts of the country, is sold to the besom-maker, and makes a valuable return. The tree seeds freely, and is in every stage of its progress easy of management. There are several species of birch, natives of North America, which attain the size of timber-trees, and all of them have been introduced into this country, and tried in British plantations; but there is not one of them which can be considered otherwise than as an ornamental object, or as one of botanical interest.

The false acacia, or locust, Robinia Pseud-Acacia, *L.*, may be placed amongst the timber-trees of the second rank. It is of unquestionable beauty, and much has been said of the value of its timber. When of a certain age, this is of great hardness and durability, and it lasts a long time as posts, or as trenails or wooden pins, for bolting together ships' timbers. For the latter purpose, however, iron and copper are now generally used, both in Europe and America. The false acacia has been much recommended by Cobbett and a host of other writers for hop-poles and props for vines; but though it has been extensively tried in England for the former purpose, it is now utterly neglected, being found rarely to grow straight and clean, and, when used, being much less durable than the ash.

Amongst hard-wooded trees of the third rank, the timber of which is of some use, are the mountain ash, Sorbus domestica, *L.*; the white beam-tree, Sorbus Aria, *L.*; the wild apple, wild pear, wild cherry, and wild plum, the hawthorn, the holly, the laburnum, and perhaps one or two others. We could hardly recommend a plantation to be made solely of any of these trees; but when a few are introduced by way of variety or ornament, it is useful to know that their timber is of some value. The laburnum, the holly, the yew (which last we have included under the needle-leaved trees), are by far the most valuable of the trees of the third rank. The heart-timber of the laburnum is almost as dark and hard as that of ebony, and that of the holly is of a beautiful white. The timber of the yew is veined, and its beauty may be increased by judicious staining. The roots of the thorn, the yew, and of most of the third-rate trees, are often beautifully veined, and employed in cabinet-making and veneering.

Soft-wooded Trees are distinguished by the comparative rapidity of their growth, and the softness of their wood, its whiteness, and its limited duration. The principal of these worth cultivating in Britain as timber-trees, are the poplar, the willow, the alder, the lime, and the horse-chestnut.

The poplar, Populus, *L.* There are several species of this tree, which well deserve culture with a view to their timber, where the soil is good and deep, and where the roots can reach water without being saturated by it. The white and gray poplars, Populus alba, *L.*, and P. canescens, *L.*, are hardy, of very rapid growth, attaining a height of thirty or forty feet in most parts of Britain in ten or twelve years, and producing a beautiful, smooth, compact, white timber, well adapted for flooring bed-rooms, and for a great many minor purposes, either in its native colour, or stained black in imitation of ebony. The black Italian poplar, P. monilifera, *Dec.*, is an equally rapid-growing tree with the white poplar, and produces a beautiful pale-yellow timber. The common black poplar, P. nigra, does not grow so rapidly as the last, and seldom produces a straight trunk; but its timber is homogeneous, of a yellowish white, and takes a fine dye. The aspen, or trembling poplar, P. tremula; and the Athenian poplar, P. Græca, are of slower growth than the white or black poplars, and they have a beautiful, smooth, homogeneous, white wood. There are a number of other species of poplar, chiefly natives of America, and the Lombardy poplar, which is a native of Persia; but none of these are worthy of being planted as timber-trees in the climate of Britain.

The white willow, Salix alba, *L.*, is a rapid-growing tree, and produces a great bulk of timber in a short period. The wood is white, soft, and sometimes slightly veined with blue. When kept dry, and well ventilated, it will last a long time, and has been found in buildings which have existed upwards of a hundred years, in a perfectly sound state. The Bedford willow, Salix Russelliana, *L.*, grows with about the same rapidity as the white or Huntingdon willow, and its timber is of the same quality. The crack-willow, Salix fragilis, *L.*, is a tree of a smaller size, but its timber is useful for a variety of purposes; and the bark of this, and of most of the other species, may be used in tanning. There are a great many species and varieties of willow natives of Europe, or of North America and Asia; but, excepting the three above mentioned, we do not consider any of them as worth cultivating for timber.

The alder, Betula Alnus, *L.*; Alnus glutinosa, *Dec.*, is an indigenous tree, of smaller size and much lower growth than the poplars, or tree-willows; but its timber is more valuable from being more compact, less liable to twist, and having a fine mahogany tinge. The tree is a native of Britain, and of most parts of Europe, on moist soils by rivers; and it is readily propagated by seeds. There are some other European species; and two, Alnus incana, and Alnus cordifolia (the latter lately introduced from Naples), may probably prove useful as timber-trees, as they both grow on dry soils; but, from the experience which has yet been had respecting them, they can only at present be recommended as ornamental.

The lime-tree, Tilia Europæa, *L.*, is a well-known soft-wooded tree, of some value for its timber, which is used by musical-instrument makers and carvers. It is a native of Europe, and is generally propagated by layers. The blossoms produce the whitest and most delicate honey in the world. There are some American lime-trees, but they scarcely attain the size of timber-trees in England.

The horse-chestnut, Æsculus Hippocastanum, *L.*, is a rapid-growing tree in good soil; but its timber is perhaps the least valuable of the class to which it belongs, as it has

little strength, and, unless kept dry, is far from being durable; but it is useful for some husbandry purposes, such as linings to carts, wheel-barrows, &c.; and it takes a ready dye as a substitute for ebony.

The only soft-wooded trees that can be recommended for culture with a view to profit, are the white, gray, black Italian, and common black poplars, and the white and Bedford willows.

Hedge-trees and Shrubs.—Plants which are useful for forming hedges are of as great importance to the planter as those which are valuable for their timber. Almost all trees planted in rows, with the free admission of air and light on every side, will become clothed with branches from the ground upwards; and if these are occasionally cut in, they will form gigantic hedges, more or less compact; but some trees are much better adapted for this purpose than others; and among those of the first class, the best are the beech, the hornbeam, the elm, the lime, the Lombardy poplar, and the spruce fir. The best of the second class are perhaps the common birch, Sir Charles Wager's maple (Acer eriocarpum), and the evergreen oak; and the best of the third class are the common thorn, the crab, the sloe, the wild plum, the buckthorn, the barberry, the holly, and the yew. By far the best of these for British field-hedges is the common hawthorn, and the next best is the wild crab. The sloe or black thorn makes an excellent hedge; but it throws up so many suckers, that it requires constant attention to keep it within bounds. It forms, however, an excellent barrier for picturesque plantations, where it is allowed to spread itself in every direction. The holly, were it not for the slowness of its growth, would form the best of all hedges, both for gardens and fields, as its leaves are little liable to be injured by insects; and, being an evergreen, it neither harbours weeds nor vermin at its roots. Birds are also much less apt to build in it than they are in deciduous hedges. It has only two disadvantages that we are aware of, viz. the slowness of its growth, and its imperviousness to wind in the winter season. On this last account, when on damp clayey soil, it has a tendency to prevent the drying of arable lands in spring. Were holly hedges occasionally introduced among those of the common thorn, they would add very greatly to the beauty of the country in the winter season; and, on dry uplands, they would form excellent shelter for stock. The common furze sown on the top of a high bank forms an effective hedge in a short period, but it is of no great duration. On moist soils fences may be made for planting rows of willows or poplars, and in situations exposed to the sea-breeze the elder may be planted; but such fences can be hardly considered as hedges, from their want of compactness and density of foliage.

Trees and Shrubs suitable for Coppice-wood and Undergrowth.—One property required for all these plants is, that they should stole or spring up from the collar or stool when they are cut over; and the true undergrowths are only to be found among such shrubs as will grow under the shade of trees. There are a great many woody plants which may be cultivated as coppice-wood; indeed there are few of the broad-leaved trees and shrubs which will not answer for this purpose, but the locality must determine the preference. In soft, wet soils, the birch, the alder, and the apple-leaved willow, are amongst the most common and useful trees. In drier soils, the ash forms a most valuable coppice-wood, supplying handles for agricultural implements, stuff for hurdles, hoops, wattles, and a great many other useful articles. In good, deep, loamy soil, the oak forms an excellent underwood; and if the situation be at a distance from a market, it is by far the most valuable that can be employed, as the bark alone will produce a sufficient profit, and, from its portable nature, it can be sent to a greater distance than timber.

Ornamental Trees and Shrubs include by far the greater number of woody plants in cultivation; though many, perhaps the whole of them, produce wood which, when it can be obtained of sufficient size, may be applied to some useful purpose. As already observed, we exclude altogether from consideration in this article, flowering and fruit-bearing trees and shrubs. We also exclude all those that are rather delicate, or require particular kinds of soil; and shall confine ourselves to trees and shrubs which are considered ornamental from their general form, and which may be introduced into the margins of ordinary plantations in most parts of Britain. We shall arrange these under the heads of evergreen and deciduous.

Evergreen ornamental Trees and Shrubs.—The most ornamental of these, and one which will thrive in every part of Great Britain, is undoubtedly the cedar of Lebanon. It is somewhat delicate when young; but, if brought forward in pots, placed where it is finally to remain when of the height of eighteen inches or two feet, and carefully planted, and protected from cattle and vermin, it soon makes a vigorous growth, and becomes a handsome tree, even in the Highlands of Scotland. The seeds of the cedar of Lebanon, when left in the cones, retain their vitality for a number of years; the cones are sometimes imported from the Levant, but more generally obtained from English trees. Where proper care can be bestowed on the seeds and the soil, it would be an improvement to sow them where they are finally to remain; because the cedar, and all the pine and fir tribe, depending principally on their surface-roots, suffer more from confinement in a pot, or transplanting from the open nursery, than trees having powerful tap-roots. The Deodar cedar differs in general aspect from the cedar of Lebanon, in having foliage of a whitish or glaucous hue. It appears to be as hardy as the other, and will probably soon become as common. Cones are imported from the Himalaya Mountains, where the tree is indigenous; or it may be grafted on the common cedar, or raised from cuttings. All the pine and fir tribe may be described as highly ornamental, and a great many of them will endure the open air in the coldest parts of Britain. The Weymouth pine, Pinus Strobus, is a very hardy ornamental tree; and still more so is the Pinus Cembra, which is of slow and erect growth, and retains the beauty of youth longer than any other pine. The Pinus excelsa is a very hardy and very ornamental species, but it is at present rare. Pinus Banksiana, and P. inops, are curious and very ornamental species. Some of the Californian pines, particularly P. ponderosa and P. Sabiniana, appear to be quite hardy. Among the ornamental spruce firs may be mentioned Abies Smithiana (A. Morinda, *Hort.*), a native of the Himalayas, which closely resembles the common spruce, and is apparently as hardy; it is readily propagated by cuttings, and by herbaceous grafting on the common spruce; and the trees already planted will probably very soon produce cones. The largest tree of this species in Britain is probably that at Hopetoun House, near Edinburgh. The Douglas fir, Abies Douglasii, is a very handsome tree, apparently as hardy as the common spruce, but differing in the dark-green colour and somewhat two-rowed disposition of its leaves, from which it appears intermediate between the common spruce and the silver fir. It has already attained the height of eighteen or twenty feet in different parts of Britain, and has produced cones. The Cephalonian fir, Abies Cephalonica, *Arb. Brit*, is a very handsome tree of the same kind, and of recent introduction; and which, having withstood the winter of 1837–38, is probably hardy enough to become an ornamental British tree. It is very readily propagated by cuttings, and cones might doubtless be imported from Cephalonia. The black and white spruces of North America are well known ornaments in our shrubberies; and there are some Californian species, such as Abies

Menziesii, which will probably soon be added to their number. The hemlock spruce (Abies Canadensis, *Mich.*) is one of the most ornamental of fir-trees; it is very hardy, and ripens seeds in different parts of England. One of the finest specimens is at Strathfieldsaye, in Hampshire, the seat of the Duke of Wellington. Among the ornamental silver firs, the first in point of grandeur is the Picea Webbiana, *Arb. Brit.*; but, even in the climate of London, it suffers so much from the spring frosts, that it is doubtful whether it will ever become a very ornamental tree in England. Nevertheless, though the severe winter of 1837–38 seriously injured this tree, it did not kill it; and probably, as it increases in age, it may be later in protruding its young shoots, and thus be more likely to escape the spring frosts. Even the silver fir, which attains the height of 100 feet and upwards in many parts of Britain, is yet frequently injured by frosts during the first twenty years of its growth. Picea pichta Fraseri, and some other species and varieties, natives of Siberia or North America, are as hardy as the balm of Gilead fir, Picea balsama, *Arb. Brit.* The Chili pine, Araucaria imbricata, is a noble tree in its native country, and appears to be much hardier in the climate of Britain than has generally been imagined. Young plants which have been two or three years established in the open ground passed the severe winter of 1837–38 without any injury, which renders it not improbable that it may ultimately prove as hardy as the common cedar. The evergreen oak, Quercus Ilex, *L.*, is a hardy evergreen tree, of which there are several varieties. It is readily propagated from its acorns, which are ripened in abundance in this country, or may be imported from the Continent. It will thrive in any deep dry soil, and forms excellent hedges, or shelter to a dwelling-house. The cork-tree, Quercus Suber, *L.*, is of a corresponding character, but rather more tender. The holly, the common yew, the Irish yew, and the box-tree, are evergreens universally known and admired. They are perfectly hardy in every part of Britain, and deserve a place in every plantation.

The Portugal laurel and the common laurel form very ornamental trees, or large shrubs; and, from their glossy foliage, they are particularly beautiful in winter. The alaternus and the phillyrea form large bodies very ornamental. The arbor vitæ, of which there are two species, is very hardy, and forms a permanent fastigiate low tree. The red cedar, Juniperus Virginiana, *L.*, the Phœnician juniper, and some other species of juniper, are at once hardy and ornamental. The cedar of Goa, Cupressus lusitanica, *L.*, is a beautiful evergreen, with glaucous foliage, but somewhat tender; nevertheless, in Ireland it has attained a great size. The common cypress, Cupressus semper virens, *L.*, grows vigorously in the central districts of England, but scarcely thrives in the northern counties. The Arbutus is one of the handsomest of evergreens, and is admired for its flowers and fruit, no less than for its foliage and general form. There are several varieties and species which endure the open air in the climate of London, but which are found rather tender farther north. The sweet bay, Laurus nobilis, *L.*, forms a bushy low tree in the climate of London, and in the south of England has attained the height of sixty feet; but it suffered much from the severe winter of 1837–38, and may be considered, on the whole, as rather tender.

Sub-evergreens are trees which retain their leaves through the winter in a green state, and drop them late in spring, immediately before the development of the new leaves. The principal British trees of this description are certain varieties of the Turkey oak, and more especially the Fulham oak, and the Lucombe oak. These are trees of the first rank, and in the central districts of England become magnificent objects. Turner's oak, Quercus Turneri, is also sub-evergreen, and forms a handsome tree of the second size. Quercus virens, the live oak of America, forms a sub-evergreen tree in the climate of London, but farther north it is to be feared that it will be found rather tender.

The common privet, especially when cultivated in good soil, becomes a sub-evergreen bush, and, when trimmed to a single stem, a handsome small tree; and to it might be added some others, such as Cratægus Mexicana, Photinia serrulata, Berberis aristata, Aristotelia Macqui, and Cotone aster frigida, affinis, acuminata, and nummularia, all of which are quite hardy in the climate of London, and also in Ireland, but rather tender in the north of England, and in some parts of Scotland.

Deciduous ornamental Trees and Shrubs.—We shall notice the hardiest of these in the order in which they occur in the natural system. Magnolia acuminata is perhaps the only species of Magnolia that can be considered truly hardy in most parts of Britain; and, from its large leaves, and curious greenish-blue flowers which afterwards change to yellow, it well deserves a place either on the lawn, or in the margin of plantations. M. cordata, tripetala, and conspicua, are quite hardy in moderate climates; but M. conspicua flowers so early that it is apt to be injured by spring frosts. The tulip tree, Liriodendron Tulipifera, *L.*, forms a tree of the first rank in the climate of London, and attains a considerable size in the milder parts of Scotland; for the beauty of its foliage, independently altogether of its flowers, it deserves a place in every collection. The Hungarian or white-leaved lime-tree, Tilia Europæa alba, *Arb. Brit.*, is a tree of the second rank, of very great beauty, and nearly as hardy as the common lime-tree. From the effect of its mass of white foliage among the green leaves of other trees, it becomes useful for breaking formal lines, directing attention to particular objects, or harmonizing white buildings with verdant scenery. The red-wooded and yellow-wooded lime-trees are very ornamental, and also the cut-leaved variety. The American limes are sufficiently hardy to attain the size of trees in the climate of London, and, from their leaves being much larger than those of the European limes, they are very ornamental. The maple, Acer, *L.*, is a genus which contains some of the finest ornamental trees that occur in British plantations. They are all valuable for coming early into leaf and early into flower, as well as for the many angled forms of their leaves, and the beauty of their buds. The variegated leaved varieties of the common sycamore form very ornamental objects, but, like all variegated leaved trees, their greatest beauty is in spring, when the leaves first expand. The variety with white striped leaves is well known, and is very generally planted; but the yellow-leaved variety, or Corstorphine plane, though by far the most beautiful, is scarcely known, except in the neighbourhood of the original tree. The purple-leaved variety is a very striking one, having the under surface of the leaves, more especially when they first come out in spring, of a dark purple. The hairy fruited, or Sir Charles Wager's maple, Acer eriocarpum, is a very elegantly shaped tree, with beautifully cut leaves, and conspicuous reddish flowers, which appear in February; it ought never to be omitted in plantations having the slightest pretensions to ornament. The red flowering or scarlet maple, A. rubrum, resembles the last tree in foliage; but its flowers are of a much darker red, and the tree is of less vigorous growth. In autumn the leaves die off of an intensely deep red, insomuch that the tree attracts attention even at the distance of a mile or two. Where it thrives, it may certainly be considered as the most ornamental of all the maples. A. Tataricum and spicatum are low trees, the first a native of Tartary, and the last of North America; they are remarkably hardy, come early into flower, and their keys and leaves die off of a fine yellow or red. The snake-barked maple, A. striatum, is a beautiful tree, whether

we regard its leaves or its bark; it is a native of Pennsylvania, and therefore quite hardy in Britain. A. macrophyllum, the large-leaved maple, is a remarkably fine tree, with leaves sometimes nearly a foot in diameter; it appears to be as hardy as the common or the Norway maple, and its growth when young is very rapid; though, having been only lately introduced from North America, it is as yet scarcely known in Europe. The Norway maple, A. platanöides, is so hardy that it might almost be considered as a timber-tree; but being inferior in this respect to the common maple, it, and its different varieties, are more generally to be ranked as ornamental. The sugar maple, A. saccharinum, in Britain, is one of the most tender North American maples; it bears a close resemblance to the Norway maple, and, like it, its foliage dies off of a very rich yellow. A. obtusatum, a native of Hungary and of Calabria, is a remarkably fine vigorous-growing tree, bearing a considerable resemblance to the sycamore, Acer Pseudo-Platanus. A. Opalus is a very handsome small tree, with round, coriaceous leaves, finely cut at the edges; this tree is little known and seldom planted, though few objects are better adapted for a small lawn. The round plaited-leaved maple, A. circinatum, is a rare species from North America; but one of great beauty of foliage, and apparently quite hardy. A. Monspessulanum is a small tree of great beauty, and in some situations sub-evergreen. The common or field maple, A. campestre, is one of the hardiest and most beautiful of small British trees: the most ornamental tree of this species is the Austrian variety, A. campestre Austriacum, *Arb. Brit.*, which forms a beautiful single object on a lawn, and also very good garden hedges. The Negundo, or box-elder, Negundo fraxinifolium, *Dec.*, a native of North America, is a beautiful tree, with its leaves cut in the manner of those of the ash, and a fine, smooth, dark-green bark. The foliage, when it first appears, is of a fine yellow, and when mature it is of a pale green. It is a desirable object, as a single tree, or in the margin of plantations. The different species or varieties of the horse-chestnut are all trees remarkable for the beauty of their foliage, but more especially for that of their flowers. The common species is known to every one, but the scarlet and red flowered varieties, and the yellow and pale flowered kinds, all comparatively of recent introduction, only require to be seen to be ardently desired by all lovers of trees. The pavias, or smooth-fruited horse-chestnuts, are much smaller trees than the rough-fruited kinds, and they are all extremely beautiful. P. rubra, flava, discolor, hybrida, neglecta, macrocarpa, and macrostachya, deserve to be in every collection. Kœlreuteria paniculata, a native of China, is a hardy tree, very ornamental from its foliage as well as its flowers. There are fine specimens both in England and Ireland, yet the tree is not generally met with in pleasure-grounds. The toothache-tree, Xanthoxylum fraxineum, is a small tree or large shrub, a native of North America, hardy and ornamental both from its foliage and flowers. The same may be said of the shrubby trefoil, Ptelea trifoliata. The ailanto, Ailantus glandulosa, is a native of China, but perfectly hardy in most parts of England. It forms a stately tree of the first rank, with a straight trunk, ample head, and magnificent foliage, the leaves, which are compound, being sometimes three feet in length. In some parts of France it is planted as a timber-tree, and is found to thrive particularly well on chalky soils. The bladder-nut tree, Staphylea, *L.*, is a hardy bush, which may be trained to a very handsome low tree, ornamental from its foliage, its white flowers, and its curious bladder-like capsules. There are two species, S. trifoliata and S. pinnata, both deserving a place in the shrubbery. The spindle-tree, Enonymus, *L.*, is a genus of which there are several species, quite hardy, and singularly ornamental when in fruit. The common spindle-tree, E. Europæus, and the broad-leaved spindle-tree, E. latifolius, are the handsomest hardy species of the genus, and, when trained up to single trees on a deep loamy soil, with ample space, they form in autumn, when their capsules are ripe, objects altogether unique in the arboricultural world. Though these species are commonly seen as shrubs drawn up among others, or growing in hedges, and forming bushes perhaps not more than six or eight feet in height, yet, when properly treated, they will form trees thirty feet high, as may be seen in some of the London gardens, and even as far north as Forfarshire, where the spindle-tree produces a timber much sought after by coopers. The different varieties of the common holly are so well known for the beauty of their foliage, that the reader only requires to be reminded of them. The Minorca holly, Ilex balearica, and the opake-leaved holly, I. opaca, are very handsome kinds, which ought not to be forgotten. The winter-berry, Prinos, is a deciduous shrub, a native of North America, which, like the holly, produces fine scarlet berries, and retains them through the winter. There are several species, all quite hardy, and one or more of them deserve a place in every collection. Christ's thorn, Paliurus aculeatus, is a native of Asia, and is used as a hedge-plant in the north of Italy. It is altogether a most elegant bush or tree, there being something quite unique in its branches, bark, and thorns, which are very numerous; and in its leaves, flowers, and seeds. The buckthorn, Rhamnus, is a hardy genus of shrubs or low trees, of which there are many species; but we shall confine ourselves to those which are decidedly hardy. Rhamnus Alaternus is a well-known evergreen, of which there are varieties having broad and narrow leaves, and leaves blotched or variegated with yellow, and also with white. R. hybridus, a native of France, is a sub-evergreen, resembling the alaternus. R. catharticus, the purging buckthorn of Britain, and the white thorn of the modern Greeks, forms a very hardy and handsome small tree. R. alnifolius, alpinus, and frangula, are also very handsome small trees; and there are several other species which, if they can be procured, well deserve a place in the shrubbery. R. latifolius, a native of the Azores, is a very handsome kind, and quite hardy both in the gardens of London and Edinburgh. The different species of rhus are very hardy and very ornamental. R. Cotinus is a particularly interesting object when its seeds are ripe. R. typhina, viridiflora, and glabra, are curious from the stag's-horn appearance of the ends of the branches; and their leaves, before they drop, assume a fine yellow, rich scarlet, or dark-red hue. Sophora Japonica forms a splendid tree in the climate of London, and there is a pendulous-branched variety which is very ornamental. One property of this tree is, that in dry and warm seasons, when the leaves of most other trees become of a paler green than usual, those of this tree assume a darker hue. Virgilia lutea is a North American tree, with fine large foliage, hardy in most parts of Britain; and, in America, valued for the yellow colour of its wood. The laburnum has already been mentioned both as a useful and an ornamental tree. The purple laburnum is a hybrid between the Scotch laburnum and the Cytisus purpureus, of vigorous growth, but more curious than beautiful. Robinia viscosa is a variety of the false acacia, or locust-tree, with a glutinous bark, and flowers slightly tinged with pink. It is a beautiful object, both in foliage and when in blossom, and is as hardy as the common robinia or locust. There are a number of other varieties of Robinia pseud-acacia, and in particular the parasol-acacia, all of which are very ornamental. The rose-acacia, Robinia hispida, of which there are several varieties, is highly prized for its rose-coloured flowers. The Siberian pea-tree, Caragana arborescens, and a number of other varieties or species of Caragana, are all very ornamental, and quite hardy; and the same may be said of the salt-

tree, Halimodendron, and of the different species of Colutea, or bladder-senna. The three-thorned Gleditschia, or honey-locust, Gleditschia, *L.*, is a genus of which there are seven species in cultivation in British nurseries, besides varieties. Some of the Gleditschias attain the size of trees of the first rank, and others are middle-sized or small trees; but they are all deserving of culture, on account of the beauty of their foliage, and their very remarkable spines. The Kentucky coffee-tree, Gymnocladus Canadensis, is a curious-looking object in winter; but in summer it is clothed with a magnificent foliage. It is a native of Canada, easily propagated by cuttings of the roots, and consequently hardy enough for any part of Great Britain; though, strange as it may appear, it is far from being common in collections. The Judas trees, Cercis Siliquastrum and Canadensis, are very handsome small trees, both when in leaf and in flower; the flowers have an agreeable acid, and they are used in Paris in salads, and fried in batter for fritters. The almond, the peach, the apricot, the plum, and the cherry, in their single or comparatively wild state, and also the varieties of these species having double flowers, are fine ornamental objects in plantations or on lawns, and are quite hardy. Cerasus semperflorens and serrulata, the Allsaint, and Chinese double-blossomed cherries, are very desirable ornamental trees. The perfumed cherry, Cerasus mahaleb, is a most valuable tree, coming early into flower, diffusing its odour in every direction, and soon afterwards becoming covered with berries, which are generally of a glossy black, but in some varieties yellow. The bird-cherry, Cerasus padus, is a native of the woods both of Scotland and Sweden, and one of the most ornamental of low trees when in flower. Its beautiful spikes of white blossoms are succeeded by black or red fruit, which is very ornamental while it remains on the tree, but when ripe is soon devoured by birds, by whom it is greedily sought after. The Cornwall bird-cherry, Cerasus padus rubra, and the pendulous branched bird-cherry, Cerasus padus bracteosa, are interesting varieties. C. Virginiana, serotina, and capollin, are species of bird-cherry resembling one another, surpassing the European bird-cherry in the smoothness and glossiness of their foliage, and equaling it in the beauty and profusion of their flowers. C. Virginiana is so hardy, and produces fruit in such abundance, that in some parts of England it may be considered as naturalized, having come up in the native copses from seeds carried thither by the birds from artificial plantations. There are about twenty other species of Cerasus, all quite hardy; and though some of them are of very humble growth, and adapted for planting on the faces of rocks, rather than amongst other shrubs, yet they are all deserving of culture.

The genus Cratægus consists of twenty-eight species, and about double that number of varieties, each of which forms a beautiful small tree. There is not perhaps any other genus of hardy ligneous plants in which so many beautiful small trees are to be found. They are all remarkable for having an irregular, picturesque character of outline, and for assuming this character at the growth of even five or six years. They all come into flower at an early age, produce flowers profusely, and all ripen abundance of fruit. The flowers are, for the most part, white and fragrant, but in some varieties they are tinged with red and purple; and in one, the scarlet hawthorn, C. oxyacantha rosea, they are of a fine rose colour. The flowers appear at various periods from March till the middle of July; and one variety, the Glastonbury thorn, often comes into bloom at Christmas. The earliest flowering species are Cratægus purpurea and nigra, and the latest C. cordifolia and Virginica. The colour of the fruit is for the most part red, as in the common hawthorn; but in some it is yellow, as in C. Aronia; black, as in C. nigra; or greenish-yellow, as in C. Mexicana. In C. coccinea the fruit is large, and of a scarlet colour. In C. Douglasii it is of rich glossy purple-black; and in C. orientalis sanguinea, *Arb. Brit.*, it is of an intensely deep port-wine colour. Of the common hawthorn of our hedges, C. oxyacantha, *L.*, there are no fewer than thirty recognised varieties, each of which would form a very beautiful and distinct tree. One of the varieties has the fruit white, another has double white flowers, another, C. oxyacantha phœnicea flore pleno, double red, another a fine single pink. One has black fruit, another yellow, and a third white. In one the entire tree takes the upright narrow form of a cypress, and in another the branches are pendulous, like those of the weeping willow; one has leaves like those of the oak, another leaves like those of the fern, and so on. All the species of Cratægus may be readily propagated by grafting them on the common thorn, by which means, when stocks standard high are used, they become trees fit for planting out where they are finally to remain, at the end of the third season. The species may be propagated either by grafting, by seeds, or by cuttings of the roots. Much ornament might be conferred on the country, and especially on the roads which pass through a hedged estate, if the proprietor were to allow some thorns in his hedgerows to grow to the average height of two or three feet above the top of the hedge, and at that height to bud, or graft these with some of the more tree-growing of the ornamental species. Cotoneaster frigida, affinis, acuminata, and nummularia, are Nepaul small trees of very great beauty, both on account of their foliage and their fruit; so much so, that though we have already mentioned them under the head of sub-evergreens, we have here repeated their names. Amelanchier vulgaris, Botryapium, sanguinea, ovalis, and florida, are very beautiful low trees, which bear a profusion of white flowers early in spring, and are succeeded by brown or black berries, which, though commonly left to the birds, are not disagreeable to eat. The common medlar, and Smith's medlar, Mespilus Smithii, *Dec.*, M. grandiflora, *Hort.*, are ornamental trees: the former is valued also for its fruit, and the latter for the profusion of white blossoms with which it is covered in April. There are a great many very ornamental species and varieties of the genus Pyrus, which is now so far extended as to include species formerly considered as belonging to Sorbus, Cratægus, Mespilus, &c. P. nivalis, sinaica, salicifolia, elæagnifolia, and amygdaliformis, may be considered as white woolly-leaved varieties of the common wild pear, and P. sinensis as a distinct variety of the common cultivated pear. P Bollwylliana appears to be a hybrid between the apple or crab, and Pyrus Aria. P. variolosa, a native of Nepaul, is a remarkable tree, with leaves sometimes like those of the common cultivated pear, and at other times cut, like those of Pyrus spuria sambucifolia. Pyrus prunifolia, baccata, and Astracanica, are crab-apples with handsome blossoms and small beautiful fruit; and there are a number of sub-varieties, which may be obtained in the nurseries. Among these, the white astracan or transparent crab of Moscow, the supreme crab, and Biggs's everlasting crab, deserve the preference. P. coronaria, and P. angustifolia, are American wild apples, with sweet-scented flowers. P. spectabilis, a native of China, but quite hardy, is remarkable for its showy pink and white blossoms, which are produced in great profusion. P. Aria, the white-beam tree, and all its varieties, deserve culture, as compact, low, or small trees; P. vestita, a native of Nepaul, is remarkable for its large woolly foliage, which dies off of a fine yellow. P. torminalis, though indigenous, is a most ornamental tree. Pyrus Sorbus, and all its different varieties, are very ornamental. Pyrus spuria, a native of Kamtschatka, forms a very beautiful little tree, with a profusion of white flowers and black fruit; and Pyrus arbutifolia, Mespilus arbutifolia, *L.* with its varieties, melanocarpa, floribunda, and depressa, are beautiful low shrubs, and, when grafted standard high on the common thorn, form very ornamental objects, whether in blossom, when covered with their fine dark fruit, or when

their leaves are dying off, and have become of an intensely dark red, shaded with yellow and purple.

The common and Chinese quinces form handsome low trees; the former more particularly so when in flower and fruit, and the latter when in full leaf. The Japan quince, Cydonia Japonica (Pyrus Japonica, *L.*), is well known as one of the most ornamental spring-flowering shrubs in cultivation. Hamamelis Virginica, the Wych hazel, is valuable from its beginning to flower in November, and retaining its blossoms till February or March: though rarely seen in collections, it is very hardy, and forms a very handsome small tree. The different species of dogwood are ornamental, and, with the exception of C. florida, quite hardy. C. alba sibirica has the shoots of a fine scarlet colour, and is singularly ornamental in the winter season. The common elder, Sambucus nigra, will thrive, and form a handsome low tree, in a variety of situations, where many other trees and shrubs will scarcely grow: on a mountain side, and in the coal-smoke of cities or factories. There is a very handsome variety with cut leaves, one with white fruit, and another with green fruit. S. racemosa is a native of Spain, which grows vigorously in this country. The leaves are finely cut; and the fruit, with which it is generally profusely covered, is of the most brilliant scarlet: being very little known among gardeners, it is scarcely ever seen in collections. The different species of Viburnum are hardy, and all more or less ornamental, both when in flower and in fruit. The leaves also die off of a fine yellow-red, sometimes tinged with purple. V. Lentago, pyrifolium, prunifolium, and nudum, when trained to a single stem, form compact-growing, neat, little trees. The common wayfaring tree, V. Lantana, and the American wayfaring tree, V. lantanoides, form very neat bushes. V. Opulus is well known as the Guelder rose; and the American variety, V. O. oxycoccos, has fruit as large as the cranberry, which is used in America for the same purpose; as is the fruit of V. O. edule, another American variety. The fly-honeysuckle, Lonicera xylosteum, and the Alpine upright honeysuckle, Lonicera alpigena, are the only two species which are sufficiently woody and large to be noticed in this selection; the other species belong to flowering shrubs. The snow-drop tree, Halesia tetraptera, is one of the hardiest of North American trees, and, when in flower, one of the most beautiful: it ripens abundance of seeds in this country, by which it is readily propagated; so much so, that in some parts of England it is, like the American bird-cherry, naturalized in the copses. It is rarely to be met with in Scotland, though few trees so well adapted for the climate of that country are so ornamental. The date-plum, Diospyros Lotus, though it ripens fruit as a standard in the climate of London, is perhaps rather tender for the northern counties; but where the climate is moderate, it forms a very beautiful small tree. The Virginian snow-flower, or fringe-tree, Chionanthus Virginica, is nearly as hardy as the snow-drop tree; and when planted in a moist soil, and trained to a single stem, its head is ornamental from its large, deep-green foliage, independently of the fine, white, fringe-like flowers which are suspended from the axils of the leaves. The common purple and the common white lilacs, Syringa vulgaris, and S. vulgaris alba, are very hardy, and make very neat small trees when trained to a single stem. The common ash is the parent of several varieties which are very ornamental. One of the oldest of these is the simple-leaved ash, of which there is a variety lately discovered in Ireland, with the leaves variegated. The pendulous-branched or weeping ash is a well-known variety, as are the yellow barked and the striped barked. There are several other varieties not in our opinion worth cultivating, though from these we except F. excelsior parvifolia, F. e. p. argentia, and F. e. p. oxycarpa. The lentiscus-leaved ash, F. Lentiscifolia, is an elegant tree; and there is a pendulous variety of it, which forms by far the most graceful tree of the genus. There are several species or varieties of American ash, very ornamental in their foliage, most of them hardy in the climate of London, but few of them adapted for the northern counties. The flowering ash, Ornus Europæa, is a very handsome tree, nearly as hardy as the common ash, and it ought on no account to be omitted in ornamental plantations. Few trees have a finer effect when standing singly on a lawn. Catalpa syringæfolia is a splendid tree when in flower: it attains the height of thirty or forty feet, and sometimes ripens its seeds in the climate of London; but in the northern counties it seldom does much good. It is one of those trees which will bear an immense deal of cold in winter, provided there has been heat and bright sunshine enough in summer to ripen its wood. The tupelo tree, Nyssa, is nearly as hardy as the Diospyros Lotus, and is more beautiful than that tree in autumn, when its leaves change to an intensely deep rich scarlet. The Oleaster or wild olive, and the Hudson's Bay olive, Elæagnus hortensis and argentea, are handsome silvery-leaved low trees; the former, however, rather tender, and the latter rather shrubby. The sea-buckthorn is a very handsome and a very hardy willow-leaved little tree, which has the great advantage of standing the sea-breeze without injury. Hippophæ salicifolia, a native of the mountains of Nepaul, is of more vigorous growth than the European sea-buckthorns, and appears to be nearly as hardy as they are. Shepherdia argentea, the Missouri silver-tree, is an elegant silvery-leaved tree, a native of North America, where it produces an edible fruit: it forms a suitable companion to Hippophæ and Elæagnus, which are also more or less silvery in their foliage. The black, the white, the red, and the tartarian mulberries, are all ornamental trees, but rather tender in the northern counties. The paper mulberry, Broussonetia papyrifera, is an interesting object, but more tender than the common mulberry. Maclura aurantiaca, the American bow-wood, or Osage orange, is a tree of very vigorous growth in the climate of London; but as it continues growing till late in the season, its wood is often not ripened so far as the points of the shoots, and the tree is therefore probably unfit for those parts of the island where the atmosphere is almost constantly charged with fog. The elm comprises many ornamental species and varieties. Of the English or narrow-leaved elm, those which we prefer are U. campestris viminalis, U. c. foliis variegatis, and U. c. virens. U. c. planifolia, and U. c. chinensis, are very beautiful as elms, but difficult to procure. Ulmus effusa is, in our opinion, by far the handsomest species of the European elms when it is in a young state; but it does not grow up to a handsome tree. The most beautiful variety of Scotch elm is the weeping elm, Ulmus montana pendula, which is remarkable for the vigour of its growth, and the picturesque manner in which its branches are thrown about. There are some American elms which are tolerably hardy in the climate of London, but which cannot be recommended for colder districts. Planera Richardi is an Asiatic tree, and attains the first rank even in the climate of London, where it sometimes ripens seeds; it deserves a place along with the elms, and along with the southern and eastern nettle-trees, Celtis australis and Tournefortii. The common walnut-tree, Juglans regia, though it becomes a tree of the first rank in the climate of London, and is cultivated for its fruit both there and in Devonshire, yet in the north has generally the points of its young shoots blackened by the spring frosts. Of the willow there are a great many species and varieties, all of which are highly ornamental when in flower. Of these we may recommend the almond-leaved willow, S. amygdalina; the sweet-scented bay-leaved willow, S. pentandra; the weeping willow, S. Babylonica; the golden willow, S. vitellina; and the purple-barked willow, S. atropurpurea. The pop-

lar genus contains several ornamental species. The first we shall mention is Populus tremula grandidentata, *Arb. Brit.*, the North American large aspen, of which there is a pendulous branched variety. P. heterophylla is an American poplar, little known and rarely met with in British nurseries. The balsam poplar, P. balsamifera, is one of the earliest trees, which sends out its leaves in spring; and it and the Lonicera Tatarica, in the climate of London, are found clothed with leaves a week or a fortnight sooner than any other tree or shrub whatever. The leaves of the balsam poplar, when they first come out, are of a rich yellow, and they perfume the air with their fragrance for some distance around; as the summer advances, they become darker, till in the autumn they are of a black or bluish green. It may give some idea of the extreme hardiness of this tree to mention, that Captain Franklin found it as far north as the Great Slave Lake; and that the greatest part of the drift-timber which he observed on the shores of the Arctic Sea was of this species. It is one of those poplars that send up suckers, and it is consequently readily propagated by cuttings of the roots. It prefers a moist soil, and though the Cree name for this species means ugly poplar, yet when full grown on such a soil, it forms a very massive round-headed tree, which at a distance might be mistaken for an oak or a chestnut, as is proved by two fine specimens in the grounds at Syon. The Ontario poplar, P. candicans, bears a close general resemblance to the balsam poplar; it has the rigid fastigiate habit of that tree, the same habit of sending out its foliage before all other poplars, its fine fragrance, and its property of throwing up suckers from the roots; but it differs from the balsam poplar in having very large heart-shaped leaves. It is rather more difficult to propagate than the balsam poplar, and, in British nurseries, is commonly raised from layers. The genus Alnus, the alder, contains some very ornamental trees. A. glutinosa laciniata has finely-cut foliage, and, what is remarkable, is in general a more free-growing tree than the species. A. cordifolia is a native of Calabria, and by far the handsomest species of the genus. We have already mentioned it as probably fit to be grown for its timber. A. incana, the hoary-leaved alder, is a very handsome tree, and has the advantage of preferring dry soil. A. oblongata, serrulata, undulata, and viridis, are low trees or large shrubs, quite hardy, and deserving of introduction into collections. The birch is a genus of which the greater number of species are natives of North America; and, though they are valuable timber-trees there, none of them in this country have yet proved anything more than ornamental. The finest American species is B. nigra, distinguished by the beautiful paper-white of its bark, which cracks, separates into thin laminæ, and rolls up, even when the tree is young and only two or three inches in diameter. B. populifolia is a handsome species, very much resembling the common birch, and in our opinion only a variety of it, as are B. pubescens, urticifolia, pontica, Dalecarlica, and others. There is a cut-leaved, pendulous variety of the common birch, which is very ornamental. The paper-birch, B. papyracea, is a fine tree; as are B. glandulosa and B. Däurica. B. fruticosa, pumila, and nana, are shrubs.

Of oaks there are upwards of forty species introduced into British gardens; the greater number of them, with many varieties, being purchasable in British nurseries. All these, with the exception of the two varieties of the common oak and the Turkey oak, may be considered as solely or principally ornamental. Of the common oak, Q. pedunculata, there are three varieties, very distinctly marked, viz. the cypress oak, Q. p. fastigiata; the weeping oak, Q. p. pendula; and the cut-leaved oak, Q. p. heterophylla. These three varieties often ripen acorns, and of the plants raised from them a number are found to have the same habit as the parent. There are several varieties of Q. sessiliflora, which differ in the size of the acorns, in the size of the leaves, in the greater or lesser degree in which these are cut, and in the presence or absence of pubescence; none of these varieties, however, have yet been propagated by the nurseryman, excepting Q. s. pubescens. The Pyrenæan oak, Q. Pyrenaica, is a very handsome and distinct species, of low growth. Q. Apennina is also a low tree. Q. Esculus, the Italian oak, is a tree under the middle size, which thrives well, and ripens its acorns in the climate of London: there are fine specimens at Whitton Park. Of the Turkey oak, Quercus Cerris, there are ten or twelve very distinct varieties. The first of these is the pendulous variety, the next the Austrian, then the Ragnal, the Fulham, and the Lucombe. Of the latter there are five very distinct sub-varieties, all sub-evergreen, and all well deserving of culture wherever the common Turkey oak will thrive. Quercus Ægilops, the Velonia oak, thrives in the climate of London; but is probably too tender for the northern counties. The American oaks, which are deciduous, may be classed as the white, red, black, and willow oaks. The white oak best worth cultivating in Britain as an ornamental tree is Q. alba; but Q. olivæformis and macrocarpa are remarkable for their fruit, and Q. obtusifolia and lyrata for their leaves. The chestnut oak, Q. Prinus, and its several varieties, also deserve culture: the leaves of these oaks resemble those of the sweet chestnut, and the species is to the other deciduous American oaks what Q. sessiliflora is to the deciduous oaks of Europe. Q. alba bears the closest resemblance to Q. pedunculata, and may be considered as being the American form of that species. All the red oaks are beautiful in the form and colour of their foliage; and some of them attain the size of timber-trees in Britain, though their wood is of little value either here or in America. Q. rubra, and coccinea, and tinctoria (the Quercitron), are perhaps the most ornamental; and Q. palustris is the hardiest, the most rapid growing, and the handsomest in point of general form. The black American oaks are all remarkable trees. The black-jack oak, Q. nigra, *L.*, is the most extraordinary species, from the very singular form of its leaves; and next to it is Q. aquatica. Q. ilicifolia, heterophylla, and agrifolia, belong to this division. The willow oaks, Q. Phellos, imbricata, and laurifolia, have entire leaves, which die off without changing colour; and this group may be considered the least ornamental of the American oaks.

The American hornbeam, Carpinus Americana, and the common and Virginian hop hornbeams, Ostyra vulgaris and Virginica, deserve a place in collections, more especially the hop hornbeams, from the singular appearance of their fruit. Of the common hazel there are some ornamental varieties, such as that with purple leaves, and another with cut leaves. The Constantinople hazel, Corylus Colurna, forms a very handsome middle-sized tree; and C. rostrata and Americana are hardy, and well deserving a place in ornamental plantations. The oriental and occidental planes are highly ornamental trees of the first rank, and Platanus Orientalis acerifolia, *Arb. Brit.*, and P. O. cuneata, *Arb. Brit.*, are fine varieties, the latter forming a curiously-twisted low tree. The Liquidambar is a splendid tree, remarkable for the beauty of its foliage and its refreshing fragrance. Liquidambar imberbe is a small tree, also very ornamental. The Ginkgo or maidenhair tree, Salisburia adiantifolia, *Sm.*, is remarkable for the singularity of its foliage: it is a native of China, but is quite hardy in most parts of Britain; and it is propagated without difficulty by cuttings made in autumn. Of the larch there are some species and several varieties, which are chiefly ornamental; those best deserving of culture are L. Europæa pendula, L. Americana pendula, and L. Americana rubra. The deciduous cypress is rather tender in the northern parts of the island; but in the climate of London, when planted where its roots are within reach of water, it forms a magnificent tree of the first rank.

III.—*The Nursery Culture of Trees.*

We have now gone through the whole of the hardy trees and shrubs of Britain, and have indicated those which we think best deserving of culture, where the objects are either timber-produce or general effect, and where no extraordinary care is proposed to be bestowed on the soil. The reader cannot fail to be surprised at the very small number of species which merit to be planted for the sake of their timber, and at the great number which we have enumerated as ornamental. That number would have been more than doubled had we included the flowering shrubs, and such foreign trees and shrubs as will only thrive in the southern parts of the island; but we have confined ourselves as much as possible to those which will thrive both in the climate of London and in that of Edinburgh. It must be recollected that all the ornamental trees produce timber of some sort; and some of them, such as the box, crab, common maple, &c., timber of considerable value. Every ornamental tree, therefore, may be considered a useful tree, even with respect to the wood which it produces; though, from the length of time it takes to produce that wood, it may not be a profitable tree to cultivate for that purpose. Having treated on the trees worth cultivating, we shall now enter on the subject of their cultivation.

The cultivation of trees and shrubs includes their propagation and rearing in the nursery, and their culture and management in plantations.

Nursery Culture.—A nursery is any plot of ground devoted to the propagation and rearing of trees and shrubs. To be perfect, it ought to contain the principal kinds of soil in which trees and shrubs grow, and to possess different climates, according to the countries of which the plants are natives; but as these requisites cannot be always obtained, particularly with respect to climate, all that art can do is to make the nearest approach to them that circumstances will admit. It may be laid down as a general principle, that all seeds will germinate, and all plants grow, in any kind of soil whatever, provided it contain some vegetable matter, be in a state of minute division, and be retentive, to a certain extent, of water. All plants, therefore, may be reared in a nursery containing only one kind of soil; but in such a nursery all will not be equally well reared; for some plants, such as all those which have hair-like roots (as the ericaceæ, including the heaths, rhododendrons, arbutuses, &c.), and in general all that are called peat-earth plants, will only thrive in a peaty-soil; or a soil composed of a mixture of very fine sand, and thoroughly decomposed leaves, or woody matter. Other plants, such as all those which attain a large size, and have strong tap-roots, will only thrive in deep loams or in deep fertile sands, though they will grow for a time very well in peat. A nursery, therefore, that contains the three leading soils of sand, loam, and peat, will suffice for all the purposes for which the most extensive nursery can be required; and, for raising such trees and shrubs as have been treated of in this article, a piece of ground containing sandy loam in one place, and clayey loam in another, or even sandy loam throughout, will be quite sufficient, as far as regards soil. With respect to climate, all the deficiencies which can occur in Britain may be made up by glazed frames, in which the more tender kinds can be raised; and in which those which are grown in pots can be kept through the winter. A nursery may be considered in two points of view: with reference to the nurserymen, and with reference to the climate and soil where the trees are finally to be planted. As matters stand at present, it is the interest of the nurseryman to have his nursery in a fine climate, and in deep, fertile soil, in order that he may raise large vigorous plants in the shortest possible period: but it is the interest of the purchaser to have the plants reared in a climate and soil inferior to that into which they are to be transplanted; because, when this is done, instead of the plants receiving a check from the operation of transplanting, as is usually the case, they will be improved by it. It is the interest of the nurseryman to have his nursery trenched and manured to the depth of two or three feet; in order that it may contain abundance of nourishment, and be retentive of moisture during the summer season, so as to cause the plants to produce long and vigorous shoots. On the other hand, it is the interest of the purchaser that the soil should not be cultivated to more than eight or ten inches in depth, in order that the nourishment and the moisture, and consequently the roots, may be concentrated in a very limited space; so that, when the plants are taken up, the whole of the roots may be taken up with them, which, where the ground has been trenched, is impossible, from the great depth to which they will have penetrated. It is for the interest of the nurseryman that the summer should be moist, in order that the shoots produced may be long and strong; but it is for the interest of the purchaser that the summer should be dry, in order that the shoots may be short, and thoroughly ripened; and that the roots should cease to grow early in the autumn, in order that their spongioles, having had time to harden, which they cannot do till they have ceased elongating, may receive the less injury when the plants are taken up. In short, it is the interest of the purchaser to concentrate all the forces of the plant within such limits as he can thoroughly command, that is, can take up and carry away. The advantages of thin sowing and planting to the planter, therefore, are obvious, though the reverse is for the interest of the nurseryman; as by thick planting the plants are drawn up taller and straighter, and a greater number will grow on a given surface. We are fully aware of the arguments which are opposed to this doctrine by nurserymen; viz. that the stronger a plant is, and the greater the number of its fibrous roots, the more likely will it be to succeed after being transplanted to a new situation; and that this strength of shoot, and abundance of fibrous roots, can only be produced in deep, rich soil. But we deny that this vigorous appearance in the shoots of plants is strength; and assert that, so far from a deep soil being favourable to the production of fibrous roots, it is directly the reverse. The strength of a plant, and its suitableness for being removed from one situation to another, and for growing vigorously after it is removed, consists in all its parts having arrived at maturity, in the thorough ripening of its wood, and in the completely dormant state of its fibrous roots; and these requisites, we assert, can only be obtained by concentrating the nourishment contained in the soil into a limited space, by the soil being compact, and by no more moisture being admitted to the roots than what is absolutely necessary to complete the growth of the season in sufficient time to allow of the thorough ripening of the young wood. If by any mode of culture these requisites can be obtained, together with the long and thick shoots which are produced by growing the plants in deep, rich soil, so much the better; but we contend, that, in the climate of Britain, this is impossible. If the purchasers of plants in nurseries will observe what takes place in the case of layers, as in those of the elm, the lime, the platanus, the white poplar, the vine, &c. they will see the justice of our statement. Such layers made in spring have generally at the end of the season shoots of three or more feet in length, which have continued growing till they were checked by frost; the consequence of which is, that neither the wood nor the fibrous shoots have ripened. The first year after removal, such plants make scarcely any growth; and if they survive the first year, it requires two or three years more before they are firmly established. Nearly the same thing may be said of almost all one-year grafted or budded fruit-trees, which, hav-

ing seldom ripened their wood thoroughly, from being planted in deeply trenched rich soil, and half of their roots having been left in the ground after they are taken up, are consequently obliged to be cut in when planted. These considerations show, as a general principle, the advantage of growing all plants that are to be transplanted, in such a manner as that they may thoroughly ripen their wood and roots, and so that the whole of the roots may be taken up with the plant. On a large scale, the only mode of effecting this is by having the soil shallow and rich, but not too moist. On a small scale, the same end is attained in a very complete manner by growing the plants in pots; and, were it not for the expense, this would be the best mode of growing all nursery articles. The plants, however, should not be kept too long in pots, because, when so treated, many species, after a time, acquire a stunted habit, and the roots, when the tree is transplanted, instead of being in a state to allow of their being unwound from the ball, and stretched out in lines radiating in every direction from the stool, are so long and slender, and the circulation through them is so languid, that they require to be cut off or shortened. In general, it may be observed, that a weak plant, with the wood and roots thoroughly ripened, is much more likely to thrive when transplanted, than a strong one from which a great part of the roots have been cut off; and hence, of two young Huntingdon elms, budded on the Scotch elm, one of which had been grown in a pot, and had its leading shoot only two feet long, and another which had been grown in the free soil, and had its leading shoot five or six feet long, as is often the case—the former, when transplanted where it was finally to remain, would far sooner attain the height of twenty or thirty feet than the latter. We do not expect that all commercial nurserymen will subscribe to these opinions, but private gentlemen who raise their own trees will find it their interest to attend to them. Hence those who plant in mountainous districts will always find it better to have their nurseries on the sides of the mountains than in the valleys.

Propagation.—Trees, like other plants, are chiefly propagated by seeds; but they are also increased by cuttings, layers, budding, and grafting. The timber-trees of all countries are raised from seeds, with the exception of a very few, such as the poplar and the willow, which are raised from cuttings; and some species of elms, limes, and a few others, which are raised from layers, or by grafting. The greater number of ornamental trees and shrubs are raised by some of these artificial methods; because in this country they seldom ripen seeds, and because varieties are always perpetuated by artificial modes. Thus, all the American oaks are, or may be, grafted on the common British oak. Most of the foreign acers and birches are raised by layers, most of the ornamental thorns by budding and grafting, and almost all the ornamental willows and poplars by cuttings. All plants which do not ripen seeds readily are propagated by some of these artificial modes; and that mode is preferred by the nurseryman, which, experience has proved, will produce the largest and most vigorous-looking plants in the shortest time. Thus, though more suitable plants for the planter would be produced by raising the platanus and the white poplar from cuttings, because in that case nature would adjust the tops to the power of the roots; yet, as much larger plants are produced by layers, that mode is everywhere preferred in the commercial nurseries. The lime-tree ripens its seeds in this country, and also the English elm; but large plants are much more rapidly procured in the first case by layers, and in the second by grafting. We do not say that in every case the mode by which the largest plants are most rapidly produced should give way to the slower mode; but merely that, in most cases, it would be advantageous to the purchaser that the slower mode should be adopted. According to some writers, plants which are raised from cuttings, or by any other mode than by seeds, are of less durability than seminal plants; but though this may be true, or appear so, in a few instances, it can never be adopted as a general principle; since, from all that we are taught by physiology, a bud contains as perfect an embryo of a plant as a seed: the only difference being, that the bud is more powerfully imbued with the peculiarities of the individual which produced it than the seed is. This doctrine is confirmed by experience; since the poplar, the willow, the vine, &c., have been propagated by cuttings from time immemorial, and, for any thing that is known to the contrary, possess respectively the same properties now that they did in the days of the Romans.

Propagating by Seeds.—The seeds should be collected from the handsomest individuals of the species, when they are quite mature; and they should either be sown immediately, or preserved in a place where they will undergo few changes in regard to heat or moisture, till the proper sowing season, which, in almost every case, will be the following spring. Nature, it may be observed, sows all her seeds soon after they are fully matured; that is, they drop from the tree upon the ground in autumn, or the beginning of winter, or, in the case of some trees, such as the pines and firs, not till the following spring; but as, when seeds are thus left to chance, the greater part of them are destroyed by vermin, by being placed in a condition not favourable for germination, or by imperfect or premature germination, only a moderate number of them produce plants. It is the business of art, therefore, to study what is favourable and unfavourable in nature's mode of sowing seeds, and to imitate only the former. The result of this study is, that by far the greater number of seeds may be kept with advantage from the time they ripen, till early in the following spring, that is, till February or March, and then be committed to the soil. There are a few exceptions, as in the case of poplar and willow seeds, which ripen early, and which, when sown immediately that they drop from the tree, often come up in the course of a few weeks; whereas, if they are kept till the following spring, the greater number do not come up at all; and also in the case of seeds which lie two years in the ground before coming up, such as those of the hawthorn, the holly, &c. and which may be kept till the second spring after being ripened before they are sown. In order to show the treatment required for the seeds of different kinds of trees, and the plants raised from them in the nurseries, it will be convenient to throw them into groups; and these may be as follow: the pine and fir tribe; the trees producing nuts, acorns, masts, and keys; trees producing pomes with kernels, berries with stones, berries in capsules, small seeds, leguminous seeds, and cottony or papery seeds.

The seeds of the pine and fir tribe ripen from October till January, and if the cones are allowed to remain on the tree throughout the winter, the seeds do not in general drop out till the following April or May; soon after which, such of them as drop into a favourable soil, where there is a certain degree of moisture and shade, come up in five or six weeks. The nurseryman collects the cones of each species immediately after they are ripe (which, with the pinaster, and a few others, is as early as the month of October), and he lays them by in a dry place till he has leisure to extract the seeds. This he does by exposing the cones to the heat of the sun under a glass case, by which the heat is retained, and raised to a higher degree than it would be in the open air; or he subjects them to artificial heat before an open fire, or on a kiln. The seeds, when taken out, are sown in April, in soil dug over, and rendered fine by raking; and over them is laid a covering of soil, which, in general, need not be deeper than the thickness of the seed to be covered, where the soil is loamy;

but it may be twice that thickness where the soil is a coarse sand. In order to retain a uniform degree of moisture on the surface, the beds, after the sowing is completed, should be shaded from the sun, by covering them slightly with the branches of trees, and especially with those of evergreens, such as the spruce fir. In cold moist climates, such as that of Aberdeen, this shading may be dispensed with; but in the climate of London it is, in most seasons, essentially necessary, and may be effected by hoops and mats, by fronds of fern, by straw, or by pea haulm. For greater convenience, the seeds are generally sown in beds, a slight excavation being made in the beds by drawing some of the earth to the sides; and in order that the seeds may be evenly deposited on a somewhat firm surface, the bottom of this excavation is rolled with a light roller. After the seeds are distributed over the beds, at such distances as that the plants, after they have come up, and have grown to the end of the season, may not touch each other, the beds are again rolled, and afterwards the covering of earth is thrown over them which was drawn off before rolling and sowing. It may be observed here, that the rolling in of the seeds, by bringing them in close contact with comparatively firm soil, renders a much thinner covering of earth necessary than if the seeds had been sown on a loose surface. It is also more favourable to the vegetation of the seeds; it being found that close contact with the soil, both in the case of seeds, and the spongioles of the roots, is a powerful stimulus to vegetation. Some of the more tender species of pines and firs, such as the stone pine, the cedar of Lebanon, the cypress, &c. are commonly sown in pots, or in flat earthen pans, for the convenience of making them germinate under glass, and in order to facilitate future transplantation; but the process of preparation, sowing, and covering, is exactly the same as when the seeds are raised in beds. The plants, after they have come up, require nothing but the usual routine culture of the nursery for two summers; at the end of which period they should be taken up, and, if possible, transplanted where they are finally to remain; but as this cannot always be done, the next best practice is to plant them in the nursery, either in lines, which is the most convenient mode, or scattered over beds; in either case keeping the plants so far apart that there may be a clear space round each plant, of from three to six inches, according to its height and the length of its leaves. Thus, for the Scotch pine and the spruce fir, which grow slowly when young, and have comparatively short leaves, three inches will be sufficient; whilst for the larch, which grows rapidly the second year, and for the pinaster, which has long leaves, six inches will be required. Here the plants may remain another two years, and afterwards be transplanted on the same principle; unless they are in the mean time removed to where they are finally to remain. Unless this has been the case, they will have little chance of doing good as timber-trees; for experience has proved, that after two years' growth, or at most four years', all the pine and fir timber are materially checked by transplanting; and that this check is of a kind which cannot, like that given to broad-leaved trees, in a similar case, be counteracted by cutting them down to the ground; but, on the contrary, remains for many years, and materially affects the future growth and habit of the tree.

Trees bearing Nuts, Acorns, Masts, Keys, &c.—These, on British timber-trees, ripen from October to December. The greater part of oaks ripen their acorns in November; but the beech, the horse-chestnut, the walnut, and the hazel, ripen their mast and nuts in October; and most of the sycamores and maples their keys in September. All these seeds ought to be gathered as soon as they are ripe; because, as they form an important part of the food of wild animals, the best are liable to be picked up by them as soon as they drop. They may either be sown immediately or kept till February, as in neither case will they come up till April or May. They should be sown in a sandy loam, in drills, the seeds being deposited at such a distance from each other, that the leaves of the plants springing from them may not touch at the end of the first season; they should be trodden into the drill with the foot, or pressed down with the back of a wooden rake; and they may be covered to the depth of twice or thrice the thickness of the seed. The reason why drills are recommended for this description of tree-seeds is, that in the intervals between the rows, a spade may be inserted obliquely, so as to cut through the tap-roots of the plant, and force it to throw out lateral roots. This operation is commonly performed early in the spring of the second year: it does not prevent a second tap-root being formed from the mutilated extremity of the first; but it throws a greater proportion of the energies of the plant into the lateral roots, which, by increasing these and their fibres, renders the tree better adapted for transplanting. At the end of the second year, plants so treated may be taken up, and either planted where they are finally to remain; or, their tap-roots being shortened, they may be transplanted into nursery lines, at distances adjusted according to the principles laid down for transplanting the pine and fir tribe. In this situation they may remain two years longer, and then be taken up and again replanted in the nursery; because all broad-leaved tap-rooted trees differ from needle-leaved trees in this important particular, that the larger and stronger they are, up to a certain point, before they are removed from the nursery, and planted where they are finally to remain, the more vigorously will they grow there. The point or limit to the size which they may be allowed to attain in the nursery must be regulated by the condition of the soil into which they are to be transplanted, relatively to moisture. If this be abundant, so as to supply all the fibrils with water during the first summer, even if the removed plant has a stem an inch in diameter, so much the better; it being clearly understood that it has been transplanted in the nursery every two years, and is consequently abundantly supplied with fibrous roots, and has all its wood perfectly ripe. If, on the other hand, the soil into which the plant is to be transplanted is naturally dry, and perhaps also thin and poor, the plants should be removed from the nursery thither at the end of the second year. The reason is sufficiently obvious; such plants, being of small size, have few leaves to exhale moisture, and before they grow large they will have adjusted their roots and annual growths to the locality.

Trees producing Pomes with Kernels.—This class includes the genera Pyrus, Cydonia, Amelanchier, Cotoneaster, Viburnum, &c. The fruits of the different species of these genera ripen at various periods from September to November. They should be gathered when ripe, and each kind should be mixed with sand, and laid up in a heap, in order to rot away the pulp. This heap may be turned over several times in the course of the winter; and in the month of February it may be sifted, and the seeds separated from it, and sown in beds, exactly in the same manner as is done with the seeds of the pine and fir tribe. After the plants have been two years in the seed-bed, they may be transplanted into nursery lines, on the same general principles as already described.

Berries having Stones.—This class includes the genera Cratægus, Ilex, Taxus, Prunus, Cerasus, Rhamnus, and some others. The fruit ripens from August (as is the case with some species of Cratægus) to December. It should be gathered as soon as it is thoroughly ripe; and after having been mixed with sand or sandy soil, the mixture should be laid up in moderate-sized heaps, exposed to the weather, and turned over frequently for two years, after which it may be taken, along with the sand, and sown in beds; and when the plants come up, and have grown two

years, they may be transplanted, and treated like the others. In general, all the plants belonging to this class, whichever way the seeds may be treated, whether they are sown immediately that they are ripe, or kept in a rot-heap two summers, will not come up till the spring of the third year; but there are some positive and some accidental exceptions. Amongst the former are the yew, the berries of which generally come up at the end of the first year, and the wild cherry, which, if sown in July, immediately after the fruit is ripe, will come up the following spring; whereas, if kept till August before it is sown, it will not come up for two years. As casual exceptions, we may mention that the holly and hawthorn, when the berries are macerated in water as soon as they are gathered, and sown immediately afterwards, will, in some seasons, come up the following spring in considerable numbers; though the same treatment in other seasons, in the same nursery, will not be attended with the same results.

Berries and Capsules having small Seeds.—This class includes the elders, the privet, the spindle-tree, the barberries, and some others. The fruit may be treated like the pomes; and great care should be taken, after it is rotten, either that the seeds are completely separated from the sand before they are sown, or that the sand and seed, when sown together, should be so distributed over the bed as that the plants may come up at regular distances, and sufficiently far apart. The covering of soil should be very thin, more especially if the seeds are rolled in; and the beds should be shaded by branches or matting till the plants are fairly above ground. At the end of the second season they may be transplanted into nursery lines as before.

Leguminous Seeds.—These include the genera Cytisus, Robinia, Gleditschia, Caragana, &c. The pods generally ripen in September or October; but some of them, such as the Gleditschia, not till November or December. The seeds may be kept in the pods till February, and then taken out and sown in beds, on the principles before laid down. At the end of two years the young trees may be transplanted as before.

Cottony, Papery, Feathery, and other soft Seeds.—These include the genera Populus, Salix, Alnus, Betula, Ulmus, &c. The seeds ripen from May to November; all the poplars ripen their seeds in May; all the willows and elms in June; the alders in November; and the birches in October. The seed of the alder and the birch may be kept in a cool, dry, airy situation till the following spring, or it may be sown immediately after it is gathered. In either case it comes up in the May or June following; but it is preferable that the seeds of the elm, the poplar, and the willow, should be sown immediately, because in that case they are much more certain of coming up. Many of these seeds will come up the same autumn, and the remainder the following April and May. The seeds may be dried and preserved in bags for a year; but in this case the greater part of those of the poplars and willows will not vegetate. The reason may be, that the seeds, when preserved, are kept too warm; which must necessarily deprive them of their moisture, through the absorption of the cottony substance with which they are enveloped. Poplar and willow seeds require to be sown on a surface rendered quite even, and slightly firm, by rolling. Afterwards the seeds should be evenly distributed over it, and they should be covered with very light, sandy soil, or peat or vegetable mould, if either can be procured, no thicker than barely to conceal the seed from the eye. After this the beds should be watered, and effectually shaded, by being hooped over and matted; and they should be kept in a uniform state of moisture, by occasional supplies of water, when the plants make their appearance. Of all the seedling trees raised in British nurseries, none come up and grow with so much vigour, the first year, as the common broad-leaved elm; and, therefore, the seeds of this tree require to be placed at a greater distance from each other in the seed-bed than those of any other kind. The seeds of the elm also keep much better till the following spring than those of the poplar and willow, and they are generally so kept by Scotch nurserymen.

IV.—*The Culture of Trees in the Plantations. The Formation and Management of Plantations.*

Whether plantations of forest-trees should be sown or planted, is a question which has been agitated and discussed by different writers. It is readily allowed, that sowing is the natural mode; but it is the business of art to improve upon nature, and to attain the same ends which she does, by more definite means. If this general principle be correct, it affords at once a decisive answer as to the respective eligibility of sowing or planting; unless, indeed, it can be shown, which some have attempted to do, that the timber of transplanted trees is never so valuable as that of sown ones. The only reason alleged for this is, that the transplanted trees have lost their tap-roots; and although a more frivolous one could hardly be imagined, yet it has been maintained by a number of writers, and is still insisted on by a few. On examining the roots of full-grown trees, however, either in natural forests or artificial plantations, no tap-root is ever found; on the contrary, those roots which proceed either directly or obliquely downwards from the base of the trunk, are uniformly found much smaller than those which proceed from the base of the trunk horizontally, at a few inches distance under the surface of the ground. The tap-root, therefore, is chiefly of use to the tree whilst in a young state; and if we trace a seedling oak through the first ten years of its progress, we shall find that, in the first year, the tap-root is larger in proportion to the part of the plant above ground, than it is in any succeeding year; and that as the top of the tree and the lateral roots increase in size, the tap-root ceases to increase, till at last, even at so short a period as ten or twelve years' growth, it is found to be the smallest of all the main roots of the tree. We assume it, therefore, as agreed on by the most intelligent planters, that a transplanted tree, other circumstances being the same, is in all respects as good as a seedling one. Hence we conclude, that all artificial plantations ought to be made by planting the trees, and for a similar reason we would plant these in rows at regular distances; and, in short, treat them, as far as is practicable, like a crop of herbaceous vegetables, when reared in the kitchen-garden or in the field. We would prepare the soil, and even manure it for the trees, with as great care as we would for a crop of turnips or cabbages; and we would stir the surface afterwards for two or three years, till it began to be covered with the branches of the trees; in which state we should leave it during the whole period of the growth of the plantation, only taking care to remove large weeds. We admit, however, that this kind of tree culture can only take place with advantage on a tolerably even surface, and where the soil is of the same nature throughout; but we think it right to lay it down as a general principle of guidance, in so far as it can be followed, for planters in all other soils and situations. With the exception of the ground destined for ornamental plantations about country houses, the great majority of cases in which plantations are to be formed with a view to profit must necessarily be on hilly and irregular surfaces; and where there is probably a considerable variety of soil, even in a very limited space. The only preparation that in cases of this kind can be given, is under-draining; for to dig or trench the surface would render it liable to be washed away by heavy rains and thawing snow. Plantations under such circumstances must be formed by digging pits for each particular tree, and by making use of such

kinds as are thought to be best adapted to the particular soil and situation. This will frequently occasion the use of a considerable variety of trees in the same plantation; but the effect will be as much more interesting in point of beauty, as the result will be advantageous in point of timber produce. We have already stated, that needle-leaved trees should, if possible, be transplanted when they are not older than two years; but that broad-leaved trees may be transplanted at four, six, eight, or ten years' growth; provided they have been removed every two years in the nursery, and that the soil in which they are placed is sufficiently deep and moist to bring all the fibrous roots into full action the first summer. In the planting of irregular surfaces, which cannot be done by digging, when strong plants of this kind are used they overcome the natural herbage immediately; and, if carefully planted, not one in a score will fail. Smaller plants, on the other hand, are apt to be choked by the grass or herbage, and to have their leaves and young shoots injured by the insects which never fail to abound in such situations. When such surfaces have naturally a very dry soil and subsoil, plants with such a mass of roots as those which we have mentioned cannot subsist on them the first year; and therefore smaller plants, or such as have been only once transplanted, are preferable.

Notwithstanding these arguments in favour of planting instead of sowing as a general practice, there are circumstances under which sowing is either the preferable, or perhaps the only mode, that can be adopted. In every case of making plantations of the pinaster, or of the cedar of Lebanon, unless we could procure a sufficient number of plants of two years old in pots, we should prefer sowing a patch of seeds in every place where a plant was intended finally to remain. Three seeds in a patch would be sufficient; and if more than one came up, the rest should be removed the second or third year. In cases of this kind the plants require to be looked over two or three times every year, to prevent the surrounding herbage from choking them. When steep rocky cliffs, or the sides of hills, consisting of loose naked stones, are to be covered with wood, then sowing is the only mode that can be resorted to. The kind of rock having been ascertained, in order to discover the nature of the debris or soil collected in its clefts, or under the loose stones, the kinds of seeds to be sown may be selected accordingly. Where the soil is good, acorns, ash-keys, maple and sycamore keys, and beech mast, may be introduced; but where it is poor, the safer mode will be to sow seeds of the Scotch pine, the larch, the birch, the mountain ash, the white-beam tree, and the elder. Where there is no visible soil, each seed, or two or three seeds, may be enveloped in a composition of common green moss, cow-dung, and loam, and these balls being deposited in clefts or crevices, or among loose stones, and left to be acted upon by the rain, will swell and burst, and the seeds which they contained will vegetate, and find nourishment in the fragments of the ball in which they were enveloped. When the object is to cover drift sand with wood, the practice followed in the downs or landes of Bordeaux may be adopted, with suitable variations. A zone of the downs, or sandy surface, on that side from which the prevalent winds blow, is first to be sheltered by a fence of boards three or four feet in height. This will protect a zone of twenty or thirty feet in width; that is, it will prevent the drifting sands from covering this space to any great thickness. On this zone the seeds of broom, as being a plant that will grow on the poorest soil, are to be sown; and, among these, the seeds of the tree which is considered the most suitable for the particular situation. Near the sea this will generally be found to be the pinaster; but in the interior of the country, where the sands are not deep, perhaps the birch or the Scotch pine may be found eligible.

Two of the most important points connected with the formation of plantations, are the distance at which the trees ought to be planted from each other, and the introduction or non introduction among them of nurse-trees. When both these points were first settled by professional planters, the important uses of the leaves of plants were not at all understood by practical men. Hence they gave directions for planting the trees at such distances as that they might draw up one another; without considering the loss of the leaves on the sides of each plant which this drawing up will produce. As the strength of every plant depends on the number of its leaves, and on the full exposure of these to the light, it follows that the strongest young trees will be those which are clothed with branches and leaves from the ground upwards, and which have their leaves fully exposed on every side to the perpendicular light. In regard to the distance from each other at which trees can be planted in a plantation, we should say, begin by planting at a greater or less distance, according to the size of the plants and the nature of the soil and situation; but do not neglect to cut down, or thin out, the moment the lower branches of the plants interfere with one another. Continue this practice year after year, till the lower branches begin to show symptoms of decay at their extremities; when, instead of thinning out the trees, the process of pruning them may be commenced. The lower tier of branches may then be cut off close to the stem, it being understood that such pruning shall take place before the branches are more than an inch in diameter at the point where they join the stem, even if the extremities of the branches have not begun to decay. The trees may then be left to grow, either till another tier of branches begins to show symptoms of decay, when, of course, that tier must be cut off immediately; or till the points of the healthy branches interfere with those of the healthy branches of the surrounding trees, in which case thinning must be resorted to as before. In this way the process of thinning and pruning ought to go hand in hand, till the trees have attained their average height; by which time the different species will be found standing at distances differing according to the height of each tree and the nature of its branches. Thus those trees which will be found standing closest together when full grown, will be the pine and fir tribe; because in them the branches never attain a timber size, and the lower tiers begin to decay at their extremities sooner than in any other trees. On the other hand, the oak has more widely-spreading and durable branches than any of the other broad-leaved trees; and hence, when plantations of this tree are fully grown, the individuals will be found at a greater distance apart than those of any other species of broad-leaved tree whatever. What this distance will be must depend on the soil and situation; because in some localities the common British oak will attain double the height and breadth of head which it does in others. Our business here is to illustrate a principle; and we shall leave it to planters who approve of it, to deduce the rules from it which will apply to their particular cases.

The next point which we have to discuss is the advantage or disadvantage of introducing nurse-plants into plantations. That these have a tendency to accelerate the growth of trees in an upward direction for a number of years after the plantation is made, there can be no doubt; but this is always at the expense of the side-branches and side-leaves, and consequently of the thickness of the trunk of the tree to be nursed. The question, therefore, is, what is gained by the nursing? Is there any advantage in having a young tree with a tall, slender stem, and few or no side-branches, rather than a tree of half the height, with a short, stiff stem, clothed with branches and leaves from the ground upwards? We admit that evergreen nurses, such as the Scotch pine and the spruce fir, considerably improve the climate of a plantation, by preventing the radia-

tion of heat from the ground; and that, provided they did not do injury in other respects, in this respect they would do good. The question as to nurses or no nurses may, we think, be satisfactorily answered in the following manner:—Suppose we adopt the principle already laid down, that all trees in plantations intended to produce timber should be kept at such distances, by thinning and pruning, as that the extremities of their lowest branches should never interfere. Then, having fixed on the kind of tree the growth of which is to be the main object of the plantation, and the number of these that, when full grown, can stand upon an acre or any given surface, plant them in their proper places, and fill up the intervals with the trees intended to serve as nurses. As the nurses increase in size, and their branches touch their principals, let them be pruned or thinned; so as in no way to prevent the principals from being clothed with branches from the ground upwards on every side, or to prevent the leaves on these branches from being fully exposed to the sun. In this way the climate of a plantation will be improved by evergreen nurses; and the nurses will protect the trees from high winds till they have attained to such a size and vigour of growth that the annual shoots produced on the top of the tree will be so short that they can be ripened in a colder climate than would be required to ripen a longer shoot produced by a young tree. This mode of nursing trees, it may be observed, is widely different from the practice of letting nurses and principals draw up one another, in which case both will be alike without side-branches; and consequently, when the nurses are removed, the principals, weakened by having their stems, unprotected by branches, exposed to the cold in winter and to the heat in summer, will remain stationary a number of years; in some cases dying away altogether, and in others making so little progress that nearly as much would be gained in the produce of timber by cutting them down, and training up a single shoot from the stools, or by trenching the ground and replanting, as by letting them grow.

We have now taken a cursory glance at the principal points which require to be considered in the culture of trees, and in the formation and management of trees; but the subject is of very great extent, and could not be entered into in all the requisite details in even double or treble the space which can be allotted to this article. Our object in writing it has been rather to direct attention to general principles than to lay down specific rules; satisfied as we are that, in every department of agriculture and gardening, too much deference is paid to routine practices, and too little recourse is had to the principles on which these practices are founded. Above all, planters do not seem sufficiently aware of the important agency of leaves and light, not only in the production of quantity of timber, but of quality also.

(The botanic names in this article are generally those adopted in Loudon's *Arboretum et Fruticetum Britannicum*, to which work we would refer for more ample information.) (C. J. L.)

V.—*Landscape Gardening.*

We now come to landscape gardening. This treats planting as a means of decorating grounds, and combines with it every other operation requisite to embellishment. It does not exclude the growing of trees for the market value of their timber, but it subordinates this to the improvement of scenery. Its entire object is to convert all the land around a residence into an assemblage of pleasing pictures. It is a subject for the exertion of fancy and taste; and expatiates on at once the simplest, the noblest, and the most beautiful scenes of nature. Its business is not confined to what is popularly called a garden, but also regulates the disposition and embellishment of a park, a farm, or even a forest. A landscape gardener selects and applies whatever is great, elegant, or characteristic in any of them; he discovers and brings to view all the advantages of the place on which he operates; he supplies its defects, corrects its faults, and improves its beauties.

The ground selected for a landscape garden may comprise broken surface, lawn, or swamp; it may be a height, a valley, a plain, or a composition of swells, dips, and levels; but it suits best to be all a tract of moderate elevation, with flowing outlines, free from angular points or great irregularities, commanding a good view, enjoying good natural shelter, and possessing a dry, deep, friable soil. All its essential characters are natural. An artist may afford important aid in selecting it; but if it be naturally ill-conditioned, he can do little or nothing to improve its general expression, and must confine his efforts to the correcting of slight inequalities, and the handling of wood and water.

Wood, in landscape gardening, is classified into woods proper, groves, and clumps. A wood proper is a large mixed plantation of both trees and shrubs, or of forest-trees and under-wood, and may comprise any amount of diversity of species, or present any variety of disposition or outline. Its prevailing character is grandeur. A grove consists of trees without shrubs, and pleases the eye not only as seen in mass, but by the individual forms of its component trees. Its prevailing character is beauty. A clump is a small separate patch of either wood or grove: it is either close or open; and in the former case it is sometimes called a thicket,—in the latter, a group of trees. Its prevailing character is gracefulness or finish.

A wood seen from the stand-point ascending the side of a hill, and terminating on the horizon, is one of the noblest objects in a landscape. It fills the eye, occupies an entire space, soars to the clouds or to the sky; yet seems all distinct, all at hand, all a part of the home scene. But if its extremity do not go quite to the sky-line, unless the characters of the hill-top above it be of a peculiar and striking character, the effect will be greatly marred. A wood seen from below, covering even a small hill to the summit, generally looks grander than one covering a much larger hill only to the shoulder. A wood seen from the stand-point spreading down a slope is still less effective. This may form only a small part of the scene, and will then be deficient in its essential character of grandeur; or it may wind out of sight or become lost in the horizon, but will then want distinctness of surface and firmness of outline. A wood on very broken ground, in a deep, winding ravine, or in any similar situation, though incapable of expansive greatness, may fully atone for it by rude magnificence and romantic force.

Varieties on the surface of any wood are essential to its effect. One variety arises from the different forms of its different kinds of trees; another from the differences in their rapidity and mode of growth; another from differences in their hues of green; another from their shadows; another from the groupings and contrasts in their order of arrangement; and another from the inequalities of the ground, and from breaks in the planting. In forming a new wood, an artist has all these varieties completely under his power, so that he can give it the best possible surface; and in improving an old wood, he may so operate on many spots, by thinning or thickening, by removing some trees or supplying others, as to render its surface scarcely inferior to that of a new one. Care must be used to render the varieties distinct, to make the groups and the masses broad, and yet not to destroy the unity of the wood, or to dissever it into contrasted parts. A single tree, or a small cluster of trees, in the midst of an extensive wood, makes no sensible variety; while a number of masses, contrasted to one another in character, standing mutually adjacent, without intermediate blendings, constitute not properly one wood, but a confused collection of several. A wood on a hill,

seen from below, requires to be thick, in order that it may not appear meagre, and must derive the variety of its surface mainly from the tops of its trees; but a wood on a slope, seen from above, suits well to be thin, showing its trees almost in the manner of a grove, and admits a large play of variety in their differences of species, habit, hue, and shadow. A wood in a broken ravine, or in any other ground with strong and salient inequalities, admits of the widest diversities and of the nearest contrasts. A deep hollow in it may be filled with trees of the darkest green; an abrupt bank may be occupied by trees rising above one another, like the tiers of an amphitheatre; and a sharp ridge may be crowned by a narrow line of cone-shaped firs or pines.

The outline of every wood also demands attention. This is completely under control; it can generally be determined by mere taste or will, without impediment from the ground; and it often produces stronger effects than any which arise from the character of the surface. The outline must be irregular: not a series of straight lines or easy curves, but a bold and various combination of sweeps, angles, and breaks. Its main diversities must be either projections or recesses, all differing from one another in length and breadth, and all rather long than broad, and narrowing to a point. These, besides being features in themselves, give peculiar force to the general outline, and have the effect of enlarging the apparent extent of the wood. Several projections from a narrow wood, or hill, or slope, will make it look grander than a much larger one of compact outline; and a deep recess in an extensive wood on a flat, penetrating beyond reach of the eye, and winding inward to a concealed extremity, produces some of the same kind of impressions as a profile scene in a great natural forest. Some parts of the outline, especially across the entrance of recesses, may be materially aided in force and elegance by a thin sprinkling of individual trees. A main rule in the forming of a wood is to modify its grandeur, to blend graces with its greatness, to diversify its uniformity, and to give strong, diffusive, intricate effect to its masses.

A grove differs from a wood, not only in containing no thicket, and in being characterized by beauty instead of grandeur, but in aiming to please the eye rather by its interior arrangement than by its outward form. It is an assemblage of trees to be seen in detail, and admired in all its parts. Its trees are so arranged, singly and in groups, that they may please the eye both by their individual elegance and by their combined effects. The surface and the outline of a grove are of much less consequence than its inner depths. An observer goes into it to walk through it, to stroll in it, or to sit; and he reserves most of his expectations from it to what he shall see in its interior. Main care, therefore, must be given to the choice and disposition of its trees. Varieties of species must be selected in every style of elegance, from the light to the massive, from the graceful to the romantic, from the bushy to the aspiring, in order at once to exhibit a large amount of loveliness in the individual forms, and to intensify and multiply this by comparisons and contrasts. Other varieties must be chosen in every style of habit; some with density of growth, some with large but few branches, some with light thin boughs and leaves, in order to produce every degree of light and shade, from a glare to obscurity. Differences in hue are of less consequence, and ought sometimes to be avoided. The disposition should be a mixture of irregularity and order, free from both uniformity and confusion. The trees should stand in groups or form irregular lines, and describe a variety of figures. The groups and the lines should be so contrived as to show to advantage the characters of the individual trees. The intervening spaces should vary in extent and form; some large and open to the sky, some over-arched with branches or contracted to a mere passage, and all so arranged with relation to one another as to afford frequent transitions and contrasts. The disposition of a new grove may be twofold,—first, with reference to its effect while all the trees are young and small; next, with reference to its matured condition, when the majority of the trees have been removed by thinning.

A clump with shrubs is formed essentially like a wood, and a clump without shrubs essentially like a grove. Clumps, however, as compared with woods and groves, are small objects, and they must be treated according to their dimensions. Sometimes also they stand in an isolated manner, and then must be treated with reference only to their own beauty; but oftener they stand in a relative position, connected with one another or with an adjacent wood or grove, and then they must be treated with reference to the character of the entire scene. Isolated clumps are most in request for relieving an expanse of lawn or breaking a continuous line of hill or slope; but unless designed by a very skilful artist, they may prove rather deformities than ornaments, remarkable for ostentation or clumsiness, and looking like large blots in the landscape. A single one, in almost any view, looks better than several; and one of the best is an open one at the point of an abrupt hill, or on a promontory in lake or river. Related clumps do best to be related to one another throughout an extensive lawn, to control its entire shape, and form beautiful glades; and either in that position, or when related to an adjacent wood or grove, they produce their desirable effects less by their own forms than by their connections and their contrasts.

Water is an important material in a landscape garden. An arm of the sea, or the sea itself, may fill more of the view than the entire ground; and a river or lake may figure as largely as hill or lawn. These in general can be improved only on the margin, and chiefly by planting; but they often admit of improvements there so extensive, rich, and varied, as to give a new character to all the landscape. What these improvements precisely are must be determined by the conditions of shore or banks, but usually appear so obvious that they need not be described. Lakes of a beautiful or picturesque kind can often be formed within the grounds; small streams also, if they have a good fall, through plantations or lawns, may sometimes be greatly changed; and these two forms of water make large demands on the care of the landscape gardener.

The proper situation of an artificial lake is a vale or hollow traversed by a little stream. The particular spot must be carefully chosen with reference both to its own limits and to the features of the surrounding ground. The bottom and sides may be either under-drained, puddled, or otherwise prepared, to prevent any contraction of foulness. A dam of an ornamental kind must be raised across the lower end, to stem the water and to form the lower boundary. The traversing stream must consist of limpid water, must not be subject to muddy freshets, and ought, if possible, to be sufficiently large and constant to maintain the lake in constant purity. Everything in the banks and in the encompassing vegetation must be avoided which would lead to marshiness or putridity. The depth of the water need not exceed five or six feet. The slope of the banks must not be too steep, and ought to blend well with the surrounding ground. The form of the lake must not be elongated, but expansive, with a breadth in good proportion to the length. Its surface may be broken by one or more islets, or invaded by one or more little peninsulas, yet only of such size and in such circumstances as will not injure the view of it as a whole, or make it appear like a collection of ponds. The outline also may be diversified, and even made intricate, with little bays and promontories, yet must so far approach regularity as to possess appreciable shape. Its immediate margin, to a variable breadth, may consist of clean gravel or rich sward, according to the na-

ture of the ground; but all the rest of the banks must be variously planted with shrubs or trees. Mounds may be thrown up, or cuts made, to increase the diversity of the ground; but all these, as well as the natural surfaces, should receive every decoration which can be given them by the rules already laid down for the making of a grove.

Small streams with a lively current may sometimes be altered, with picturesque effect, throughout most of their course, within a landscape garden. If two or more flow near each other, they may perhaps be advantageously thrown together to form one current. The stream need nowhere be furious except at cataracts or cascades; but neither must it be anywhere dull or stagnant, except at pools, and therefore it may be straitened at dull tortuous reaches to increase its velocity. Cataracts or cascades may be improved or formed at places of sufficient descent, and eddying pools may be created at sudden bends overhung by high banks. Bits or masses of rock ought to project boldly at the falls, and may often take an increase of apparent height and dignity from diggings to expose them, and will generally admit of being picturesquely shagged or romantically diversified with shrubs or trees. The general course of the stream can be variously sown with herbage and planted with wood, in such manner as to allow ferny banks, and narrow, winding, shady walks; and a tortuous reach of it, with sufficiently lively current and of sufficient length, may be crossed and re-crossed by the walks over little rustic bridges, or by means of stepping-stones.

Bits or masses of rock in all kinds of situations often give scope for much improvement. Any appearance of them, indeed, in a meadowy or champaign tract is incongruous, and requires to be hidden by gentle mounding or by planting. But even detached pieces of rock, rough and large, fitted into the ground and partially covered with vegetation, on spots of a bold character, such as at the foot of a wooded acclivity, have often an excellent effect, if not directly on the eye, at least on the imagination. Slight protrusions of rock at the walls of a terrace give an idea of dryness and stability; larger protrusions in remoter parts often afford picturesque aid to the diversities of the ground or to the forms of plantation; and ledges of rock, whether they exist naturally, or can be laid bare by art, form a fine flank to a road, a cross, or a declivity. Large protuberances, cliffs, or other huge masses, are features, or assemblages of features, substantially beyond the reach of art, yet admitting as much change on the surface, by mounding, by digging, and especially by planting, as largely modifies or alters their expression. Their prevailing character ranges from savageness to dignity; and when disagreeable, it may be concealed; when imperfect, it may be improved; when pleasing, it may be magnified. Rocks of a disagreeable appearance may generally be concealed by wood; rocks deficient in apparent or relative height may be improved by the removal of earth from their base, and the planting of a line of wood along their summit; rocks standing apart from one another at intervals which destroy or mar their picturesque effect, may be woven into one scene by means of shrubs and trees planted partly on their skirts and partly in the intervals; and rocks of lofty stature and irregular face, soaring, precipitous, rent, and shelving, may be worked into a mingled display of beauty, romance, and grandeur, by the skilful disposition of points, tufts, lines, and masses of wood.

The materials of landscape gardening which we have hitherto noticed—ground, wood, water, and rocks—are natural; but others requiring notice—small in value compared with the natural, but equally indispensable—are factitious. These consist of fences, walks, roads, bridges, seats, and buildings.

Boundary fences do not belong properly to the landscape garden itself, but ought to be well concealed from its walks by masses of shrubs and trees, and may be constructed in any style of security which comports with neatness. Even interior fences have a place in the garden, not as materials of ornament, but as matters of necessity, and do best to be as quiet and unconspicuous as circumstances will permit. Sunk fences are the most desirable, and ought always to be preferred, but are seldom suitable for any situation except between the lawn and the park. Light iron fences, or what are called continuous fences, are generally the best in other situations. A neat rustic wooden fence may suit well to protect plantations from cattle or sheep. Hedges anywhere within a landscape garden, especially in its more open parts, are deformities and obstructions, disagreeable in themselves, and damaging to the view; and even around plantations, they give them a hard, stiff outline, and blot out the sweet beauty which belongs to the trail of their branches on the ground.

The walks in a landscape garden are designed both for the exercise of walking and for the disclosure of the scenery. They must be so formed in material, slope, and border, that they can be comfortably used in wet weather. They ought to lead from view to view, to take a variety of levels, to be concealed from one another, and to command at successive spots all the best aspects of the house, of the garden itself, and of the surrounding country. Their direction must be determined by the points to which they lead, and the nature of the ground over which they pass. They ought never to run long in a straight line, but ought to wind hither and thither in continual variety of sweep, neither making abrupt turns, nor setting their curves to any regular radius.

Some roads within a landscape garden, as drives and rides, are designed only for amusement; while others, as the approach to the mansion, are designed expressly for communication. One road may be formed to serve both kinds of purposes; but every road of a specific character ought to have a direction adapted to its specific use; and a road for communication needs to be straighter than one for mere amusement. The principal road is the approach to the mansion. This generally does best to be a waving line, with very easy sweeps, controlled by inequalities of the ground, and passing through a diversity of wooded scenery; but on a flat tract of large extent, leading to a house of pretty regular form, it may all be a straight line, along an avenue of two, four, or more rows of trees. The first view of the house from it should be oblique or angular, and in good perspective; and the concluding view should show the entire façade and the entrance. The terminating piece of gravel for carriages to turn in is sometimes made so large as to have a diminishing and disfiguring effect on the surrounding objects, but need not be of greater breadth than from thirty to forty feet.

Bridges must be at once useful, ornamental, and consistent. They must exist only on spots where walks or roads really need them, and must possess the kinds of character and elegance most in harmony with the scenes around them. A bridge for a footpath over a brawling streamlet in a wood, or over a stripe of lake to an islet, may suit well to be nothing more than a strong rough plank, with wooden props, and a wooden hand-rail; one for a footpath in a more conspicuous situation may still be all of wood, somewhat elaborated, yet light and rustic; while a bridge for a drive, or for the main approach, amid the finest scenes of the garden, ought to be a structure of stone or iron in some of the highest styles of elegance which architectural skill can design. Bridges of any kind, in any situation, must be well supported at their ends with bushes or trees, to relieve the rigidity of their lines, and to make them blend softly with the adjacent ground; and embankments leading to them, if any embankments be necessary, must be well masked with masses of shrubs.

Seats are useful for rest, shade, and conversation. They

should be set down at all points which command good views, but are seldom appropriate in other situations. Their character, like that of bridges, must be in harmony with the scenery. In rude spots the simple trunk, rough from the woodman's hands, and the stools of rooted trees, without any other marks of tools upon them than those of the saw which severed them from their stems, are proper seats; and in romantic or recluse spots, caves, or grottos, natural or artificial, dry within, and commanding fair views, may be suitable; but all must be so formed and finished as to look in keeping with the adjacent ground. In spots near the mansion or among the finest embellishments of the garden, the seats of even the simplest form require to be elegant and of a light colour, and the most conspicuous may have architectural features.

The buildings of a landscape garden present enormous scope for design, and are in a considerable degree the subject of a specific art. They do not belong to architecture alone, or to gardening alone, or to any ready or obvious combination of the two. Even the mansion must not be designed by a mere architect, but requires in many respects, particularly as to site, style, and harmony with surrounding objects, to be determined also by the landscape gardener. Other buildings of a decorative kind throughout the grounds demand a skill which shall combine proficiency in most of the fine arts with power to adapt their designs minutely and variously to effects on landscape. Loose theory, rather than any system of rules, has hitherto prevailed respecting them; even sheer caprice has not seldom taken the place of theory; and whatever taste or judgment may have controlled the theory or the caprice has been subject to extreme change, from fluctuations in architecture, from fluctuations in gardening, and from collisions and repulsions between the two. A passion long reigned, especially on the Continent, for crowding gardens with all sorts of decorative buildings; the tide of taste turned, continued long on the ebb, and seemed about to carry them all away; but again a love for them, of a chastened kind, and under jealous rules, has revived. We cannot more fitly express the best existing cast of opinion respecting them than in the words of Mr Edward Kemp, in the second edition of his work, *How to Lay Out a Garden*, London, 1858. He says (pp. 178–183):—

"Modern tendencies in gardening have been too much away from its character as an art, and the more it is restored to its legitimate position, the more nearly will it be brought into kindred with architecture. On the other hand, the too commonly cumbrous, regular, and unyielding nature of architectural objects, when used for garden decoration, has tended still further to detach two pursuits which are essentially and obviously allied. For, as a house and a garden are naturally and intimately associated, and it is a law of the universe that the boundaries of each domain in the natural kingdom should insensibly mingle and be lost in each other; so it is plain that an unvitiated taste would be most gratified when the province of architecture is extended so as to embrace lightly and harmoniously such parts of the garden as may be most contiguous to the house; while the garden also in these parts rises in character to meet the requirements of the architecture, until either art is so refined and attenuated that it would be almost difficult to say what belongs exclusively to each. Still there is that about gardening which, in the nature of things, and apart from the difference of the materials with which it has to deal, constitutes it a distinctive art. And garden architecture has lineaments of its own so decidedly removed from those of house architecture, and so seldom studied, that the ordinary architectural practitioner is at sea the moment he enters the region of the garden. It is less a matter of rule and measurement. Its effects are more to be judged of by the eye. It comprehends a far greater variety of combinations. It requires a man to be as much an artist (at least in feeling) as an architect, and to be familiar with natural groupings and tones, to take in an entire landscape in the range of his design, and not merely isolated or detached objects. In fact, the garden architect has to make a general picture, and not simply to set a work of art, as it were, on a solitary pedestal.

"The province of garden architecture is, primarily, to supply fitting appendages and accompaniments to a house, so that the latter may not appear naked, alone, and unsupported. If judiciously applied, it will be effective in helping to produce a good outline or group; to carry down the lines of the house; to connect it with other buildings, such as a conservatory, arbour, &c.; to provide a proper basement for the house; to afford shelter and privacy to a flower garden; to extend the façade or frontage of a house; to shut out back-yards, offices, &c.; to enrich, vary, and enliven the garden; to supply conveniences, such as shelter, receptacles for birds, plants, sculpture, &c., with museums for works of art or specimens of natural history, and supports for climbing plants; to indicate refinement, wealth, and a love of art; and otherwise to blend the various constituents of a garden with the house, and harmonize the two by communicating a more artistic tone to the garden. Wing-walls to a house, broken by a conservatory, and terminated by a summer-house, aviary, museum, or sculpture-rooms; corridors, similarly broken and terminated, and glazed or open, so as merely to form covered ways; conservative walls, either glazed or simply protected by bold projecting piers and copings; viaducts, aqueducts, arbours, arches, arcades, tunnels, boat-houses, temples, prospect and flag towers; with an almost infinite number of smaller objects, such as sculptured figures, sun-dials, statuary, pillars, obelisks, terrace-walls, &c., constitute the elements with which garden architecture has to work.

"In its leading traits, it necessarily comes within the same category as house architecture, and is governed by the same principles. Like the house, it should exhibit design, some degree of symmetry, harmony of parts, unity of expression, consistency of style, fitness for the locality, adaptation for the intended purpose, and stability and permanence of appearance. But it should also display a greater amount of lightness and elegance; a comparative absence of regularity; a decorative rather than an exclusively useful purpose; a superior variety of outline; extreme attention to general grouping; a blending of its forms with those of nature; an especial regard for placing its creations where they will have a distinct meaning and object; a leaning to the use of good materials, but somewhat rougher than those employed in the house; a preference rather for a picturesque outline than for mere ornamental details; and, as a most important characteristic, a marked boldness and prominence of parts. Indeed, picturesqueness, such as would be occasioned by changes of level in the ground, by diversity in the heights of walls, by prominent piers, buttresses, or cornices, by broad projecting eaves to the roofs of buildings, and by any arrangement that will yield depth of shadow, should be the ruling constituent of garden architecture.

"Every architectural object admitted into a garden should form part of the general plan of that garden, and fit into its proper place. It will create a serious incongruity if merely put down at random, or not duly established as part of the main design. Smaller architectural ornaments, too, must be adequately connected with and kept in the neighbourhood of the house or other sufficiently important building; otherwise they will be too different from the forms of nature to appear harmonious. A strictly garden building or object, unless very large, should never be obtrusive. It ought always to be quiet-looking, and not violently different in colour from the surrounding vegetation. Hence white, whether in marble, stone, or painted objects, is decidedly

to be avoided, and a warm drab or a darker tint to be preferred. When a terrace or other ornamental wall, whether balustraded or otherwise pierced, or simply devoid of any relief in the way of openings, becomes the principal foreground to a garden or other scene, as viewed from the windows of the house, it will, however much it may be broken up by piers, vases, &c., appear too hard, cold, and monotonous, without some aid from grass and shrubs. In all such cases, therefore, there should be a broad band of grass between the terrace-walk and the wall; and a few clusters of evergreens, rising in broken masses above the line of the wall, or of climbers mantling its summit in occasional patches, will require to be skilfully introduced, otherwise the wall would seem to divorce rather than mingle with the landscape beyond.

"To pass from the consideration of garden architecture, I now return to the subject of architectural gardening. Its distinctive principles are,—a strict observance of rule; a prominent indication or exhibition of art; the maintenance of a decided harmony and connection with the house and other architectural objects; the adoption of regular figures; the employment of rigid, formal, and exotic plants; the necessity for flat and even surfaces, with the use of terrace-banks or extremely regular slopes; and the production of a conspicuous character of dignity and repose. The proper sphere of architectural gardening is the immediate neighbourhood of the house; as an accompaniment to particular styles of architecture, especially the Italian; in connection with detached architectural structures, as temples, plant-houses, &c.; within the circuit of the flower garden, parterre, rose garden, &c.; in the gardens attached to a palace, mansion, or first-class villa, rather than to a small villa or cottage residence; the kitchen garden; and, where the circumstances are favourable, the town garden.

"There are certain incongruities and defects which frequently attend the practice of architectural gardening, and which should be sedulously avoided. Some of these are the mixture of inharmonious styles; the use of rustic or unarchitectural ornaments, except in remote parts, and where they will not be observed as constituents of the general scene; the placing of terrace-walls or other erections on a sloping bank, or where they have shelving ground immediately below them; the extension of a formal mode of treatment into the park; generally the obtrusion of a flower garden into the view from the principal windows, unless it be on a lower level than the base of the house; an avenue or row of trees that crosses any main line of view, or one on the summit of a hill that forms the line of horizon; a curved avenue; a ground-line that is oblique to the basement of the house on either of its chief fronts; diagonal lines of walk on lawns, or walks crossing or starting from other straight walks at any but a right angle; plants trimmed into formal or grotesque figures, unless it be the heads of standards,—plants with naturally appropriate habits, or confined in tubs, being preferable; gravel-walks in flower-gardens that are inaccessible; monograms, or very intricate patterns, in which the beds are too small to admit flowers, for parterres; and the employment of pavements, gravels, or sands, of different colours, in the place of flowers, or merely for producing variety or contrast.

"Among the most characteristic details of architectural gardening, prominence should be given to terraces; broad, flat, and conspicuous walks; extreme smoothness and polish; changes of level, effected by formal banks or walls; raised beds and sunken panels; avenues, vistas, rows of flower-beds; walks and vistas terminating with some proper object, as a temple, obelisk, pillar, &c.; rectangular forms, or those in which various segments of a circle are combined; with a sunk fence and parapet-wall as boundaries to a garden. There are likewise many desirable accessories, of which a few may be noted. These are,—a sufficient breadth of open lawn between the house and the park; a detached flower-garden, with accompanying plant-houses, glass walls, or walls for ornamental climbers, and the opportunity of looking down upon this garden from a raised terrace; a rose garden in a retired spot, with attendant rose-house, or houses for delicate sorts; a winter garden, to be filled exsively with evergreens, the beds arranged in pattern, with a due admixture of specimens, and all the plants selected with reference to their habits and the colour of their foliage in winter; a garden for bulbs, florists' flowers, &c., in some spot which need not be made accessible during the winter; standard or fastigiate plants; plants that blend best with architectural objects; groups or beds of plants, in which one kind or class prevails; and hedges, whether to frame and inclose scenes that it is wished to detach, or in a diminutive state, to make borders and edgings to flower-beds and clumps.

"In practically applying the principles of architectural gardening, it should be remembered that, as extreme irregularity is a merit and a beauty in most kinds of Gothic architecture, the garden accompanying it will also bear to be treated in an equally irregular manner. But, in relation to any variety of Grecian or Italian house, the garden, like the architecture, should be more distinguished by symmetry and regularity. Architectural gardening would further be out of place in connection with a house inferior in design, or destitute of character and style. It is peculiarly suitable for a tame and smooth general landscape; but is quite admissible, for contrast, in a picturesque, bold, and wild region. It specially demands that everything should be good and nicely finished; that the plants shall be of the best and most carefully-selected kinds; the grass evenly laid; the figures, and beds, and edgings of walks neatly and accurately cut; the gravel fine and well laid, and its smoothness (and that of the edgings) not obviously broken by gratings. The edgings, too, should all be particularly shallow, the edges of terrace-banks quite square and even at the top, and the soil in the beds and clumps very slightly raised above the level of the lawn. The spaces for specimens, flower-beds, and masses of shrubs should, moreover, be cut out of the flat lawn, and not have the grass curved up to them, as in the more natural style of treatment. And all the lines, whether of walks or other edgings, ought to be extremely straight or regular, thoroughly well-beaten and level, and the grass be very fine and smooth.

"The practice of employing masses of evergreens to cover changes of level in grounds, to break the transition between a terrace-bank and a natural slope, to fill up the corners of terraces and relieve the hardness and bareness of their walls, and in many ways to reconcile discrepant lines in the form of ground, is one which I have largely and for several years adopted. And I have invariably found it of the greatest possible service, while the result obtained from it is always satisfactory. Indeed this seems to be the only feasible and really thorough solution of a problem which every practitioner who has to direct the shaping of ground about houses must be constantly encountering."

Planudes || La Plata.

PLANUDES, Maximus, a learned Byzantine monk, flourished at the court of Constantinople in the first half of the fourteenth century. His inquisitive, self-confident mind seems to have meddled with many branches of knowledge. He dipped into politics, and was sent in 1327 on an embassy to Venice. He tampered with controversial theology, and was lodged in prison for his leaning towards the creed of the Roman Church. His interest in the exact sciences was also great, as his manuscript work on the *Indian Mode of Calculation* sufficiently testifies. (See Arithmetic.) Nor was time wanting for dabbling in classical literature, and for making Greek versions of Cicero's *Somnium Scipionis*, Cæsar's *De Bello Gallico*, and other Latin works. But it was in the character of an editor of Greek epigrams that Planudes chiefly recommends himself to the notice of posterity. His object was to abridge and re-arrange the scarce *Anthology* of Constantinus Cephalus. Careless and devoid of poetical taste, he blundered along, choosing and omitting at random. Occasionally his clumsy hand expunged whole couplets to make room for stiff and prosaic verses of his own, which his self-conceit imagined to be better. The ungainly collection was completed in seven books, and owing to the scarcity of other anthologies, continued for a long time to be popular, and to pass through many editions. The latest and most perfect edition is that of De Bosch and Van Lennep, in 5 vols. 4to, Utrecht, 1795–1822.

Plassey || La Plata.

PLASSEY, a village of British India, in the district of Nuddea, presidency of Bengal, on the left bank of the Hooghly, 96 miles N. of Calcutta. It is memorable as the scene of the victory that laid the foundation of the British-Indian empire. On the 23d of June 1757, Clive, with a force of 900 Europeans and 2100 Sepoys, crossed the river to attack 68 000 men under Sooraj-oo-Dowlah, soubahdar of Bengal. After much cannonading on both sides, Meer Jaffier, who was in the interest of the British, advised the soubahdar to retreat. Clive immediately advanced, routed the army, and took the camp of the soubahdar, who was dethroned to make way for the traitor Meer Jaffier.

PLASTER, in *Pharmacy*, an external application of a harder consistence than an ointment, and which is, according to the different circumstances of the wound, place, or patient, spread either upon linen or upon leather.

Plaster of Paris. See Gypsum.

PLATA, LA.

The United Provinces of the Rio de La Plata, otherwise called the *Argentine Confederation*, a country of South America, lies between S. Lat. 22. 20. and 40. 56., and between W. Long. 55. 20. and 70. 30.; and is bounded on the N. by Bolivia; E. by Paraguay, Brazil, and Uruguay; S.E. by the Atlantic; S. by Patagonia; and W. by Chile. It extends from the eastern slope of the Andes to the rivers Paraguay and Uruguay, which separate it from the respective countries of these names; and on the S. it is divided by the Rio Negro from Patagonia; but there is no natural boundary on the side of Bolivia. The country thus bounded includes the province of Buenos Ayres, which is at present independent of the Confederation. But as the existing arrangement is merely provisional, it will be included in the general description of the country. The greatest length of the country is about 1260 miles from N. to S., the breadth varies from 500 to 800, and the area is estimated at 786,000 square miles. The country is partly mountainous, but about five-sixths of its area is occupied by immense plains.

Mountains.

The Andes in the southern parts of La Plata are comparatively little known. They consist of two parallel ranges, of which the western, being the more elevated, forms the boundary-line of Chile and La Plata. The general elevation of these mountains is 12,000 or 13,000 feet above the sea; and they are crossed by several passes. North of the 37th degree of latitude the country is better known; the same character prevails, the distance between the ranges varying from 30 to 80 miles. About 33. 30. S. Lat. they approach to about 20 miles of each other, and between them lies the elevated valley of Tunuyan, 7500 feet above the sea. Farther north the mountains again recede, forming the wider valley of Uspallata, on the west side of which rises Aconcagua, the loftiest known volcano in the world. North of the 30th parallel the mountains extend over 120 miles of breadth, and form three parallel chains,—the Andes proper to the west, the Sierra Famatina, and the Sierra Velasco,—none of these ranges being so high as the more southerly ones. North of this point the Andes send out branches far to the east; so that the whole of the N.W. of La Plata, as far as the Rio Vermejo, is a mountainous region. The loftiest part of this region, known by the name of *El Despoblado*, or "The Desert," occupies the extreme N.W. of the country, and is a level plateau 13,000 feet high. From this table-land several mountain chains diverge in different directions,—the principal being the Sierra Ambato and Sierra Ancasta, stretching S.E.; and the Sierra Aconquija, a branch of the Sierra Ambato, towards the N.E. The north-eastern part of La Plata, near the Paraguay, is also mountainous; and in various parts of the country there are ranges of hills and mountains which would be conspicuous anywhere except near the Andes.

Plains.

By far the greater portion of La Plata is low and flat, constituting what are called the *pampas*. These occupy the whole breadth of the country, from the 33d degree of latitude to the Rio Negro; and they are divided by elevated regions into various parts, in which the soil varies considerably in fertility. The eastern and western portions of the plain also differ in their character; and there are three marked belts or regions stretching across the pampas from north to south. For about 180 miles west of Buenos Ayres the ground is covered with clover and thistles alternately. In winter and spring the luxuriant and shaggy leaves of the thistle give the whole region the appearance of a vast turnip field; and in the former season the clover, which is very rich, is grazed on by herds of wild cattle. In summer the thistles rapidly shoot up to the height of 10 or 11 feet, and become so strong and dense as to form an impenetrable thicket. In autumn the thistles wither and die, the dry stems continuing to rattle in the wind until they are laid low by the hurricanes of the region. West of this region an immense plain, covered with long grass, stretches for about 450 miles. There are also lakes of salt water, and salt marshes overgrown with reeds, in this plain, the soil of which is strongly impregnated with muriate of soda, giving even the grass a salt taste. Beyond this a tract of country extends to the foot of the Andes, covered with low thorny trees and bushes, and having a soil which, though arid, sandy, and saline, only requires irrigation to bear the most abundant crops. The western portions of the pampas have been very little explored except along the banks of the rivers; but their character in the northern part of the plain, which is traversed by the road from Buenos Ayres to Mendoza, is well known. The plains of Patagonia, which extend southward from the Rio Negro to the Strait of Magellan, and are claimed by La Plata, are described under

La Plata. PATAGONIA. North of the pampas, between the Sierra Velasco and a parallel ridge of hills called the Sierra de Cordova, there is a level plain, only a few feet above the sea-level, covered with an incrustation of salt, from which it has got the name of Great Salina. But the most remarkable plain in La Plata, next to the pampas, is that called the Gran Chaco, which occupies the N.E. portion of the country, and covers an area of 120,000 square miles. It is very little known, being but thinly peopled, and that chiefly by Indians. The southern part is an arid, sandy desert; while the northern portion is covered with extensive forests. Between the Gran Chaco, which extends as far south as 30°, and the pampas, lies an undulating country of considerable fertility; and the country between the Parana and Uruguay is occupied with hills, forests, and pastoral plains.

Coast. The coast of the country, extending from the estuary of the La Plata to the mouth of the Rio Negro, has few indentations, and is in general low, consisting of sand-hills or cliffs of little elevation. The principal promontory is Cape Corrientes, in S. Lat. 38. 6., which is a high and rather bold headland. Samborombon Bay and Bahia Blanca are the only bays on the coast; the latter contains Port Belgrano, the best and most capacious harbour south of 25. S. Lat., and the nearest point on the Atlantic from which a communication might be established with Conception on the Pacific.

Rivers and lakes. The principal rivers of La Plata are those which fall into the estuary from which the country derives its name. (See PLATA, *Rio de la.*) Besides these, La Plata contains few rivers of any size. The Rio Salado of Buenos Ayres flows through the pampas, and falls into the Atlantic. It is dry in summer, and can be used neither for navigation nor irrigation. Farther south is the Rio Colorado, rising in the Andes, and flowing S.E. to the sea. Its whole length is between 500 and 600 miles, of which it is navigable for about 100. The Rio Negro also rises in the Andes by two branches, and flows at first N.E.; and after receiving the Neuquen from the north, it flows E. and S.E. to the Atlantic. Its whole length is nearly 600 miles, and it is navigable for large boats about 500.

Numerous rivers take their rise in the eastern declivities of the Andes, and after irrigating considerable tracts of country, are either absorbed by the soil or flow into inland lakes. Amongst these may be mentioned the Rio Dolce, which originates in the lofty mountains of Tucuman, and, after watering the capital of the same name, passing near Santiago del Estero, capital of the province so named, and traversing Cordova, is lost in a salt lake situated in that province, and called "lagunas saladas de los Porongos." The Rio de San Juan and the Rio de Mendoza rise in the valley of Uspallata, and flow, the one from its northern and the other from its southern opening, into the lagoon of Guanacache, which is one of a series of lakes between 31. 40. and 32. S. Lat. These lakes are drained by a river called the Desaguadero, which flows S. and E. for 250 miles into another group of lakes, called Belvedero, between 33. 30. and 34. 30. S. Lat. They receive also the Tunuyan from the valley of the same name. Another branch of this river flows south, and, joining the Rio Diamante and the Chadi Leubu from the Andes, flows into the Urre Lauquen, a lake but little known, in 37. S. Lat.

Lakes are distributed over the whole expanse of the pampas, and some of them are of considerable size; but they cannot be said to correspond in grandeur to the other features of this region. The soil is almost everywhere impregnated with salt; and the water of most of the lakes and pools is brackish and disagreeable to the taste. So plentifully is this saline matter distributed, that whole tracts of country are covered with its efflorescence. But a want of water is universally experienced; for notwithstanding the number of lakes and inferior rivers, many of them disappear during the dry season. A growth of rushes overspreads their bottoms, serving as lairs for the pumas, that lie in wait for the cattle, as, perishing of thirst, they fly to the green stagnant water which lies on the marly surface and swarms with myriads of mosquitos.

Geology. The geology of this country presents little variety, and scarcely anything that is interesting. Rocks are seldom seen, except in the mountainous region. Where they do occur, they are generally granitic, covered in some places with quartz. Some gypsum is found in the vicinity of Buenos Ayres, and limestone is said to occur in several places. The stones used in paving the streets or in building are brought from the island of Martin Garcia, at the mouth of the Uruguay, or as ballast in vessels from Europe.

The soil of the pampas is a rich mould, perfectly free from stones, not one being seen on its surface for many hundred miles together. One of the most remarkable features of this region is the number of fossil remains, chiefly of immense quadrupeds, which are found in the soil of the plains.

The mineral productions are gold and silver, copper, tin, lead, and iron (of which large masses are often found), saltpetre, alum, sulphur, marine salt, and bituminous shale; and there are also numerous mineral springs besides the saline lakes already mentioned, from which salt can be procured.

Climate. The tropical climate which prevails in the northern districts disappears more and more towards the south; so that snow and ice are not unknown. Upon the east coast the air is humid, and rain, thunder, and violent storms are not unfrequent; but in the western district the atmosphere is free from vapour, rain is unfrequent, dew never falls, and the drought is often very great. The climate of the pampas is subject to a great difference of temperature in winter and summer, although the gradual changes are very regular. The winter is about as cold as November is in England, and the ground at sunrise is invariably covered with white frost, but the ice is very thin. In summer the sun is oppressively hot; and not only is manual labour suspended during the middle of the day, but even the wild horses and cattle are exhausted by it. The only great irregularity in the climate is the *pampero*, or S.W. wind, which sweeps over these plains with a velocity and a violence which it is impossible to withstand. These periodical visitations, however, produce beneficial effects, the weather being particularly agreeable after they have exhausted their fury; and, taken as a whole, the pampas may be said to enjoy as beautiful and as salubrious an atmosphere as the most healthy parts of Greece and Italy, and without being subject to malaria. With regard to humidity, the atmosphere varies much in different parts of the country. In the provinces of Mendoza and San Luis, or in the regions of wood and grass, the air is very dry, and there is no deposition of dew at night; but in Buenos Ayres a considerable quantity of moisture prevails in the atmosphere, probably from the vicinity of the place to the ocean.

Productions. In some parts of La Plata there are wooded tracts, consisting of palms, cedars, and other trees; but from the Rio de la Plata to the Straits of Magelhaens, as well as throughout the most part of the pampas, we find neither tree nor shrub. In the country north of the Gran Salina tropical productions are raised, such as mandioc, rice, maize, sugar, cotton, and tobacco; while the Paraguay tea plant, the cactus that bears the cochineal insect, the aloe from the fibres of which ropes and cordage are made, and other plants, grow wild here. In the southern regions wheat and maize are principally grown. Cultivation hardly extends beyond the banks of the Parana and the mouths of the other rivers. The N.W. part of the country is chiefly agricultural, while the eastern and southern regions abound in pasture land. The fruits of Southern Europe grow in La Plata

La Plata.

Animals.

This country has long been celebrated for the abundance of its cattle, horses, sheep, goats, asses, mules, and swine. The horses are both wild and tame, and the number of them, as well as of the cattle, is immense. The number of cattle in 1851 was estimated at twelve millions; and the horses, mules, and asses are probably far more than four millions. Amongst the wild animals may be mentioned the jaguar, the puma (which may be said to represent the lion in the New World), the carpincho or water-hog, tajassu, tapir, armadillo, guanaco, monkey, deer, many species of serpents, locust, mosquito, wasp, ant, bee, &c. Amongst the birds of this country may be mentioned the condor, Brazilian eagle, many hawks, emu, crax, guan, wild turkey, parrots, troupiales, woodpeckers, many species of duck, &c. Near the Andes, and on the banks of the Parana, bees are kept, and wax is collected. The cochineal insect is also reared. Of fish, there are various kinds in the rivers; and along the coast whales and seals (which yield train-oil and fish-bone for exportation), sharks and turtles, are found.

Inhabitants

The population of La Plata is very various in its character and origin. It consists of natives, of Spaniards, of races of mixed native and Spanish blood, of Negroes, and of European immigrants. The Indians themselves are not all of the same race, but belong to three different classes. In the mountains and valleys of the N.W. dwells a race of Peruvian origin, speaking the Quichua language; east of the Parana lives a race of Guaranis, who are also spread over a large part of Brazil; and the southern part of the country is occupied by Araucanian tribes. Of the natives but a small proportion are subject to the dominant race, and these are only found in the northern provinces. In some places these natives live in villages separate from the white population. The independent Indians, who inhabit the Gran Chaco and the pampas south of 35. S. Lat., are often at war with the Europeans. With the exception of those tribes who have been taught husbandry by the Jesuits, these people all lead a nomadic life, being almost constantly on horseback, and subsisting on the chase and the produce of their flocks and herds. The tribes of the Gran Chaco, though having no friendly intercourse with the Spaniards, are not constantly at war with them; but those of the pampas carry on their hostilities almost without intermission. They were at one time restricted to the regions south of the 33d parallel; and at present they are by treaty forbidden to cross the Rio Negro without permission, but they pay very little attention to this restriction. They are divided into families, each under a chief, who has very little power except in war. The Spaniards, who are the dominant race, form a very small proportion of the population; but in many parts the bulk of the people is composed of the mixed races. Of these mixed races, the most remarkable are the Gauchos, or rustics of the pampas. They live in huts of osiers and mud; but the greater part of their time is spent on horseback, hunting the wild cattle and horses of the plains. Their dress consists of a coarse jacket and breeches, over which is a poncho or square woollen mantle, with a slit in the middle for the head; a broad straw hat; and boots made of the skin of a horse's hind leg, without a seam. They frequently wear silver buckles, silver-mounted knives, and silver-rowelled spurs. Their peculiar weapons are the *lasso*, or long leather thong and noose, and the *bolas*, or two balls attached to a leather thong. Both these missiles they handle with great dexterity, seldom failing to hit their mark: the lasso they throw round the neck or horns of the animal, the bolas round the legs. There were at one time numerous Negro slaves in some of the provinces of La Plata; and though slavery has been abolished since the revolution, their descendants still form a distinct class among the inhabitants.

Manufactures.

The manufactures of La Plata are few and unimportant, as the great mass of the people are employed in agricultural or pastoral pursuits. The most important manufacture is that of ponchos, which are made of the finest quality at Santiago. Various other woollen fabrics are made for dresses and other purposes. The wearing apparel, knives, spurs, household furniture, &c., of the peasantry are to a large extent imported, and are generally of British manufacture.

Commerce

A large amount of internal commerce is carried on among the different provinces, as most of them produce articles that are not found in the others. There is also some trade by land with the neighbouring countries of Peru, Bolivia, and Chile; and through the Rio de la Plata commercial relations are kept up with other foreign countries. This commerce is chiefly carried on through Buenos Ayres; and since the separation of that province from the other thirteen, through Rosario. Cotton cloth, calico, linen, woollen, and silken fabrics, leather, hardware, cutlery, glass, earthenware, arms, ammunition, &c., are imported from Great Britain; wines, silk, perfumery, jewellery, &c., from France; and various other articles from other parts of Europe, the United States, Brazil, &c. The principal articles exported from La Plata are mules, salt beef, hides, horns, and wool. The annual value of the imports is about L.208,000, and that of the exports L.230,000.

Government.

The provinces of La Plata form a federal republic similar to that of the United States of North America. Each province is so far independent that it has its own constitution, its legislature, and executive; while there is at the same time a federal Congress and a president of the whole confederacy. The Congress consists of two chambers,—the lower one composed of 38 deputies, elected directly by the people; and the upper of 28 senators, named by the provincial legislatures. The authority of the Congress extends to the relations of the republic with foreign states, and the financial affairs of the nation. The president is elected indirectly by the people for the period of six years. The capital and part of the territory are under the immediate government of the president and Congress. The army of the confederacy amounts to 5000 men; and there is a national militia that may be called out in time of war. The national finances are in a very bad condition; the paper currency is very much depreciated; and the debt amounts to a large sum. The annual public expenditure is about L.40,000. The established religion in La Plata is the Roman Catholic, but all others are tolerated. Education is not very far advanced; but in the chief towns it is in a better state than in most parts of South America.

Provinces

The confederation of La Plata consists at present of thirteen provinces, besides the country occupied by the Indians. The provinces, with their area, population, and capitals, are as follows:—

Provinces.	Sq. Miles.	Pop.	Capitals.
Cordova	45,780	150,000	Cordova.
Catamarca	38,150	70,000	Catamarca.
Corrientes	12,720 (with Entre Rios)	84,600	Corrientes.
Entre Rios		50,000	Parana.
Juyjuy	55,100 (with Salta)	40,000	Salta.
Salta		60,000	
Mendoza	47,050	60,000	Mendoza.
Rioja	58,500	40,000	Rioja.
Santiago del Estero	69,620	80,000	Santiago.
San Juan	39,100	40,000	San Juan.
Santa Fé	40,900	32,000	Santa Fé.
San Luis	35,800	40,000	San Luis.
Tucuman	41,960	60,000	Tucuman.
Total	484,680	806,600	

We proceed to describe the several provinces in detail.

Cordova.

Cordova is bounded on the N. by Santiago and Catamarca, E. by Santa Fé, S. by the Indian territory and Buenos Ayres, and W. by San Luis and Rioja. It is occupied in the central and western portions by the Sierra de Cordova and its branches, from which many rivers flow, the principal being the Sercero, an afflu-

ent of the Parana. This is a fine province, the soil being rich and fertile, and well irrigated. It is pretty well wooded, possesses excellent pasturage, and abounds in fine clover. Cordova, the capital of the province, is picturesquely situated in a deep valley, on the Primero, in S. Lat. 31. 15., W. Long. 63. 40. It was founded in 1573, and became a place of considerable importance in the time of the Jesuits. An active trade is carried on through Cordova, between Buenos Ayres and the upper provinces of La Plata Pop. 14,000.

Catamarca.

Catamarca is a tract of country situated near the foot of the Andes, and is bounded by Santiago, Tucuman, and Salta on the N. and E., by the Andes on the W., and by Rioja and Cordova on the S. It consists of a mountainous table-land, but is noted for an extensive and fruitful valley, called the Valley of Catamarca. The climate of this district is of the most genial description, and the country produces cotton of a very superior quality. The city of Catamarca is situated about 180 miles south-west of Tucuman, in Lat. 27. 45. S., and Long. 66. W. It was founded more than a century and a half ago, and stands in the beautiful valley which bears its name. It contains about four thousand inhabitants. The other towns in this province are unimportant.

Corrientes.

Corrientes is situated between the rivers Parana and Uruguay; on the N. it is bounded by the state of Paraguay, E. by Brazil, S. by Entre Rios, and W. by the Gran Chaco. The southern parts of the province are well wooded and fertile, the principal productions being cotton, tobacco, rice, and sugar. The territory of Corrientes is intersected by several rivers, some of which are navigable for a considerable distance Besides the celebrated lake Ybera, which is very shallow, but covers sometimes 1000 square miles, there are in the province numerous sheets of water, by which it is rendered one of the most fertile countries on the face of the globe. Corrientes, the capital, is admirably situated on the banks of the Parana, near its junction with the Paraguay. It is a very ancient city, and contains several public buildings. Its position is very good for commercial purposes. Pop. 7843.

Entre Rios.

Entre Rios is situated between the two great rivers Parana and Uruguay, and is bounded on the N. by the province of Corrientes, E. by Uruguay, S. by Buenos Ayres, and W. by Santiago. It possesses several peculiar advantages, and is one of the most fertile and pleasing provinces in the whole republic. Embraced on all sides but one by the two great rivers just named, it is easily accessible by shipping, and being thus insulated, it is protected from the incursions of the Indians. It is copiously irrigated, the southern part being subject to an annual inundation, and the soil is distinguished for its fertility. Wood is abundant, but small in size. The pastures are extensive; but the wild cattle, which formerly abounded, are much reduced in number. Hides, horns, tallow, and beef are the principal articles exported. Parana or Bajada, the capital of Entre Rios, and the seat of government of the confederation, stands on the left bank of the river Parana, opposite Santa Fé. It is a large town, and contains a hall of representatives, a theatre, and several churches. An active trade is carried on here; and the noise and bustle of the town present a striking contrast to the solitude and silence that prevails on the banks of the river both above and below the town. Parana was founded in 1730. Pop. about 15,000.

Jujuy and Salta.

The provinces of Jujuy and Salta are bounded on the N. and W. by Bolivia, S. by Catamarca and Tucuman, and E. by the Gran Chaco. The western part belongs to the great range of the Cordilleras, and is rich in metals. Here are found gold and silver, copper, iron of various qualities, sulphur, alum, vitriol; and there are also indications of the existence of tin and quicksilver. Many branches of mountains, off-shoots from the colossal chain of the Andes, extend into the province, from which proceed pleasant and beautiful valleys, intersected by numerous streams which irrigate and fertilize the country. The vegetable productions are wheat, maize, pulse, cotton, sugar, indigo, &c. There are extensive forests and good pastures, where horses and cattle are reared. In one of the intervals between the low collateral branches of the Andes is situated Salta, the capital of the province of that name, in Lat. 24. 15. S, and Long. 64. W., on the great road leading from Buenos Ayres to Lima by the way of Potosi. It was founded in 1582, and has long been a place of some consideration in this thinly-peopled region. The climate, however, is very unhealthy. The population amounts to about 9000 souls. The town of Jujuy stands on a river of the same name, in a country rich in precious metals.

Mendoza.

(For an account of the province and town of Mendoza, see MENDOZA.)

Rioja.

Rioja is situated at the foot of the Andes, and is bounded on the N. by Catamarca, E. by Cordova, S. by San Luis and San Juan, and W. by Chile. Like the other provinces in this region, it is mountainous, including the Sierra Famatina and Sierra Velasco, which form the three parallel valleys of Guandacol, Famatina, and Arauca. Rich silver mines are worked in the Sierra Famatina. Vines are grown in the north of the province; agriculture is carried on in the W., and cattle are fed on the rich pastures in the S. Rioja, the capital, is a small and unimportant city, situated at the foot of the Sierra Velasco, in Lat. 28. 30. S, and Long. 68. 35. W. It contains about 8800 inhabitants.

La Plata.

Santiago del Estero.

Santiago del Estero is situated between Tucuman and Cordova, being south of the former and north of the latter. It is of great extent in all directions, and is one of the most fertile of these provinces. Agriculture is the chief occupation of the inhabitants of Santiago. Honey, wax, many valuable woods, cochineal, &c., are obtained here, and some manufactures are carried on. All kinds of grain may here be brought to perfection; yet the inhabitants are slow to avail themselves of the advantages presented by nature. The city of Santiago, situated on the road to Bolivia through Cordova, in 27. 55. S. Lat, and 63. 20. W. Long., is of little importance. Pop. 4000.

San Juan.

San Juan is bounded on the N. by Rioja, E. by San Luis, S. by Mendoza, and W. by Chile. In the north of the province there are some gold mines, which are worked to a small extent. The country is remarkably fertile, producing wheat, maize, olives, and vines in abundance. The produce of the olive plantations is much esteemed in Buenos Ayres; but the natives direct their attention chiefly to the cultivation of the vine, which grows luxuriantly, and to the making of wines and brandies, which they export in large quantities as far as Potosi, Buenos Ayres, Santa Fé, and a great portion of the eastern side of the Rio de la Plata. The city of San Juan, situated in Lat. 31. 15. S, and Long. 68 35. W., was founded as early as 1560, and is consequently one of the most ancient places in the republic. Pop. 8000.

Santa Fé.

Santa Fé is bounded on the N by the Gran Chaco, E. by Entre Rios, S. by Buenos Ayres, and W. by Cordova. This fertile country is irrigated by numerous rivers, some of which are of considerable size. The chief employment of the inhabitants consists in the breeding of cattle and horses, the skins of which animals are conveyed to Buenos Ayres. Santa Fé, the capital, is situated on the western bank of the Parana, and has risen to importance by becoming a depôt for goods on the river. The inhabitants of the town amount to about 4000. The largest town in the province is Rosario, which occupies the farthest south, and therefore most important position of any town on the Parana, being nearest to the markets of the west. It is 150 miles above the confluence of the Uruguay and Parana, and the river is here navigable for ships drawing 14 feet. In the latter half of 1854 the vessels that entered and cleared were 290; tonnage, 11,000; value of cargoes, L.760,000. Pop. 12,000.

San Luis.

San Luis is bounded on the E by Cordova, S. by the territory of the Pampas Indians, W. by Mendoza and San Juan, and N. by Rioja. The soil is poor; and though the climate is salubrious, the inhabitants are very indolent. Agriculture is not pursued to any extent, but large numbers of cattle are reared. San Luis, the capital, is a very ancient town, and the only place of any importance in the journey between Buenos Ayres and Mendoza. It is situated in a fertile valley at the foot of the Sierra de Cordova. Pop. 1500.

Tucuman.

Tucuman, one of the most important and fertile provinces in the republic, is bounded by Salta on the N., and by Santiago and Catamarca on the S. and S.W. It contains mines of gold, silver, copper, and lead; but these are only worked to a small extent. The other productions are wheat, maize, rice, sugar, and tobacco, of which thousands of bales are exported to Cordova, San Luis, San Juan, Mendoza, and other cities. Fruits of various sorts are abundant, and potatoes here attain an enormous size. Tucuman, the capital of the province, is a straggling city, situated in 26. 50. of S. Lat., and 64. 35. of W. Long. To the west of the city is a mountain of great height, from which numerous rivers descend to fertilize and beautify the surrounding territory. Along all the lower parts of this mountain are immense clusters of trees, and amongst them many of bitter oranges. The city is surrounded by these woody tracts, in which the trees sometimes attain an extraordinary size, and the timber is of the best quality used in America. The houses in general are of an inferior description; but the place is memorable from its having taken a distinguished part in the revolutionary struggle. Pop. 8000.

History.

To the Spaniards belongs the honour of first discovering this part of the South American continent. In the year 1516, Juan Dias de Solis, having been furnished by the court of Spain with two ships for the purpose of exploring Brazil, arrived, in the course of his voyage, at the mouth of the Rio de la Plata. Touching on the N. coast between Maldonado and Monte Video, he took possession of the land in name of his sovereign; but, thrown off his guard by the deceitful friendship of the natives, he was slain, along with a few attendants who had followed him on shore. The coast was immediately abandoned by the survivors on board of the vessels; but in the year 1526 a fresh expedition, under the celebrated Sebastian Cabot, then in the service of Spain, entered the river, and cast anchor opposite the site of the present Buenos Ayres.

This took place at the time when a Spanish captain called Garcia was making discoveries in other parts of the same river. Advancing about 300 miles upwards, Cabot discovered a fine river, the Tercero, flowing into the main stream Up this he sailed with his fleet, and disembarking his men, built a fort, in which he left a garrison; whilst he himself, with his remaining followers, pursued his discoveries still farther up the river. The Indians with whom he came in contact exhibited abundance of gold and silver plates, particularly the latter, brought by them from the eastern parts of Peru. This circumstance led Cabot to believe that mines of the precious metals existed in the country in which he then was; and accordingly he gave the name of *Rio de la Plata*, or River of Silver, to the noble stream by which it was watered. The Spaniards soon determined on colonizing this valuable acquisition, and, to prevent any interference on the part of the other nations of Europe, Don Pedro de Mendoza, with two or three thousand followers, was sent from Spain to secure the possession, and establish a relationship between it and the mother country. He landed upon the western shore of the La Plata in the year 1535, and founded the city of Buenos Ayres, which he so named from the salubrity of the climate. Pursuing his way into the interior, he explored all the country as far as Potosi, at which mines of silver were discovered nine years afterwards. The first settlers at Buenos Ayres were most unfortunate; their town was burned by the Indians, and after suffering every privation, they were shortly afterwards compelled to abandon the place. Previously to this event, Assumption, the capital of Paraguay, had been founded; and thither the wretched remains of the expedition retreated. A second armament was fitted out, and an attempt made to rebuild the town, in 1542; but it was overwhelmed by a calamity similar to that which had overtaken the former. The chief attention of the Spaniards was for some time directed to forming settlements in Paraguay, in order to facilitate their communication with the mines of Peru, where Pizarro and his successors were gathering in a rich harvest. Contentions with the Indians were frequent and bloody, for the Guarani Indians of the vast plains upon either bank of the La Plata proved much more difficult to subdue than the timid and tractable Peruvians.

It was not until the year 1580 that the Europeans succeeded in their attempts to found a town upon the site chosen by Mendoza. Before this period, however, they had established themselves at Santa Fé, Mendoza, and some other places in the interior; so that, as Dr Southey observes, the history of this part of South America differs from that of any other colony in one remarkable circumstance,—the first permanent settlement was formed in the heart of the country, and the Spaniards colonized from the interior towards the sea. But they were not permitted quietly to enjoy the success of their third attempt to found Buenos Ayres. Stimulated by the recollection of their previous triumphs in demolishing the works of the invaders on the same ground, the Indians once more attacked it; but the town was so well fortified and garrisoned as to bid defiance to their efforts. From this period the city began to prosper; and the ship which carried to Castille the intelligence of its refoundation took home a cargo of sugar, and the first hides with which Europe was supplied from the wild cattle which now began to overspread the country, and soon produced a total change in the manners of all the adjoining tribes. The immense pampas of La Plata appear to have been originally stocked with cattle from a few which had been brought by the earliest settlers; and so rapidly had they multiplied that, about the year 1610, no less than a million is said to have been driven from the country in the neighbourhood of Santa Fé into Peru.

From the first period of the colonization of this country till the year 1778, the government was dependent on that of Peru, although the chief of Buenos Ayres had the title of Captain-General. A false idea of what constitutes wealth led Spain to estimate the value of her possessions by the number and richness of their mines of gold and silver; and Buenos Ayres being deficient in these, its more solid advantages of a fertile soil and a salubrious climate were consequently overlooked. The pernicious system of policy practised by Spain towards her colonies was the main cause why this city remained for such a length of time almost entirely unknown to Europeans. Apprehensive lest commodities might be introduced into Peru by way of Buenos Ayres, and thus prejudice the sale of the cargoes imported by the fleets which they sent to Panama, the early traders solicited and obtained from the government the prohibition of every kind of commerce by the Rio de la Plata. Those whom this measure most nearly affected put in a strong remonstrance against it, and were so far successful that, in 1602, permission was granted them to export for six years, in two vessels belonging to themselves, and on their own account, a certain quantity of flour, tallow, and jerked beef, but only to two ports. Upon the expiration of the term, an indefinite prolongation was solicited, with an extension to all kinds of merchandise, and liberty to trade also with other ports. This application was vehemently opposed; but notwithstanding, in the year 1618, the inhabitants of the shores of the Rio de la Plata were authorized to fit out two vessels, not exceeding 100 tons burden each. Several other vexatious restrictions were imposed on them; and to prevent any traffic with the interior of Peru, a custom-house was established at Cordova del Tucuman, where a duty of 50 per cent. was levied upon all imports. This custom-house was also designed to prevent the [illegible] of the precious metals from Peru to Buenos Ayres, even in payment for mules furnished by the latter city. By an order of 1622 the permission previously given was prolonged for an indefinite period; and with a view to promote the prosperity of the country, a royal *audiencia* was established at Buenos Ayres in 1665.

Under such a miserable system of policy, it is not surprising that the provinces of the Rio de la Plata languished in indigence and obscurity. But the resources of so extensive and fertile a territory could not remain for ever concealed. As the population and wealth of the country increased, the continual remonstrances of the people at last opened the eyes of the Spanish government to the importance of the colony, and a relaxation took place in the system of commercial monopoly which had hitherto been rigorously adhered to. Indeed the absurd restrictions had been followed by their natural consequence, smuggling; and to such a height was the contraband trade carried that, in order to put a stop to it, the government of Castille gave permission to register ships to sail under a license from the council of the Indies at any time of the year. The *flota* which hitherto had embarked from Spain once a year, and was the only legitimate means of communication with America, dwindled away from 15,000 to 2000 tons of shipping; and in 1748 it sailed for the last time to Cadiz, after having carried on the trade of Spanish America for two centuries. The register-ships now supplied the market with European commodities at a cheaper rate and at all seasons of the year, and from that time Buenos Ayres gradually rose into importance Other relaxations in the mercantile system followed soon afterwards. In the year 1774 free trade was permitted between several of the American ports; and this was subsequently followed by additional liberties.

The improvements which took place in Buenos Ayres by this enlargement of its commercial relations were frequently interrupted by circumstances which carry us back to an early period of its history. The Spaniards and Portuguese have, by a singular coincidence, been destined to be rivals, not only in the Old, but in the New World. The neighbouring territory of Brazil belonged to Portugal, and bitter hostilities frequently took place between the two countries. It is computed that, in the hostile incursions which the Brazilians made into the Spanish possessions in this quarter of America, they destroyed upwards of 400 towns and villages. These marauders, the offspring of Portuguese, Dutch, French, or Italians, by Brazilian women, were called Mamelucos. Their principal object was to carry into slavery the Indians whom the Jesuits had partially civilized; and in exercising their inhuman trade they committed the most horrid enormities. It does not appear that their acts were authorized by the government which they professed to obey; for repeated decrees were passed in favour of the oppressed Indians. These, however, were seldom or never observed; and governors and others, who profited by the captivity and sale of the native tribes, winked at the traffic. But the rivalry and animosity of the Portuguese were productive of other results besides those consequent on hostile incursions. We have alluded to an extensive contraband trade, originating, in the first instance, in the blind policy of Spain. This was chiefly carried on by the Portuguese, who were enabled, by extending their settlements to the banks of the Rio de la Plata, to organize a system of smuggling which ultimately almost annihilated legitimate commerce. But this illicit trade, though detrimental to the mother country, by whom it was finally put down, contributed not a little to the prosperity of the colony.

In the year 1778 the provinces of the Rio de la Plata, Paraguay, Uruguay, and Bolivia were erected into a viceroyalty, of which Buenos Ayres was constituted the capital. At the same time, it was thrown open to free trade of every description, even with the interior of Peru; and such was the effect of this wholesome measure that the number of vessels trading with South America was at once augmented, and kept gradually increasing from year to year.

In the year 1806 a British squadron, under the command of Sir Home Popham, appeared in the Rio de la Plata. From this armament a body of troops was landed, for the purpose of taking the capital. The British force was small, but, by the culpable negligence of the viceroy, who does not appear to have made any attempt to defend this important city, General Beresford accomplished his object on the 26th of June. This rash and unauthorized enterprise was fortunate in the first instance, but exceedingly disastrous in its issue. The viceroy having retired to Cordova, Don Santiago Liniers

a Frenchman in the service of Spain, put himself at the head of all the troops he could collect on both banks of the Plata, and on the 12th of August attacked the city at several points. So vigorous and successful was the assault, that the British general and his troops were compelled to surrender themselves prisoners of war. In the meantime, British reinforcements arrived from the Cape of Good Hope, whence the original expedition had sailed; and Sir Home Popham, after making an unsuccessful attempt on Monte Video, took Fort Maldonado, at the mouth of the River Plata But the intelligence of the first capture of Buenos Ayres was so well received by the British public that government resolved on maintaining possession of the banks of the Plata; and an armament was therefore fitted out for effectually reducing the country. The first body of troops, which were commanded by Sir Samuel Auchmuty, enabled the British to undertake the conquest of Monte Video, which was carried by storm in February 1807. In May following, General Whitelocke arrived at the head of a formidable force; and about a month afterwards these were joined by a further reinforcement under General Crawford. The army now amounted to 8000 men, and the chief command was confided to General Whitelocke, a man destitute alike of courage and ability. The reduction of Buenos Ayres was now resolved upon, the attacking army sailed up the river, and, disembarking below the capital, marched towards it, but met with a reception which was little anticipated. The inhabitants of Buenos Ayres had made every preparation for a desperate resistance. The streets were intersected by deep ditches, defended by cannon, and the windows and house-tops were thickly planted with armed men. No sooner had the British troops begun to penetrate the streets in columns than they were assailed by grape and musketry, under which they perished in great numbers, without being able to retaliate on the citizens. The cool, determined valour of the troops, and the heroic energy of their leaders, were exerted in vain. About one-third of the British army was either killed, wounded, or taken prisoners, without any material advantage having been gained. In these circumstances, it would have been madness to persist in such a mode of operation; and next day an armistice was concluded. A convention followed, the terms of which were, that the British should evacuate the possessions on the Plata in two months, and that all prisoners taken on both sides should be restored. By this capitulation Monte Video, which might have been safely maintained against any enemy, and which would have afforded a secure depôt for our manufactures, was also lost.

But the events which were now passing on the continent of Europe were destined to change completely the aspect of affairs in South America. The invasion of Spain by Napoleon in 1808 gave the colonists an opportunity of throwing off their allegiance to the mother country. The princess-regent of Portugal, claiming the crown of Spain, despatched emissaries to La Plata to concert measures for her residence at Buenos Ayres. Her proposals were received with enthusiasm; but when on the point of being crowned with success, they were rendered abortive by the viceroy Cisneros, who was a staunch supporter of the rights of Ferdinand VII.

From this period the principal supporters of the Princess Carlota changed their views, and formed plans of ultimately setting up the standard of independence. After some political struggles, they succeeded in deposing the viceroy, and, on the 25th of May 1810, named a *junta gubernativa*, the leading member of which was Don Mariano Moreno, the secretary. As the eyes of the people in the provinces were opened to the daring nature of the step which had been taken, the authority of the junta became more and more circumscribed, and was soon reduced to the limits of Buenos Ayres. Monte Video did not recognise it at all. But Moreno was nothing dismayed by this want of support, and his measures became more decisive as the emergency increased. He succeeded in expelling the viceroy from the country; and had not the junta itself become divided, such a man at the head of affairs would have soon brought matters to an issue. It became impossible for the junta to exist in its then disjointed state. Moreno and his party withdrew; and he having accepted a mission to England, unfortunately died on his passage.

The people of Buenos Ayres having so far succeeded in establishing their independence, considered themselves powerful enough to proselytize in the provinces. A division of patriots under Ocampo was sent against Cordova, where a formidable faction opposed to the new order of things had been organized by Liniers; and this leader was taken prisoner, and shot, along with several influential persons The opposition to the republicans was by these violent measures put an end to; but though nearly the whole of the country was now in favour of independence, there were continual disputes as to the form of government that should be established,—Buenos Ayres endeavouring to obtain the supreme power, while the other provinces contended for equal rights. In January 1813 a sovereign constituent assembly was convened at Buenos Ayres. It was not until now that the Spanish flag and cockade were replaced by the bicolour. Now also the coinage bore the republican arms.

Monte Video still stoutly maintained the sinking cause of Spain: the effort was unavailing. Twice the soldiers of the fortress, in attacking the soldiers of Buenos Ayres, were driven back. In 1812 the town was taken, when between 5000 and 6000 royalist troops laid down their arms, and an immense quantity of military stores was likewise given up. The changes which the government of Buenos Ayres underwent we need not follow; and the civil dissensions by which the country was afflicted are equally endless and uninteresting. In 1816 a congress of deputies from all the provinces met at Tucuman, which named General Pueyrredon director of the republic, and declared the countries on the Plata independent. An army was raised and disciplined to defend the country, and to assist the people of Chile against their common enemy. The combined forces gained over the Spaniards the two decisive victories of Chacabuco (1817) and Maypu (1818). Various attempts were made by the Spaniards to regain possession of La Plata, but they were all without success; and finally their troops were totally defeated by the republicans in July 1821. In 1824 the independence of La Plata was recognised by the British government. The internal dissensions in the country previous to the appointment of Rosas dictator in 1835, and the events which led to his downfall and flight in 1852, are briefly narrated in the article BUENOS AYRES. This event, which seemed to put an end to a protracted war, was in reality but the signal for fresh contests. The people of Buenos Ayres, exulting in their newly-obtained liberty, were still animated with all their old jealousy of the other provinces, and of General Urquiza, who supported their rights. Accordingly, when the governors of all the provinces, assembled by Urquiza at San Nicolas, appointed him provisory director until a general Congress, which was to meet at Santa Fé, should prepare a constitution, the representative assembly of Buenos Ayres accused Urquiza of attempting to set up a new tyranny, and forbade the execution of the treaty of San Nicolas. Urquiza, in the exercise of his provisory power, dissolved the assembly, and occupied the city with his troops. While thus possessed of supreme power, the director followed a more liberal policy than Rosas, by acknowledging the independence of Paraguay, opening the La Plata to ships of all nations, and permitting free commerce in the interior of the country. But no sooner had Urquiza quitted Buenos Ayres to attend the Congress at Santa Fé, than a revolution took place in the town; his troops were obliged to retire; the representative assembly again met, and appointed General Pinto provisory governor of the province. But the province of Buenos Ayres itself soon became divided, the country rising against the town; civil war raged afresh; and General Urquiza besieged Buenos Ayres by land and sea. Meanwhile all the other provinces sent deputies to the Congress of Santa Fé, which prepared a federal constitution, and published it May 1, 1853. The representatives of Brazil and Bolivia attempted in vain to mediate between the contending parties; and afterwards the ministers of Great Britain and France interfered with as little success. On the 26th of June 1853 Commodore Coe, the commander of Urquiza's squadron at Buenos Ayres, influenced, it is said, by a bribe, went over to the other side. Mutiny and desertion broke out in the besieging army; and Urquiza was obliged to retire to the province of Entre Rios, of which he was governor. Then ensued a separation between the contending parties. Buenos Ayres declared itself a sovereign state; while the other provinces fixed their capital at Parana, and appointed Urquiza president of the republic for six years. In this divided condition La Plata has since remained; and although several attempts have been made to negotiate a reunion, none has proved successful. Two treaties were concluded in December 1854 and January 1855, by which the two states were to allow free commerce between their territories, to use one national flag, and to defend each other against foreign aggression. Fresh misunderstandings and aggressions however arose; and these treaties were declared null March 18, 1856. But the country has purchased, at the expense of this division, a respite from the long series of revolutions and tyranny, civil and foreign wars, which have agitated it from the period of its independence to that of its dismemberment. The thirteen provinces endeavoured to lessen the preponderance of Buenos Ayres by opening up the Parana and Paraguay to commerce, and by imposing extra duties on merchandise coming by Buenos Ayres. At the same time, they are turning their attention to the internal improvement of the country, by colonizing its vast and rich though almost unpeopled territories, by constructing railways to connect its various parts, and launching steamers on its magnificent rivers. The experience of the last half century seems at last to have taught the people and their leaders how ruinous it is to fight about constitutions and governments, and to neglect or wantonly to destroy the undisputed gifts which nature has so lavishly bestowed. A few years of peace would probably do much to develop the resources of the country, and create a common interest among the provinces, which would unite them more firmly together than laws or treaties ever could.

PLATA, Rio de la, a large estuary of South America, formed by the confluence of the Rivers Parana and Uruguay. It is about 185 miles in length; and its breadth gradually increases from its head towards the sea. At Buenos Ayres, about 30 miles below the confluence of the two great rivers, it is 29 miles across; at Monte Video, 70 miles farther down, it has expanded to 53 miles; and at its mouth, between Cape San Antonio and Punta de la Ballena, its breadth is about 130 miles. This vast sheet of water is by no means deep: the average depth at the mouth is 10 fathoms; farther up it becomes gradually shallower; and between Monte Video and Buenos Ayres the average depth is only 3 fathoms. The estuary is also much impeded with sand-banks; and the currents are very strong and variable, on account of the immense body of water brought down by the rivers, which drain an area estimated at 1,200,000 square miles; being thus inferior in this respect to the Amazon and Mississippi only. The tides in the La Plata are hardly perceptible; but this is owing not to any real deficiency in their force, but to their being confused, and, as it were, concealed by the other currents. Violent storms frequently agitate the La Plata, chiefly raised by the gales called *pamperos*, which drive the water in a great volume in one direction. From these causes, the navigation is here so difficult that the estuary has been called *El Inferno de los Marineros* (Sailors' Hell). The water of the rivers is very long in mingling with that of the ocean; it floats muddy and dark on the surface in an easterly direction; and at the distance of 600 miles from the land it has a velocity of 1 mile an hour, and spreads over a breadth of 800 miles. Of the two great rivers that form the Rio de la Plata, the largest is the Parana, which rises in Brazil not more than 100 miles N.W. of Rio de Janeiro. The upper streams of this river have various names; but at the confluence of the Rio Grande, the longest of them, with the Parnahiba, the combined river takes the name of Parana, which it retains till it merges itself in the Rio de la Plata. The Parana flows southwards, receiving several large affluents, and separates Paraguay from Brazil and La Plata. It then turns to the west, and flows in that direction for 50 miles, still forming the boundary between Paraguay and La Plata. On receiving the Paraguay from the north at Corrientes, it again turns south, and flows through La Plata till it falls into the Rio de la Plata by several branches, forming the island of Martin Garcia and others. The Martin Garcia channel, by which the Parana is entered, is difficult of navigation, and does not admit vessels drawing more than 14 feet of water. The total length of the Parana is 2040 miles,—namely, 500 from the source of the Rio Grande to its confluence with the Parnahiba, 1000 from that point to the union of the Paraguay and Parana, and 540 thence to the Rio de la Plata. It is navigable to Corrientes for ships drawing 7½ feet, and for smaller vessels to Candelaria, 150 miles farther, where rapids occur. The principal affluent of the Parana is the Paraguay, which exceeds, in the volume of its water and in the length and directness of its course, the river that retains the name. It issues from several lakes in the Sierra Diamante in Brazil, and flows southwards, separating La Plata from Brazil and Paraguay. Its principal tributaries are the Pilcomayo and Vermejo, both from the west. Its whole length from its source to Corrientes is about 1890 miles; and it is navigable to Assumption, 200 miles above Corrientes, for vessels drawing 7½ feet. Above this point it is believed to be navigable for smaller vessels for 800 miles, and the Vermejo for 500. The Parana also receives from the west the Salado, which is entirely within the provinces of La Plata, rising in the N.W., flowing S.E., and joining the main stream at Santa Fé. Like all rivers from within the tropics, the Parana has a low and a high season, depending on the periodical rains. The former lasts during the winter and spring of the Southern Hemisphere, from June to December, and the latter during the summer and autumn. The difference in the height of the river in these seasons varies at different parts, being about 3 feet where it is wide, 8 feet where narrow, and on an average over the whole about 4 feet. The Uruguay rises in Brazil in the Sierra de Santa Catharina, and flows first west and then south, separating Brazil and Uruguay from La Plata, and falling into the Rio de la Plata, where its blue waters preserve their clearness for miles before they are lost in the muddy current of the Parana. Its whole length is more than 800 miles, and it is navigable for ships drawing 5 or 6 feet for 250 miles. The estuary of La Plata is fitted by nature to be the outlet of a most extensive river trade, though as yet its advantages have been turned to very little account. Goods from foreign countries destined for the interior are generally unshipped at Buenos Ayres, and put on board smaller river craft. But as, until lately, all the river trade was performed by sailing vessels, the means of communication were very imperfect; for no ships could ascend the rivers unless they had not only a wind up the stream, itself not a very frequent occurrence, but one sufficient to impel them against the current running from 2 to 4 miles an hour. At the same time, large steamers could not ascend on account of the shallows. But since the opening of the rivers in 1852 steamers have been introduced, after the model of the Mississippi boats, which will much accelerate and facilitate the conveyance of goods.

PLATÆA, or Plataeæ, an ancient city of Bœotia, stood on the southern bank of the Asopus, under the northern declivity of Mount Cithæron. Its early history is characterized by a determined resistance to the domineering power of Thebes, and a steady alliance with Athens. Its later annals are rendered remarkable by two very important events. The one is the famous battle of Platæa, which took place in 479 B.C., between the Persians and confederate Greeks. In that year the Grecian troops under Pausanias took up their position near the walls of the city, on a level meadow between two branches of the river Œroë. Up from the banks of the Asopus, in pursuit of them, came the invaders, led on by Mardonius. A scattered fight ensued. The Greeks drove their enemies back, stormed their camp, and routed them over the country, till only a few were left to carry the news of the disaster to the East. In the full flush of success, the confederates returned to honour the scene of the battle. Assembled round a sacrifice in the market-place, they took an oath to defend and maintain for ever the independence of the town. Out of their spoils they contributed eighty talents for the erection of a temple to Minerva in the place. The privilege was also conferred by them upon the citizens of paying religious honours every year at the graves of the illustrious slain, and of celebrating, at the end of every five years, the feast of the Eleutheria, in commemoration of the deliverance of Greece. Equally notable with this victory was another event,—the siege of Platæa by the Peloponnesians under Archidamus in 429 B.C. In anticipation of the approach of the enemy, the children, the old men, and the mass of the women, had been sent away and consigned to the protection of Athens. There were only left 400 citizens and 80 Athenian allies to hold the town, and 110 women to take charge of the household affairs. To wrest the city from this devoted band, the invaders set themselves with sanguine determination. At first they tried to storm the place. A mound was thrown up, the battering-ram was plied, and a pile of brushwood was set on fire close to the wall. After all these attempts had been foiled by the ceaseless activity of those within, they turned the assault into a blockade, and, casting up two lines of circumvallation, sat down in the shelter of the intermediate space. The besieged were now doomed to wait, and to continue to wait

in vain, for relief. It is true that in the second year of the siege 212 of their number, taking advantage of a tempestuous winter night, climbed lightly over the enemy's fortifications, amid the darkness and turmoil of the storm, and escaped in safety to Athens. But the rest remained shut in from all hope, until, in the summer of 427 B.C., they were compelled, haggard and weak with famine, to give themselves up to the mercy of their relentless foes. The men, after a mock trial, were butchered one by one in cold blood; the women were sold as slaves; the houses were razed to the ground; and two temples to Juno, the one surrounded with an inn, and the other newly erected, were all that was left to mark the site of the city, until its restoration by the Lacedæmonians in 387 B.C. After this date there is nothing very important in the annals of Platæa, except its second destruction by its inveterate enemy Thebes in 372 B.C., and its second restoration by Philip in 338 B.C. Its ruins are still seen near the small village of Kokhla. (For a detailed account of the celebrated siege of Platæa, see Thucydides.)

PLATFORM, a plane surface, lying level, of any materials, for the reception of the foundations of a building, or for the piers of a bridge. The term is likewise applied to a level scaffold raised above the ground for a temporary purpose.

PLATINA, or PLATINUM (Spanish *plata*, silver), is a metal of a white colour, exceedingly ductile, malleable, and difficult of fusion. It is the heaviest substance with which we are acquainted, its specific gravity being about 21·5. It is subject to no change from air or moisture, is not attacked by any pure acid, is dissolved by the influence of chlorine and nitro-muriatic acid, and is subject to oxidation by pure potassa and lithia. It is found only in the Ural Mountains and in South America, where it is usually procured in small lustrous grains combined with palladium, rhodium, &c., and is for the most part commingled with sand. The portions of it which are found seldom exceed a small pea in size, but occasionally it has been found in lumps varying in size from a hazel nut to a pigeon's egg. (See CHEMISTRY; also MINES AND MINING.)

PLATING is the art of covering the baser metals with silver or gold, either for use or ornament. Of late, manufacturers have availed themselves of electro-chemical decomposition for the purpose.

PLATO.

THE birth of Plato is nearly coincident with that great epoch of Grecian history, the commencement of the Peloponnesian war. In the first year of that war, the Athenians, having ejected the unhappy people of Ægina, apportioned the island amongst colonists from themselves.[1] Amongst these Athenian occupants were Aristo, and Perictione, or Potona, as she is also called, the father and mother of Plato. Their residence, however, in the island was not permanent nor even long, as the intrusive colony was in its turn ejected by the Lacedæmonians, on which occasion his parents returned to Athens.[2] It was during this interval, and in the year 429 B. C., that the philosopher was born.[3]

From these circumstances, it has been commonly supposed that Plato was born in Ægina. They are not, however, sufficient to establish such a conclusion. For a colonization of the kind here described did not necessarily imply residence on the part of those persons to whom the lands were allotted.[4] Nor is the fact of the recovery of the island by the Lacedæmonians from the hands of the Athenians, mentioned by the contemporary historian. Ægina was still in the occupation of the Athenians in the fifth year of the Peloponnesian war;[5] and in the eighth year of the war we find that the poor exiles, who had meanwhile obtained a refuge at Thyrea, were there cruelly exterminated by the Athenians.[6] On the whole, it seems more probable, from the constant designation of Plato as "the Athenian," without any other addition, though this alone, it must be allowed, is not decisive of the fact, that Athens itself may claim the honour of having been his birthplace.

It is remarkable that his proper name was not that which his fame has immortalized, but Aristocles, after his paternal grandfather.[7] The name of Plato is said to have been given to him by the person who was his master in the exercises of the gymnasium, as characteristic of his athletic frame in his youth.[8] In this way, being familiarly applied to him, it gradually prevailed, to the entire disuse of his family name.

The philosopher was connected by descent with the ancient worthies of Athens; on his mother's side with Solon, and on his father's with the patriot king Codrus.[9] And thus, according to the notions of nobility prevalent amongst the Greeks,[10] he could trace up the honours of his parentage to a divine founder, in the person of the god Neptune.

A circumstance is related of his infancy, which, though obviously fabulous, cannot properly be omitted in his biography, as a pleasing and appropriate tribute of the imaginative genius of the Greeks to their poet-philosopher. Whilst he was sleeping when a babe, on Mount Hymettus, in a bower of myrtles, during the performance of a sacrifice by his parents to the muses and nymphs, bees, it is said, lighted on him and dropped honey on his lips, thus giving an evident augury of that peculiar sweetness of style by which his eloquence would be distinguished.[11]

For the same reason, a similar fancy, which has thrown a poetical ornament over the account of his first devotion to philosophy, must not be passed over in silence. Socrates, it is related, was apprized beforehand, in a dream, of the first visit of the gifted pupil, who was destined to carry philosophy forth on the wings of his genius to its boldest flights. Socrates was telling his dream to some persons around him, how he seemed to see a young swan coming from an altar in the grove of Academus, and first nestling in his bosom, then soaring up on high, and singing sweetly as it rose in the air, when Aristo presented himself, leading his son Plato, whom he committed to the instruction of the

[1] Thucyd. ii. 27.
[2] Diog. Laert. in *Vit. Plat*
[3] Diog. Laert. in *Vit. Plat.*
[4] Thucyd. iii. 50.
[5] Thucyd. iii. 72.
[6] Ibid. iv. 56, 57.
[7] Aristocles was also a Spartan name, being the name of the brother of the king Pleistoanax. Thucyd. v. 17.
[8] As derived from πλατυς, *broad*. Laertius gives this explanation, which Seneca also adopts (*Epist.* lviii. 27), but says others interpreted the name as denoting a broad forehead; others, as characteristic of his style of eloquence.
[9] His family also is shewn to have been of rank, from its connection with some of "the Thirty," called "the Thirty Tyrants," established at Athens by the Lacedæmonians. See Plat. *Ep.* vii.
[10] See Herodot. *Euterp.* 143.
[11] Cicero, *De Divin.* i. 36.

sage. Socrates, it is added, struck by the coincidence, immediately recognized the fulfilment of his dream, and welcomed Plato as the young swan from the altar, represented to him in the vision.

The accounts of his early education, to which we should naturally have looked with great interest, are extremely meagre. We only know by general notices that he passed through the usual course of education adopted amongst the higher classes of the Greeks. That education was directed to the cultivation at once of the powers of the mind and of the body, under the two great divisions of literature and gymnastics. The youth was delivered to the charge of the grammarian, the teacher of music, and the trainer. From the grammarian he learned the art of reading and writing his own language, and a knowledge of its authors, especially its poets; from the teacher of music, skill in performing on the lyre and the flute, together with the principles of the science of music; from the trainer he acquired strength and expertness in the several exercises of wrestling, and boxing, and running, by which it was intended not only to mature the powers of the body, but to qualify the youth for attaining eminence at the public games. These were the schoolmasters of the accomplished Athenian, and with these he was occupied until he had reached about his twentieth year. Accordingly, the names have been transmitted to us of those who discharged these offices for Plato; of Dionysius, as the grammarian under whom he learned the elements of that command over his own language, and its literary resources, which his matured eloquence so richly displayed; of Draco of Athens, and Metellus of Agrigentum, as his masters in music; and of Aristo the Argive, as his master in gymnastics. It is added that he also studied painting; but the name has not been given of any individual who acted as his preceptor in the art.

In evidence of his great proficiency in these early studies, it has been stated, that he gave specimens of his genius in every department of poetical composition; that in epic poetry he laboured after the highest excellence, and only abandoned the attempt on comparing his efforts with the poems of Homer, and despairing of reaching so high a standard; that in dramatic poetry, he had prepared a tetralogy, the four plays usually required of an author in order to competing for the prize at the festival of Bacchus, but changed his purpose only the day before the exhibition, in consequence of impressions received from Socrates. And even in gymnastics excellence has been claimed for him; since it has been asserted that he actually entered the lists at the Isthmian games.

Whatever credit we may give to these particulars, there can be no doubt, that so inquisitive a mind as that of Plato, and so resolute a spirit in the prosecution of its undertakings, received the full benefit of this preliminary culture; and that he was thus amply prepared for entering on the severer discipline of those pursuits which engaged him when he became a hearer of Socrates.

This preliminary education, in fact, was very imperfect as a discipline of the mind. It gave the youth a forwardness and fluency of knowledge, so that he was fain to fancy himself, when he had scarcely attained manhood, equal to undertake affairs of state, and to serve the highest offices of the government. But it did not form his mind or character. He had yet to learn the nature of man; to study the principles of ethics and politics. This task of instruction devolved on the sophist or the philosopher (as the same person was at first indifferently called), into whose hands the Greek youth was now delivered.

Plato, accordingly, at the age of twenty years, began to be a regular attendant on the lessons of Socrates. The reputation of Socrates as a teacher in this higher walk of education, now eclipsed that of all other professors of philosophy. He had at once exposed the incompetence of the sophists who preceded him, and superseded them in their office. Plato would be conducted to him by his father, as the account states he was, very much in the way which is depicted under caricature by the comic poet,[1] as to the most distinguished master of the day, to be qualified for taking on him those public duties to which every citizen of Athens might be called; to enable him to distinguish himself in counsel and argument, and obtain influence and importance in society. From the numbers that resorted to Socrates, as well as to the sophists before him, it is plain that, to obtain instruction in philosophy for its own sake, or to become philosophers themselves, was not the object with which he was sought by the generality. Here and there the spark fell on a kindred genius, and lighted up a flame of philosophy in the breast of a disciple. Thus from the school of Socrates came the founders of several other schools; and, on the whole, a greater impulse was given by his teaching to the study of philosophy than had ever been felt before in Greece. Still, as Socrates himself did not profess to teach his hearers wisdom, so neither did they in general come to him as learners of wisdom, or as actuated by the pure love of wisdom, but to acquire practical information which their previous studies had not given them. We may imagine such a disciple as Plato first presenting himself amongst the multitude of hearers; how he would be struck by the first observation of the extraordinary manner of Socrates, especially at finding the very person to whom he came to be taught professing that "he knew nothing;" and that he was only wiser than other men on this account, that, whilst others knew not and presumed they knew, he neither knew nor presumed that he knew. The interest of such a mind as Plato's could not but be powerfully called forth by so strange an avowal on the part of a man whom he had been led to look up to as the wisest of men. To him it must naturally have prompted the questions, what philosophy might be; what the nature and condition of man; what the criteria of truth and falsehood; and thus have firmly laid hold of those tendencies to speculation which we see fully developed in the mature fruits of his genius. Again and again he is present at the searching investigations carried on in the discussions of which Socrates is the leader; soon he is himself interrogated by Socrates; and we cannot doubt that he is thenceforward irrevocably become, not the disciple of Socrates only, but the disciple and votary of philosophy.

That Plato was thus won over to philosophy from an early period of his life, is evident from the statement of Aristotle respecting him, that "from his youth he had been conversant with Cratylus, and the opinions of Heraclitus,"[2] and from the indications in two at least of his dialogues (and these supposed to be the earliest in the date of their composition, as written indeed during the lifetime of Socrates), the *Phædrus* and the *Lysis*, of his early acquaintance with Pythagorean notions.

There seems, too, but little room to doubt that he had begun at the same time to study the doctrines of the Ionic school under Hermogenes, as well as those of Parmenides and Zeno. For what he puts into the mouth of Socrates in the *Phædo*[3] respecting Anaxagoras, is probably (as Socrates himself was known to have had a strong aversion to physical science) the expression of his own disappointment and dissatisfaction at the outset of his studies, in the conclusions of the school, of which Anaxagoras was then the chief authority. Of Parmenides, again, he more than once

[1] Aristoph. *Nubes.*

[2] Aristot. *Metaph.* i. 3.

[3] *Phæd.* pp. 220–225, ed. Bip.

speaks in terms of enthusiasm, as of a name with which he had very early associations of reverence;[1] here, as in the instance of Anaxagoras, we are disposed to think, depicting, in the person of Socrates, a portion of the history of his own mind.

Judging indeed from the tenor of his writings, we should conclude that his curiosity was excited, from a very early period, to explore the whole field of philosophy; and that, so far from resting on what he learned from Socrates himself, he applied the lessons of Socrates to the extending and perfecting those researches which he was carrying on at the same time, by means of books, or oral instruction from others.[2] Socrates was to him the interpreter, and commentator, and critic, of the various philosophical studies in which he was engaged. For this is the view which he has given us of Socrates in his Dialogues. Socrates there seldom or never appears as a didactic expounder of truth. He is presented as the critic of opinions and doctrines and systems, and the judge to whom everything is to be submitted for approval, or rejection, or modification, as the case may be.

Indeed, so exuberant and energetic a mind could not have been satisfied with being simply a learner in any school. It would eagerly seek the means of comparing system with system, and of examining into points of agreement or disagreement in the theories proposed. The doubts raised by Socrates, the hints thrown out by him, the conclusions to which he pointed, but which he yet left unconcluded, would to such a mind seem as so many points of departure for its own excursions. They naturally suggest that much more must be done than merely to take up what has been said by Socrates, in order to work out, or even rightly to conceive, what had fallen from his lips. For the conversations of Socrates were not framed to convey positive instruction, so much as to set the mind of the hearer a-thinking, and to provoke further inquiry. In the living pictures of them which Plato has drawn, they leave off just at the point where we expect the teacher would proceed to speak out more distinctly, and tell us precisely what his view of the subject is. If these pictures represent (as we may reasonably believe they do) the impressions received by Plato from the conversations of Socrates, what stimulants to inquiry must he not have felt in the several particulars which he has so forcibly touched,—in the mingled lights and shadows of the scenes in which the great master occupies the foreground. Well therefore may we conceive that, at the time when he enjoyed the guidance, and control, and encouragement of Socrates, he was laying a broad foundation of erudition for that vast and richly-ornamented fabric of philosophy which the existing monuments of his genius exhibit.

From Socrates himself this demand of the inquisitive hearer could evidently not be supplied. Socrates was deficient in erudition properly so called. He had studied men rather than books. His wisdom consisted of deep and extensive observation accurately generalized, drawn from passing things, and capable accordingly of ready application to the same course of things; forcibly convincing his hearers by the point and propriety with which it met each occasion, and giving experimental proof of its soundness and truth. Erudition, accordingly, was to be sought elsewhere; and Plato therefore supplied this need from other sources, infusing it into, and blending it with his own speculations, whilst the Socratic spirit mellows the whole mass, and gives unity to the composition.

The death of Socrates—over which how his disciples mourned, appears in that affecting account of the last moments of their loved master, consecrated to his memory by the genius of Plato, the Dialogue of the *Phædo*—naturally excited alarms for their own safety amongst those who had been conspicuous among his associates. They saw, by the violent extremity to which the spirit of intolerance had proceeded, unchecked by any feeling of humanity or regard for truth, that no wisdom, or gentleness, or benevolence of character could be a security against the deadly hatred of jealousy. They found that priestcraft could stoop to employ any instruments, however mean, for the accomplishment of its vengeance; that it could instigate the actor on the scene of civil affairs to do its work of destruction, whilst the prompter of the mischief wore the mask of concern for the public good, and arrogated the merit of upholding the cause of religious truth. Persecution has ever been the same. Its essential features are vices of the human heart, not of any particular system of religion. We find it, accordingly, in several recorded instances in the heathen world, displaying itself very nearly as in the dark times of anti-Christian corruption. Athens itself had already furnished examples of its operation. In particular, the case of Anaxagoras had been a striking illustration. When not even the power and the eloquence of Pericles could save Anaxagoras from a prison, and expulsion from Athens, on account of his physical speculations,—the very philosopher whose system of physics raised an insuperable barrier against atheism, by demonstrating the supremacy of mind,—it was but too evident that there was a mysterious agency working in the heart of society, like secret fires in the depths of the earth, capable of awing and paralyzing every other power that might rise up against it.

A more recent experience of the same truth, within the memory of the youngest disciple of Socrates, was in the dark proceedings consequent on the mutilation of the Hermæ, the rude images of Mercury erected in the vestibules of private houses as well as in the sacred places of Athens, and on the discovery of the profanation of the Eleusinian mysteries by the mock representation of them in private houses.[3] The secret information on which those proceedings were carried on; the indifference shewn at the period of alarm to everything else, even on an occasion of great public interest, but the vindication of the popular superstition; the effect which the charge of being implicated in these outrages had in checking the career of Alcibiades at the moment of his triumph over his political opponents; all shewed, that it was a vain hope to resist the secret arbiters of public opinion on questions of religion. Then came the fearful consummation of this vengeance in the death of Socrates by the poisoned cup; leaving no doubt in the minds of any, that they who would follow his example in boldly and honestly inquiring into current opinions, and declaring their convictions of the truth on matters affecting the conduct of men, must either prepare themselves for exile (which alone was a great punishment in the ancient world),[4] or drink the hemlock.

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[1] Μελισσον μεν και τους ἀλλους οἱ ἐν ἑστως λεγουσι το παν, αἰσχυνομενος μη φορτικῶς σκοπωμεν, ἧττον αἰσχυνομαι, ἢ ἑνα ὀντα Παρμενιδην. Παρμενιδης δε μοι φαινεται το του Ὁμηρου, αἰδοῖος τε μοι εἶναι ἁμα δεινος τε· συμπροσεμιξα γαρ δη τῷ ἀνδρι, πανυ νεος, πανυ πρεσβυτῃ· και μοι ἐφανη βαθος τι ἐχειν παντπασι γενναῖον. (*Theætet.* pp. 137, 138. *Parmenid.* p. 72.)

[2] This evident early devotion of Plato to the pursuit of his whole life, argues the mere calumny of that statement which represents him to have at first sought his fortune by the profession of arms. The calumny is a current one, which has been applied to other philosophers. He has also been absurdly represented as present at the battles of Tanagra and Delium, when he was, in truth, a mere child.

[3] The performance of religious rites in private houses is forbidden in Plato's Dialogue on Laws, x. p. 117.

[4] Cicero says of exile, endeavouring to reconcile the feelings to it, "jam vero exilium, si rerum naturam, non *ignominiam nominis* quærimus, quantum demum a perpetua peregrinatione differt." (*Tuscul. Quæst.* v. 37)

Socrates himself had the courage to take the latter part of the alternative. To him it was the natural termination of that energetic course which he had from the first adopted. He would have unsaid all his teaching; he would have practically recanted the strong language in which he had, through all his life, been discoursing of the worthlessness of the body and of the present life, and of the immortality and perfection of the soul. His philosophy, and the sense of the dignity of his character and position, kept him immured in his prison, and riveted the chains on his limbs, far more than the condemnation of his judges or the strength of the iron with which he was bound. For, as he says of himself, in the words in which Plato has expressed his sentiments, "these sinews and bones would long ago have been either about Megara or the Bœotians, had I not thought it more just and more honourable, instead of flight, to submit to the judgment of the state."[1]

But this was not the case with the hearers of Socrates. They were not, like him, placed in a commanding post, from which they could not retreat without being stigmatized as deserters of their profession, and betrayers of the truth. They might with honour and propriety consult for their safety. Whilst, therefore, as is probable, the bulk of those who had attended on the teaching of Socrates simply withdrew from public notice, and sought their homes at Athens or elsewhere, the principal disciples of the school—those who were most known as followers and admirers of Socrates—left Athens, and sought an asylum for themselves and for philosophy at Megara.

Amongst those whom Socrates drew around him were several individuals of mature age, already trained in some sect of philosophy, and eminent in their own walk of science, yet desirous of availing themselves of the far-famed wisdom of the sage of Athens. Of this class was Euclid of Megara, from whom the Megaric school derives its existence and celebrity.[2] As a disciple, he belonged to the Eleatic school, and, trained by Zeno, the great master of dialectic before him, had made that science his especial study. He had shown a singular zeal in attending on the teaching of Socrates; for he continued to resort to him even after the passing of the Athenian decree by which Megarians were excluded, under the penalty of death, from the harbours in the Athenian empire, and from the agora of Athens itself. For this purpose, he would set out from his home at nightfall, a journey of more than twenty miles,—such was the distance from Megara to Athens,—assuming the disguise of female attire that he might enter the city unnoticed.[3] His conduct on the occasion of the dispersion of the school of Socrates corresponded with this zeal. He received the members of the school with open arms, and gave them a home with him at Megara. There, for a time at least, they gathered themselves, in shelter from the storm which had driven them from Athens. But the school, in fact, was broken up. It had subsisted and been held together by the personal influence of Socrates himself, and with him its principle of vitality, as a body, was gone. He had not laboured to establish a sect or a theory; and he left, therefore, no particular symbol of union around which a party might be formed. He was himself the principle and bond of union to his disciples; bringing together around him the professors and disciples of every different sect. There was yet to arise out of his society one who, richly imbued with his teaching and method, should rekindle the extinct school with his own spirit, and bid it live again in its genuine offspring; and that individual was Plato. But the times were not yet ripe for this.

In the meantime, Plato was destined to spend several years in journeying from place to place, at a distance from the past and future scene of his philosophical labours. These were doubtless years of great importance to him, for the perfect formation of the peculiar character of his philosophy. In the course of them, we find him visiting Megara, Cyrene, the Greek settlements on the coasts of Italy, Sicily, Egypt, "exploring (as Cicero says of him in oratorical language) the remotest lands,"[4] after the manner of Solon and Pythagoras, and other wise men before him, who had enlarged their minds by contemplations pursued in foreign travel. Thus did he singularly combine in his studies the more ancient with the Socratic mode of philosophizing. The method of Socrates was exclusively domestic. He studied mankind within a small compass (the circle of Athens itself), only with a more accurate and searching eye than any one had ever done before him; and therefore drew sound general conclusions from his observations within that range of view. He evidently judged it better thus to restrict the attention, and require men to investigate closely what lay before them, than to encourage them to indulge the prevailing habit of more diffusive and vague observation. This is told us in other words by Plato himself; where he introduces Socrates as a stranger even to the beautiful scenery in the immediate neighbourhood of Athens, and as one who appeared never to have been out of the walls of the city; and as owning that, in his fondness for moral study, he was content to learn of the men in the city, who could teach him what the fields and the trees could not.[5] But this method, good as a foundation, and necessary as a corrective of desultory and superficial habits of thought and study, was not sufficient for the requirements of Plato's mind. He observes in one of his works, that there is much to be gained from contemplation rightly directed in foreign travel both by land and sea; that we are not only to look to our own country for examples, but seek in the world at large for specimens of the highest order of men, who, though rare, might from time to time be found under every form of government; and that no perfect civilization can be attained without this means of observation and improvement.[6] He describes, in fact, the course which he had himself pursued, and the benefit which he had found resulting from it.

Having sojourned for a time at Megara, together with the other disciples of Socrates, and probably there, with the assistance of Euclid, increased his acquaintance with the writings of Parmenides and Zeno, as well as studied more intimately the dialectic of their school, he appears to have proceeded to Cyrene. Cyrene was the home, not only of Aristippus, to whose school it afterwards gave its name, but of the venerable Theodorus, the most eminent geometrician of his day. Theodorus had been occasionally a resident at Athens, and an attendant on the teaching of Socrates, whilst he was himself resorted to by the Athenian youth for instruction in the science of geometry.[7] Plato no doubt had been amongst those who had thus availed themselves of the presence of Theodorus at Athens. His predilection for mathematical studies is conspicuous throughout his writings. His skill in geometry, in particular, requires no other evidence than the fact of his ready solution, in that state of the science, of the problem of the Delphic Oracle, which required the doubling of the cubic altar at Delos.[8] He has described Theodorus as present at Athens at the time when the prosecution was instituted

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[1] See *Phædo*, p. 224; also *Crito*, throughout.

[2] Euclid the mathematician flourished about a century after him.

[3] Thucyd. i. 139; Aul. Gell. *Noct. Att* vi. 10.

[4] Ultimas terras lustrasse Pythagoram, Democritum, Platonem, accepimus: ubi enim quid esset quod disci posset, eo veniendum judicaverunt. (*Tusc. Qu.* iv. 19.)

[5] *Phædr.*, p. 287; *Crito*, p. 122.

[6] *De Legib.* xii., p. 196, 197.

[7] Plat. *Theætet.*, p. 51, 52; Xenoph. *Mem.* iv 2, 10.

[8] Plutarch. *De Socrat. Genio*, p. 288, tom. 8, Reiske. The inscription said to have been over the portal of the Academia, "Let no one enter who is not a geometrician," seems to belong rather to Pythagoras, or perhaps was imitated from the Pythagoreans.

Plato. against Socrates.[1] He now went to Cyrene, probably with the view of following up that course of geometrical study which had been so abruptly terminated; whilst he regained also the society of a friend for whom he evidently felt respect and admiration.[2]

The course of his travels conducted him to the Greek settlements on the coast of Italy and Sicily, where the colleges of the Pythagoreans were established. It may readily be imagined with what eager curiosity Plato undertook this voyage, what delight he promised himself in seeing the place itself where Pythagoras had taught, and in personal conference with the living successors of the mystic sage, and in obtaining a greater insight into the doctrines of a school which had such charms for him. He had much to observe also in the peculiar discipline by which the Pythagoreans were formed into a distinct fraternity amongst themselves. Greece Proper had nothing to exhibit like this. For though the different sects of philosophy were distinguished there by the names of founders and places, they were not held together by any rules of discipline. But the Pythagoreans at Tarentum, Crotona, and elsewhere in Magna Græcia, had incorporated themselves into synedria, or colleges; each individual giving his property in common, and regarding the bond of connection with his brethren of the sect as closer than the ties of kindred.[3] Associations of this kind must have appeared, at the first, as anomalies even to the philosophical Athenian, accustomed as he was to regard the free intercourse of social life as indispensable to his very existence.

It has been said that Plato was admitted to the secret discipline of the Pythagoreans. Probably he was only received by them with great cordiality, and had access to writings and information respecting their doctrines, which might have been denied to one, who came less recommended to them by the sincere enthusiasm of philosophy, and approximation to their views. There are no traces certainly in his writings, or elsewhere, of his having been a professed Pythagorean; although he undoubtedly was greatly captivated by the Pythagorean doctrines, and has introduced them largely into his own speculations.

Archytas, the greatest name of the Pythagorean school after that of Pythagoras himself, was then flourishing at Tarentum. It must have been an interesting occasion when there were assembled together at Tarentum, as Cicero relates,[4] Pontius the Samnite, the father of that Pontius who defeated the Roman consul at the Fauces Caudinæ; Archytas the Pythagorean, discoursing against pleasure; and Plato the Athenian traveller. The very place where they met,—a point of contact between the old empires of the world, and the rising power destined to break them in pieces,—in itself adds to the interest. Then the characters of the two philosophers who thus met, further arrest our attention:—Archytas, the representative of the old traditionary theological systems now moulded into a scheme of philosophy and a discipline of life; and Plato, the accomplished artist, who was soon to take up the scheme of philosophy where the Pythagoreans left it, and consecrate it by the inspirations of his own genius to an eternal empire on the throne of literature:—Archytas, nurtured in the reserve and mysticism of the Pythagorean discipline; Plato, formed to busy and importunate discussion by the ever-colloquial Socrates,—two philosophers so contrasted with each other in many respects, and yet so concordant in their love of ancient wisdom and indefatigable research after truth. Plato.

From the Pythagoreans Plato proceeded to Egypt to converse with the priests of that ancient land, from which Greece had derived her original civilization and science. Since the settlement of the Greek colony in Egypt by Psammetichus,[5] there had existed a regular channel of intercourse between Greece and Egypt, and accurate means of information to the Greeks respecting Egypt. The history of Herodotus must in itself have awakened the curiosity of those who had any taste for such inquiries, to know still more of a people from whom Greece had already learned so much, and from whom evidently so much was to be learned, and must have stimulated them to avail themselves of the existing facilities of gratifying that taste. To Plato, indeed, if, according to Herodotus, the Greeks derived the notion of the immortality of the soul from the Egyptians, who were the first, he thinks, to teach it in connection with that of the transmigration of souls,[6] a visit to Egypt must have been most attractive. Herodotus has given a most instructive and interesting view of the impression which such a visit produced on his mind. What an animated picture must the still more philosophical mind of Plato have presented, of the result of his conversation with the priests of Egypt. Though the account of his having had the mysterious wisdom of the inscriptions on the Hermetic Columns unfolded to him by the priests, and of his being instructed in magic,[7] on this occasion, seems without sufficient authority, there are evident traces of information collected in Egypt, throughout his writings, and, so far, it cannot be doubted that this visit was not without its influence on the character of his philosophy.

Indeed it has been further asserted, that, whilst in Egypt, he had access to an existing Greek version of the Old Testament, and that to this circumstance we must attribute that purer and more elevated theology which his works exhibit, in comparison with those of other heathen philosophers. A strange oversight in chronology has also attributed to him a personal intercourse with the prophet Jeremiah.[8] These statements are obviously mere suppositions, by which Christians, over-zealous for Plato's philosophy, vindicated their admiration of it, whilst they asserted also the originality and supremacy of Scripture truth. At the same time, it is indisputable that Judaism diffused much religious and moral truth beyond its own pale; and that not only Plato, but the Egyptian priests, his instructors, unconsciously derived much from the inspired sources, in collecting, under the form of fable, or allegory, or maxim, portions of truth which the sacred oracles had scattered around them in their transmission.[9]

Having traversed Egypt, where he is said to have assumed the disguise of an olive-merchant, in order to journey more securely in a country not naturally tolerant of strangers, he purposed penetrating into Persia and India. But the disturbed state of those parts of Asia prevented his fulfilling his intentions. He returned accordingly to Magna Graecia, once more to enjoy the society of the Py-

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1 *Theætet.* ad fin.

2 See *Theætet.* throughout.

3 See Plato, *Rep.* x. p. 293; Polyb. ii. 39; Aul. Gell. i. 9; Origen. *C. Cels.* ii. p. 67, iii. p. 142, ed Spenc.; Jamblich. *Pyth. Vit.* c. 17, p. 154.

4 *De Senect.* c. 12. Cicero says Plato was at Tarentum in the consulship of L. Camillus and Appius Claudius. There appears some inaccuracy in the tradition, but we may believe its substantial truth.

5 About B. C. 650. Herodot. *Euterp.* 154.

6 Herodot. *Euterp.* 123.

7 Pliny says that Plato went to Egypt for the purpose of learning magic. *Hist. Nat.* xxxi. c. 1.

8 Quapropter in illa peregrinatione sua, Plato, nec Hieremiam videre potuit tanto ante defunctum, nec easdem scripturas legere, quæ nondum fuerant in Græcam linguam translatæ. (Augustin. *De Civ. Dei*, viii. 11.) Clement of Alexandria, however, asserts that there existed a version of the Law prior to that of the Septuagint. *Strom.* i.; Euseb. *Præp. Evan.* ix. 6.

9 Hence it was said by Numenius the Pythagorean, τι γαρ ἐστι Πλατων, η Μωσῆς Αττικιζων, "What is Plato, but Moses speaking in Attic idiom.

thagoreans. At length, having spent several years in these travels, he turned his steps homeward. We have no means of ascertaining the exact time which these travels occupied, or at what period of his life precisely he undertook the office of teacher of philosophy at Athens. From the epistle addressed to the friends of Dion, it appears that he was scarcely forty years of age when he first went to Syracuse;[1] so that probably not more than about ten years were taken up in his wanderings.

The visit to Sicily here referred to, had for its object to explore the crater of Mount Ætna, and therefore properly belongs to that part of his history which we have just been tracing. But it had also very important bearings upon the future fortunes, both of himself and many others; so important, indeed, that Plutarch, following out a remark which occurs in the supposed epistles of Plato, attributes it to a providential arrangement, in order to the restoration of liberty to the Syracusans.[2] For it was at this time that he became acquainted with the elder Dionysius, tyrant of Syracuse, and Dion, whose sister Dionysius had married. He reclaimed Dion, who was then quite a youth, from a life of vicious indulgence, to habits of sobriety, and inspired him with an ardent love of philosophy. Thus began an intimate friendship between the philosopher and Dion, which subsisted unimpaired until the tragical death of the latter.

Through the influence of Dion, the tyrant Dionysius, who was himself a literary man and a patron of literature, was induced to receive Plato into the circle of his court. The result, however, whether it was owing to the jealousy of other philosophers who were then at the court of Syracuse, or to an excess of freedom of speech in Plato, and an ebullition of temper and disappointed literary vanity on the part of Dionysius, was unfortunate. Dionysius was affronted at some words that passed at an interview with him, and was only prevented by the interposition of Dion from slaying the philosopher in the moment of exasperation. But still he did not remit his displeasure; for on suffering him to depart, he instructed the Lacedæmonian ambassador, Pollis, in whose vessel he was to be conveyed from Sicily, either to slay him on the voyage or to sell him as a slave; observing sarcastically, "that being a just man, he would be equally happy though reduced to slavery." Pollis is said to have so far lent himself to this cruel treachery, that he actually caused the philosopher to be sold as a slave, by landing him at Ægina at a time when a decree was in force there, sentencing to death every Athenian who should set foot in the island. From this shameful indignity, however, Plato was immediately relieved by the generous kindness of Anniceris, a philosopher of Cyrene, who happened to be at Ægina at the time, and paid the twenty minæ, the price of his redemption. And such, it is added, was the noble concern which Anniceris felt for him, that he could not be prevailed on to receive back the money from the friends of Plato at Athens, but refused it, saying "that they were not the only persons interested in the welfare of Plato."[3]

The story is related with circumstantial particularity, and so far bears the aspect of truth. Still it has been questioned, as inconsistent with the character of Dionysius, who, though despotic in the power which he possessed, and often cruel in his use of it, was a man of education and courtesy, and the patron of literary men. And the treachery of Pollis, as thus exhibited, has been regarded as altogether unlikely in the high-minded Spartan. Nor again do we find any allusion in the writings of the philosopher himself to so affecting an incident in his life. The story may be thought still more improbable, if the account be true that Dionysius presented him with a considerable sum of money, with which he was enabled, during his residence in Sicily, to purchase a treasure inestimable to him, the books of Philolaus the Pythagorean. These arguments, however, may be pressed too far. Individuals possessed of absolute power have often been found capable of deeds from which their own feelings, apart from that great temptation, would have shrunk: and sudden and most unreasonable and absurd outbreaks of violence, inconsistent with their general behaviour, are characteristics of such power. And as for the Lacedæmonians, we know that at the height of their civilization they were guilty of the acts of barbarians. Their extreme cruelty to the poor debased Helots is well known;[4] and in the Peloponnesian war they slaughtered indiscriminately all whom they met with at sea, even neutrals, and persons inoffensively engaged in the business of commerce.[5] Further, there are repeated instances of Greeks selling as slaves the free inhabitants of captured cities in their wars with each other.[6] There is no reason, at any rate, to question the general truth of the story, whatever may be thought of the particulars. There can be little doubt that the visit of Plato at Syracuse ended unsatisfactorily; that offence arose between the tyrant and himself; that he was treated with great indignity, and that he returned to Athens in disgust.[7]

From this time we may contemplate him as pursuing, with little interruption, the course of philosophical labour for which his whole previous life had prepared him. The term "Academy" is now familiar to every one as synonymous with a place of learning. How strongly does this mark the celebrity of a school, which has thus immortalized in vernacular language the grove of the hero Academus or Hecademus, the ground on which Plato walked, and, as he walked, imparted to the throng around him the riches of his genius, and taste, and learning! Here, in the most beautiful suburb of Athens, the Ceramicus, Plato possessed a small patrimony, a garden, where he fixed his abode, in the immediate vicinity of the grove, his daily resort. Here, amongst the tall plane-trees which shaded the walks, were assembled, year after year, the master-spirits of the age, whether in pursuit of knowledge for its own sake, or for counsel in the direction of public or private life,—the philosopher, the statesman, and the man of the world,—to converse with the Athenian sage, and imbibe the wisdom which fell from his lips. What an interesting assemblage must that have been which comprized in it, amongst other influential persons, and young men who afterwards rose to importance in their respective states, Demosthenes, Hyperides, Aristotle, Speusippus, Xenocrates, Polemo, Dion! At once you might see in the throng the young and the gay by the side of the old and the sedate; the stranger from some distant town of Asia Minor, or Thrace, or Magna Græcia, and the citizen of Athens; the tyrant of some little state learning theories of government and laws from the philosopher of the republic; and the haughty Lacedæmonian paying deference to the superior wisdom of an individual of a country which his own had humbled in arms.[8] Nor was the audience exclusively of the male sex. The wives and daughters of Athenian citizens, indeed, were not

[1] B. C. 389. *Ep.* vii. p. 93, Bipont ed.
[2] Plutarch in *Dion*, tom. v. p. 262, Reiske.
[3] Laert. in *Vit. Plat.*
[4] Thucyd. iv. 80.
[5] *Ibid.*
[6] *Ibid.*
[7] The conduct of Dionysius towards Philoxenus, the dithyrambic poet, for freely giving his opinion on the bad poetry of Dionysius, was very similar. See Diodorus Siculus, xv. 6, who also, in xv. 7, confirms the account of this treatment of Plato.
[8] In the Dialogue "on Laws," it is the Athenian stranger who instructs the Lacedæmonian and Cretan in the theory of legislation. Here we have probably a representation of what actually was seen in the Academia itself. Socrates is away; Plato speaks; Cretans and Lacedæmonians, among others, are the auditors.

in that assembly; for custom excluded these. But the accomplished courtezan, whom the unnatural exclusion of the chaste matron from social intercourse had raised to importance in Grecian society, was there, seeking the improvement of her mind by joining in the discussions and listening to the instructions of the philosopher, and thus qualifying herself for that part which she had to sustain as an intimate with the men of the highest rank and most intellectual cultivation in Greece. The celebrated Aspasia had been at once the intimate of Pericles, and a hearer of Socrates; and Plato himself pays her the compliment of saying, that both Pericles and Socrates had taken lessons in rhetoric from her, as a most accomplished mistress of the art; to whom, indeed, Pericles had been chiefly indebted for his eloquence.[1] So now in Plato's own school of the Academia were found, amongst others of the same class, the beautiful Mantinean Lasthenea, and Axiothea of Phlius.

Socrates attracted persons around him from all parts of the Grecian world, by the charm of his engaging conversation, and thus became in himself a great object of interest.[2] Plato made Athens itself also, even more than his own person, an object of interest to the civilized world of his day; converting it, from being only the centre of political intrigue and agitation to the cities of Greece, into a common university and common home for all. Compare what was said of Athens about half a century before, "that it was the nature of Athenians neither to keep quiet themselves, nor to suffer other people to do so,"[3] and its well-known character at that time of a "tyrant state,"[4] with the respect which Plato had won for it, when it became, not through the versatility of its citizens, and its inexhaustible resources, but by a truer title, through the lessons of virtue and wisdom, which it freely imparted to all, pre-eminently the School of Greece;[5]—and what an exalted opinion does the change now operated give us of the influence of Plato!

Isocrates had, at the same time, his school of rhetoric overflowing with pupils. Aristippus, also trained in the school of Socrates, was inculcating his scheme of ethics, which maintained the theory of Pleasure as the Chief Good. But esteemed as Isocrates was for the gentleness of his life, and his skill as a master of rhetoric; and acceptable as the doctrines of Aristippus must naturally have been to a corrupt society; neither of these great names sufficed to obscure the greater name of Plato, or could rival the pretensions of the Academia to be the great school of philosophy, and literature, and civilization.

A mind so intensely occupied as that of Plato, would scarcely find leisure for taking part in the political affairs of his country. The profession of philosophy was not as yet indeed become entirely distinct; but the teaching of Socrates had greatly tended to render it so. His rigorous method of interrogation which called forth the latent difficulties on other subjects, could not but produce great distrust in those who laid themselves fully open to it, as to their own ability to manage the complex matters of public concern, as well as impress them with despair of success in that walk of exertion. Socrates himself avoided as far as possible all interference in the politics of Athens. Plato strictly followed his example. Accordingly, we find, in several places of his writings, a contrast drawn between the philosopher and the man of public life; and an indirect apology for himself, as one who kept aloof from the public assemblies and the courts.[6] He betrays indeed strong disgust, not unmixed with contemptuous feeling, at the state of misrule into which the democracy of Athens had degenerated in his day, and he was evidently glad to avail himself of the plea of philosophy to absent himself from scenes so uncongenial to his taste. Doubtless, independently of any political bias, he was glad to escape from the sycophancy and tumult of the popular assemblies at Athens, and to enjoy the calm shades of his beloved retreat. This was the sphere of action for which nature and his whole previous life had peculiarly fitted him. Here he could effectually diffuse the salutary influence of his philosophy, in counteracting, in some measure at least, the selfishness of the world. Here he could maintain an undisputed supremacy over minds, which (such was the impatience of all authority in those times) no mere external power could have controuled or so entirely subjected to the direction of an individual.

Through the influence, however, of his Pythagorean friends, with whom he appears to have held constant intercourse, Plato was prevailed upon, at the age of sixty-five years, to quit the retirement of his garden for a time, and pay a second visit to Sicily.[7] It was the policy indeed of the Pythagoreans, like that of the Jesuits in modern times, to keep up an active intercourse with society, whilst in their internal system they cultivated philosophy with the ardour of exclusive devotees. Socrates wished to govern the conduct of men by an appeal to their reason; convincing them of their errors and follies, and leading them to seek the means of informing themselves aright. The Pythagoreans, like the Jesuits, aspired to carry out their views by a moral hold over men in society; by taking part accordingly in the management of states, and by a secret influence over those in power. The accession of the younger Dionysius to the throne of Syracuse, and the opening presented for producing an effect on him through Plato's influence with Dion, the next in power to the tyrant, were opportunities which would not be lost by their watchful zeal. Such seems, if we may proceed on the authority of the Epistles, to have been the occasion of this invitation of Plato to Syracuse. We see, at the same time, that there was a struggle of factions at Syracuse at this period. The party opposed to Dion, in order to counteract his influence, obtained the recall of Philistus, a man distinguished alike as a statesman, a commander, and an historian,[8] and a strenuous supporter of the existing government, but then in banishment through the ingratitude and caprice of the elder Dionysius. The result was, that though the reception of Plato at Syracuse was most flattering, for he was welcomed with the royal pomp of a decorated chariot, and the celebration of a public sacrifice, his mission was ultimately fruitless.

At first everything seemed prosperous. The change wrought in the manners of the court is described as marvellous. Philosophy became the fashion; and the very palace was filled with the dust stirred up by the number of geometricians. Even the expulsion of Dion, which soon followed, through the successful intrigues of his enemies, did not at once estrange Dionysius from the philoso-

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[1] Plat. *Menex.* p. 277.

[2] During the representation of "the Clouds," he stood up in a conspicuous part of the theatre to gratify the curiosity of the audience, many of them strangers visiting Athens at the festival, to see the philosopher who had attracted so much notice as to be personated on the stage. Ælian. *Var. Hist.* ii. 13.

[3] Thucyd. i. 70.

[4] *Ibid.* i. 124.

[5] *Ibid.* ii. 41.

[6] *Phædo*, p. 145; *Theæt.* p. 115, et seq.; *Gorg.* p. 82, et seq.; *Repub.* vi. p. 79; *Epist.* vii.

[7] Diogenes Laertius says, he went to Sicily on this occasion, in order to found a city according to the principles of his Republic, but that Dionysius failed in his promise of land and men for the purpose. But others, he adds, stated that the object of his visit was the liberation of the island from tyranny. In *Vit. Plat.*

[8] Cicero speaks of Philistus as a writer in the following manner: Philistum doctum hominem et diligentem. (*De Divin.* i. 20.) Catonem cum Philisto et Thucydide comparares? quos enim ne e Græcis quisquam imitari potest. (*De Clar. Orat.*)

Plato.

pher. He would not indeed allow Plato to leave Sicily with Dion; but, using a gentle constraint over him, detained him within the precincts of the citadel; shewing him at the same time all respect, and hoping at last, as it seems, to bring him over to his interest. At length the attention of Dionysius was called to preparations for war; and Plato, released from his embarrassing situation, was enabled to return to Athens.

He was not, however, deterred from once more making the trial, how far an impression could be made on the mind of Dionysius, and the restoration of Dion to his country effected; and, as on the former occasion, so now, he was chiefly induced to undertake the enterprise, by the earnest intercession of his Pythagorean friends. Dion himself was living at Athens, waiting the opportunity of returning to his country; and his relatives at Syracuse sent letters to Plato, urging him to use his exertions in behalf of Dion. Even Dionysius himself wrote a letter to him, entreating him to come, and promising satisfaction at the same time in regard to Dion. He also sent a trireme for him, with Archidemus, a disciple of Archytas, and others with whom the philosopher was acquainted, to render the voyage more agreeable to him.[1] For a while Plato persisted in declining the invitation, pleading his advanced age, for he was now sixty-eight years old;[2] but at length he gave way to these united solicitations. Dionysius, indeed, like his father, was fond of drawing around him men of eminence for literature and philosophy. At this time, amongst others of the same class at his court, were the philosophers Diogenes, Æschines, Aristippus, and some Pythagoreans. Plato might have not unreasonably hoped, therefore, that a mind delighting in such society, or at least ambitious of the reputation of being a patron of literature, might yet be influenced to sound philosophy. He was, besides, desirous of making an attempt to produce a reconciliation between Dionysius and Dion. Thus did he pass the Straits of Sicily a third time, to be a third time disappointed in the object of his voyage. Though he was welcomed, as before, with great splendour and demonstrations of respect, not only were his endeavours for the restoration of Dion unsuccessful, but he incensed the tyrant by venturing to intercede in behalf of Heraclides, a member of the liberal party at Syracuse, who was under suspicion of having tampered with the mercenaries. Still Dionysius was desirous of retaining the friendship of the philosopher. Plato was removed, indeed, from the garden in which he lived, under the pretence of a sacrifice about to be performed there by women, and placed in the quarter of the mercenaries. Such a situation was most unpleasant to him; as he could not but feel himself in danger amongst that lawless class, who naturally disliked him, as an enemy of the power which gave them employment and pay.[3] But this indignity was probably more the effect of the hostility of the opposite party against Dion, than an act of the weak tyrant himself. Plato, in his perplexity, applied to Archytas and the Pythagoreans at Tarentum, to extricate him from these difficult circumstances. At their instance, accordingly, Dionysius consented to the departure of Plato, and dismissed him with kindness, furnishing him with supplies for his voyage.

Thus did Plato once more return to Athens, heartily disgusted with the untoward result of his visits to Sicily.[4] Though the friend of Dion, the head of one great party at Syracuse, he had acted in Sicily consistently with his conduct at Athens, in not taking any active part in political affairs. Even Dionysius himself seems, throughout his conduct towards him, to have been jealous rather of his personal regard for Dion, than suspicious of any exertion on his part in the cause of Dion against him, and to have sought to detain him at Syracuse, not out of fear or ill will, but for the honour of the presence of the philosopher at his court. This is further evinced by the subsequent conduct of Plato. For, in the expedition which Dion planned and executed against Dionysius, he took no part; making answer to the invitation to join in it, "that if invited to assist in doing any good, he would readily concur; but as for doing evil to any one, they must invite others, not him."[5]

Plato.

The remaining years of his life were gently worn away amidst the labours of the Academia. These labours were unintermitted to the very close of a long life; for he died, according to Cicero's account, in the act of writing; his death happening on the day in which he completed his eighty-first year. "Such," adds Cicero, "was the placid and gentle old age of a life spent in quietness, and purity, and elegance."[6] Another account, however, of his death states that he died during his presence at a marriage-feast.[7] And another account besides (evidently the invention of some enemy to his fame), attributes his death to a loathsome disease.[8] On his first residence in the garden of the Academia, his health had been impaired by a lingering fever, in consequence of the marshiness of the ground. He was urged to remove his residence to the Lyceum, the grove afterwards frequented by the school of Aristotle; but such was his attachment to the place, that he preferred it, he said, even to the proverbial salubrity of Mount Athos; and he continued struggling against the disorder for eighteen months, until at length his constitution successfully resisted it.[9] Adopting habits of strict temperance, he thus preserved his health during the remainder of his life, amidst the harassings of foreign travel, and the undermining assiduities of days and nights of study.

Plato was never married. He had two brothers, Glauco and Adimantus, and a sister, Potona, whose son, Speusippus, he appears to have regarded with peculiar affection and interest, as the destined successor to his school of philosophy. He inherited a very small patrimony, and he died poor, leaving but three minæ of silver, two pieces of land, and four slaves, and a few articles of gold and silver to the young Adimantus, the son, as it would seem, of his brother of that name.[10]

In person he is described as graceful in his youth, and, if the etymology of his name be correct, as remarkable for the manly frame of his body.[11] One circumstance, however, is mentioned, which detracts in some measure from his bodily accomplishments; the imperfection of his voice, which has been characterized as wanting in strength of tone.[12]

In regard to moral qualities, he was distinguished by the gravity, and modesty, and gentleness of his demeanour. He had never been observed from his youth to indulge in excessive laughter.[13] Several anecdotes are told of his self-command under provocation; as, for example, his declining to inflict the due punishment on a slave when he found himself under the excitement of anger.[14] A pleasing instance is given of his amiableness and modesty, at a time

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[1] Plat. *Epist.* vii p. 124.
[2] B. C. 361.
[3] Plutarch. in *Dion.*
[4] *Μεμισηκως την περι Σικελιαν πλανην και ατυχιαν.* (Plato, *Ep.* vii. 149, Bip. ed.)
[5] *Ep.* p. 149.
[6] Diog. Laert. in *Vit.* after Hermippus.
[7] *De Senect.* c. 5.
[8] *Μυρωνιανος δ' εν Ὁμοιοις φησι, Φιλωνα παροιμιας μνημονευειν περι των Πλατωνος φθειρων, ὡς ὁυτως αυτου τελευτησαντος.* (Diog. Laert. in *Vit.*)
[9] Ælian.
[10] Diog. Laert. in *Vit.*; Aul. Gell. *Noc. Att.* iii. 18.
[11] Erat quidem corpus validum ac forte sortitus, et illi nomen latitudo pectoris fecerat. (Seneca, *Epist.* 58.)
[12] *Ισχνοφωνος.* Diog. Laert. in *Vit.*
[13] Diog. Laert. in *Vit.* after Heraclides.
[14] Diog. Laert. in *Vit.* Seneca *De Ira.* The anecdotes themselves can hardly be regarded as original. Similar stories are told of others, as of Archytas. Ex quo illud laudatur Archytæ; qui cum villico factus esset iratior, "Quo te modo, inquit, accepissem, nisi iratus essem?" (Cicero, *Tusc Qu.* iv. 36.)

Plato.

when his fame was at its height. Some strangers, into whose company he had been thrown at Olympia, coming afterwards to Athens, were received by him there with the greatest courtesy. All the while, however, they were ignorant who their host was. They merely knew that his name was Plato. On their requesting him to conduct them to the Academia, and show them his namesake, the associate of Socrates, they were astonished to find, by his smile and avowal of himself, that they had experienced so much unpretending kindness from the great philosopher himself.[1] Again, being asked by some one if there would be any saying recorded of him, he answered with the like modesty, "One must first obtain a name, and then there will be several."[2]

The gravity of his manner was by some interpreted as severity and gloom. The comic poet Amphis complained of him, that "he knew nothing but to look sad, and solemnly raise the brow." Aristippus charged him with arrogance. It is no wonder, indeed, that, in contrast with the coarse freedom of Diogenes, and the excessive affability of Aristippus, he should appear haughty and reserved. But that this character did not really belong to him, we may judge from the social humour which mingles even with the sarcastic touches of his Dialogues, and from the anxiety which he shewed to correct such a disposition as a fault in Dion. His favourite pupil Speusippus was distinguished by the opposite quality of a lively temper; and to his especial direction we find Plato sending Dion, that he might learn, by the conversation and example of Speusippus, a more conciliatory and agreeable mode of address.

The instance given of his vanity in putting himself forward at the death of Socrates, as competent to retrieve the great loss in his own person alone, bears evident marks of a calumny. It may be so far true, as it represents a desire upon his part to console his brother disciples under their common affliction. But as an evidence of an assumption of superiority over them at such a moment, it accords little with that feeling of dismay for themselves, under which he, in common with the rest, fled to Megara as an asylum; or with his indisputable affection for the person of Socrates, and veneration for his wisdom and talents.

Again, the strictness of Plato's philosophical profession, amidst the general dissoluteness of manners at Athens, was construed by some who had an envious eye on his reputation, as only an affected austerity. It was complained of him, that his life did not answer to the high requisitions of his moral teaching.[3] Two of his brother disciples in the school of Socrates, Antisthenes and Aristippus, imputed to him the grossest licentiousness. The former taking offence at Plato for objecting to a treatise, which he proposed to read, on the Impossibility of Contradiction, vented his spleen in a most abusive dialogue, which he entitled Satho, intending at once by that term a satirical play on the name, and a stigma on the character, of the philosopher. These calumnies are in some measure supported by the tenor of certain epigrams attributed to Plato, and by passages of his Dialogues, which display a license of impure allusion, shocking to the feelings of the reader, in these days at least. His calumniators then found occasion for their scandal, in observing amongst those by whom he was surrounded, the young and the handsome. But though we may see much to reprobate in such passages, and painful as the impression is which they leave on the mind, as evidences of the deep corruption of human nature, we are not warranted in regarding them as conclusive of corresponding immorality of conduct in a writer of his age and country. They would show, indeed, that the writer has not escaped the contagion of the vicious atmosphere which he breathed; and they are of course a great drawback in our estimate of the purity of his sentiments and character. But we ought to set off against them the high tone of religious and moral feeling which is the general characteristic of his philosophy; the beacon which it holds up to warn men of the debasing allurements of pleasure, and of the misery consequent on the indulgence of passion; and its glowing exhortation to seek for true happiness, not in externals, or by aiming at a mere human standard of virtue, but by internal purification, and by imitation of the perfections of the Deity.

Much has been said on the absence of any reference to Xenophon in the Dialogues of Plato. Xenophon, in his *Memorabilia*, has spoken of Plato, and alluded to the affection with which Plato was regarded by Socrates.[4] But Plato has not availed himself of any opportunity of paying the like compliment to Xenophon. This silence cannot, perhaps, be entirely accounted for, without supposing that there was a feeling of literary jealousy on the part of Plato. But there are some considerations which may partly account for Xenophon's not appearing as an interlocutor in the Dialogues. Xenophon, though a man of philosophical mind, evidently attended the teaching of Socrates, not to learn the art of disputation, or for the indulgence of a speculative curiosity. When he philosophized, it was as a man of the world, acquainting himself with human nature, with the manners and opinions of men, in order to his own conduct in life. He was not one of those eager and flippant sciolists, whom Plato takes delight in submitting as apt experiments to the interrogatories of Socrates. Nor was he, again, a devotee of science, like the wise Theætetus, the interesting person who gives occasion to the dialogue of that name, and whom in some points he resembled. He would not therefore naturally be selected by Plato, in order to the carrying on of discussions intended for the development of his philosophy. It is remarkable, that Plato has only in two places even alluded to himself; in the *Phædo*, to explain his absence from the death-scene in the prison;[5] and in the *Apologia*, as amongst those present at the trial of Socrates, and capable of giving evidence as to the nature of those instructions which Socrates addressed to the young.[6]

Such was the character of this eminent man. His distinguished career exposed him to the shafts of envy and detraction; and the high aspirings of his mind were clogged and weighed down by that corrupt heathenism with which he was surrounded. Still his reputation for wisdom and virtue stands above all these attacks and circumstances of disparagement. The more we converse with him in his writings, the more we are charmed by the deep feeling of natural piety which pervades his philosophy as its master-thought, and by the sound practical wisdom which shines forth from them as the real character of the man, reclaiming and subduing the wild aberrations of his speculative fancy.

His remains were buried in the place which he had ennobled whilst living. Nor were they unattended by the

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[1] Ælian, *Var. Hist.* iv. 9.

[2] Diog. Laert. in *Vit.* p. 23, Bip.

[3] "Aliter, inquit, loqueris; aliter vivis." Hoc, malignissima capita, et optimo cuique inimicissima, Platoni objectum est, objectum Epicuro, objectum Zenoni. Omnes enim isti dicebant, non quemadmodum ipsi viverent, sed quemadmodum vivendum esset. (Seneca *De Vit. Beat.* c. 18.)

[4] Xenoph. *Mem.* iii. 6.

[5] Πλάτων δὲ, οἶμαι, ἠσθένει. (*Phædo*, § 6.) This circumstance was perhaps thrown in for graphic effect. His own sorrow is too intense to be depicted; therefore he is concealed from the view: his name is introduced, but merely to state that he was not present.

Apol p. 78, Bip. ed.

Plato's Writings and Philosophy.

customary tributes of honour and affection. Aristotle, who had been his constant disciple during the last twenty years preceding his death, displayed his veneration for his preceptor by consecrating an altar to him. A festival, called after him Platonea, was instituted in honour of him, and celebrated annually by his disciples. A statue, dedicated to the Muses, was afterwards erected in the Academia by Mithridates the Persian. He had not, indeed, been dead but a very few years, when the great celebrity of his name called forth from his nephew and successor, Speusippus, an express work in his praise. Seneca further tells us of a singular mark of honour which was paid to him on the very day of his decease. There were some Magi, he relates, at Athens at the time, who, struck by the singular circumstance of his having exactly completed the perfect number of nine times nine years, performed a sacrifice to him, esteeming him on that account to have been more than man.[1] The story is evidently the invention of his later admirers. It is referred to here, as a testimony of the enthusiastic admiration with which his name has been ever attended. To the same feeling must be ascribed the fiction of the discovery of his body in the time of Constantine the Great, with a golden tablet on the breast, recording his prediction of the birth of Christ, and his own belief in the Saviour.[2]

PLATO'S WRITINGS AND PHILOSOPHY.

The writings of Plato obtained an early popularity. Already, during his lifetime, copies of them appear to have been circulated. An iambic line, *λογοισιν Ἑρμοδωρος ἐμπορευεται*, proverbially applied, long after the time of Plato, to those who made a traffic of the writings of others,[3] shews that there was an immediate demand for them in Greece. The Hermodorus here referred to, was one of his hearers, who is said to have sold the writings of the philosopher in Sicily for his own profit. The fact of their early circulation is further evidenced, if it be true, as has been stated, that complaints were made by some of the persons whose names appear in the Dialogues, and even by Socrates himself, of the manner in which they had been represented in them by Plato.[4] It is very probable, also, that during the long time in which he was publicly teaching at Athens, and, doubtless, recurring frequently to the same topics of discussion, considerable portions of what he delivered orally, were treasured up in the memory of some who heard them, and afterwards written down, and thus published to the world without having received the finishing touches of the author's hand. The practice, indeed, of thus carrying off the oral lessons of the philosopher is alluded to by Plato himself in passages of his writings, as in the *Phædo*, and *Theætetus*, and *Parmenides;* where the dialogue is related by some one remembering what has passed in conversation on a former occasion. This circumstance may, at once, account for the comparative inferiority of some of the Dialogues in point of execution, and for the fact that some have been passed under his name which are not really his; whilst we have, at the same time, a very considerable collection of writings authenticated by testimonies descending from his own times.

It is by no means necessary for our purpose here (which is to obtain a just general view of the character of the philosopher and his writings), to enter into the criticisms by which doubts have been thrown on particular Dialogues, and on different Dialogues by different critics, out of the number commonly included amongst the genuine works of Plato. We may only remark, that these doubts do not rest on external testimony, but are drawn from considerations of the internal character of particular writings, which have been judged inferior to the rest in matter and execution. Nor is it necessary that we should discuss the various theories proposed for connecting the several Dialogues, and tracing in them the gradual formation and development of the philosophical system of the author. This inquiry certainly has its interest; and could we arrive at any clear results in the prosecution of it, it would be valuable, for the light which it would throw on the interpretation of the philosophy of Plato. But though we can discover a connection between several of the Dialogues, like that of a series of discussions on the same subject, it is not possible to decide on the order in which the points discussed presented themselves to the philosopher's mind, or which we are to regard as the more mature expression of his doctrines. This inquiry further demands a decision of the agitated question concerning the double teaching practised in the ancient schools, known by the technical division into esoteric and exoteric, or mystic and popular; the former addressed to the mature disciple, the latter to the novice or general hearer. There are undoubtedly marks of a recognition of this distinction throughout the writings of Plato;[5] and it is also probably referred to by Aristotle, when he speaks of the "unwritten doctrines" of Plato.[6] But we cannot practically employ it in determining the relative value of particular discussions or statements in his writings, without involving ourselves in a maze of theoretic disquisition, and ending at last, perhaps, in absolute scepticism respecting his doctrines.

But there is a particular class of writings attributed to him, which would possess a peculiar interest for us, if we could establish their genuineness; respecting which, however, the severe verdict of modern criticism compels us to hesitate in pronouncing on their genuineness. We mean what are commonly published in the editions of his works as the Epistles of Plato. By some the question has been regarded as settled beyond controversy, against their reception.[7] The style of their composition has been judged to be quite below the character of Plato's mind. The apologetic tone of the chief part of them has also been considered as evidence of their having proceeded from friends or disciples of Plato, vindicating his character from misrepresentations in regard to his intercourse with the court of Syracuse. But though we may allow weight to these considerations, they are not sufficient peremptorily to decide the question against the Epistles; particularly as we have in their favour the authority, not only of Plutarch, who founds much of the narrative in his Life of Dion upon them, but of Cicero, referring to them and quoting them expressly as writings of Plato.[8]

Perhaps no philosophical writer has ever received so early and ample a recompense of his labours, not only in the reception and circulation of his writings, but in the still more glorious tribute of the spread of his philosophy, as Plato has received. We have mentioned the ordinary marks of admiration which accompanied him during his life and after his death. A more enduring monument was reserved for him in the foundation of the school of Alexandria, not many years after his voice had ceased to be

[1] Senec. *Ep.* lviii. 28.

[2] Brucker, *Hist. Crit. Phil.* tom. i. p. 654.

[3] Dic mihi, placetne tibi, primum, edere injussu meo? Hoc ne Hermodorus quidem faciebat, is qui Platonis libros solitus est divulgare; ex quo λογοισιν Ἑρμοδωρος. (Cicer. *Ep. ad Att.* xiii. 21.)

[4] Athenæus, xi. 113. Axiothea is said to have been induced to attend on the teaching of Plato, from having read the Republic.

[5] See particularly *Conviv.* p. 245.

[6] Aristot. *Phys.* iv. 2.

[7] Mitford, *Hist. of Greece*, vol. vi.; Ritter, *Hist. of Anc. Phil.*

[8] Est præclara Epistola Platonis ad Dionis propinquos; in qua scriptum est his fere verbis: "Quo cum venissem, vita illa beata quæ ferebatur," &c. *Tusc. Qu.* v. 35; also *De Offic.* i. 7; and *De Fin.* ii. 14.

Plato's Writings and Philosophy.

heard in the groves of the Academia. There, as in a fitting temple, on the confines of the Eastern and Western Worlds, was enshrined the philosophy which had moulded into one the philosophical systems of the East and the West. And though, in the course of things, the infusion of Eastern Philosophy predominated at Alexandria, it was still under the venerated name of Plato that the new system was taught. The disciples of the Alexandrine school were proud to call themselves Platonists, and to regard themselves as interpreters of the teaching of Plato, whilst they altered and disfigured that teaching. Here, then, was erected the proper monument to his fame. Meanwhile, in the Academia, teachers in regular succession transmitted their inheritance of his name, and by the charm of that, prolonged a feeble existence. For the spirit which had formed and animated the school had fled with him; and the Middle and New Academics only attested, by their lingering decay, the strength of the foundation on which they had been built. How great the influence of Plato was on the philosophy of the Romans, needs not to be told to those who are even slightly acquainted with the philosophical writings of Cicero. And even when Christianity threw into the shade all systems of man's wisdom, the only philosophy which maintained its credit at the first, was that of Plato. Christian teachers were found, not unwilling to own that there was great accordance between his doctrines and the revealed truth. Whilst, on the one hand, there were disciples of the philosopher who claimed for him all that was excellent in the Christian scheme, there were Christians who asserted, that he had learned his superior wisdom from the elder Scriptures. All this shews the hold which his name still retained over the minds of men at this period. The great father of the Western Church, St Augustin, avows himself a warm admirer of Plato. He concedes the approximation of the Platonists to the Christian doctrines; affirming that all other philosophers must yield to those who had speculated so justly as they had respecting the Chief Good.[1] Afterwards, indeed, we find Aristotle supplanting Plato in favour with the Christian controversialist. The struggle had been for some time between their respective advocates, which of them should obtain the lead in the Christian schools. But Plato, on the whole, had the mastery, though the result of the struggle was an eclectic system, in which the principal differences of the two philosophers were studiously reconciled. In fact, we may consider Platonism as in the ascendency in the Christian schools, until the period of Scholasticism, that is, until the twelfth and the following centuries, when the discipline of argumentation was at its height in the Church, and with it the study of Aristotle's philosophy. Even then the theories of Plato maintained their ground. The speculations pursued by members of the Church continued to be for the most part Platonic in their principles, though they were conducted and modified by the dialectical method of Aristotle.

What, then, was the character of this philosophy, it will naturally be asked, which both rendered it so attractive to those amongst whom it arose, and also secured for it such an immortality?

It is a very remarkable circumstance that, as far as we know, Plato should have escaped all censure at Athens on account of his philosophy, when other philosophers, who, like him, became centres of popular attraction, were the objects of extreme persecution. It is the more remarkable, as not only his master experienced such persecution, but his immediate disciple, Aristotle, was forced to fly from Athens to escape the storm with which he was threatened. Coming between these two, and enjoying, at the height of his popularity, an influence perhaps surpassing that of either, he yet was suffered to wear out his life unmolested, amidst the tranquil labours of his school.

Plato's Writings and Philosophy.

The only evidence to the contrary of this is an unauthenticated anecdote, told by Laertius, of Plato's having accompanied Chabrias to the citadel of Athens, and shewn his zeal in support of that general, under the capital charge brought against him. Upon this occasion, it is said, Crobylus, the sycophant, meeting him, observed, "Are you coming to plead for another, as ignorant that the hemlock of Socrates awaits you too?" to which he replied, "When I served my country in the field I underwent dangers, and now in the cause of duty I undergo them for a friend."[2]

But though we may refuse to believe this story, it is quite evident, that the condition of philosophy at Athens was not without its obloquy and danger even in its most flourishing times under Plato. We may gather from many passages of the writings of Plato, that the cause of philosophy still needed defence, and that great caution was required on the part of those who publicly professed the study of it. A re-action indeed had taken place in favour of philosophers, in consequence of the severity with which Socrates had been treated; and the assailants of Socrates suffered retribution from the popular feeling. Still there was in the mass of the Athenian people a strong antipathy to philosophy, from their ignorance of its real nature. They had been taught to regard philosophers as idle and mischievous drivellers, ever prosing about nature and the phenomena of the heavens, and as contemners of the gods.[3] They had seen also how some of those to whom Athens owed her greatest calamities, had been amongst the students of philosophy. Alcibiades, for example, had been a hearer of Socrates; one of singular natural endowments, in the formation of whose mind Socrates had taken especial pains, and who might therefore be regarded as the test of what philosophy could effect. The people had loved him as their spoiled child, in spite of all his follies; but they had felt also the mischief and misery of his wild career of ambition; and they threw the blame on his instructors, and the system in which he had been trained. Again, a great prejudice had been excited in the public mind against philosophy in general, from the many low and mercenary professors of it with which Greece abounded; minute philosophers, patronized by the public for their temporary services in teaching the arts of public life, but who produced ignominy and disgust to the true profession by their unworthy monopoly of its name. Add to this, that popular opinion had been corrupted by the false teaching, which had been so long and extensively at work throughout Greece. Erroneous principles of judgment and conduct had taken root in the public mind; or, to describe the case more correctly, all principles were unsettled, and the state of the public mind was a state of inward anarchy and insubordination. A philosopher, therefore, seriously devoted to his profession, and pursuing it with a single eye to the advancement of truth, was necessarily regarded with suspicion and dislike. For it is a natural propensity of the mind to adhere to what is established, whether it be good or evil, simply because the transition is easy, and no effort of thought is required, no trouble of self-examination imposed, no censure of self exacted; and what is inveterate in their own minds passes with men for the oldness of truth and nature. A reformer, therefore, is always an object of aversion; and no reform is successfully accomplished, until it has worked its way by subduing the prejudices which it has to encounter at the outset. Not

[1] Augustin. *De Civit. Dei*, viii. Chapter after chapter is taken up in Eusebius' *Præparatio Evangelica*, in shewing the agreement of Plato with the Scriptures.

[2] Diog. Laert. *in Vita Plat.* 18.

[3] Οὐδ' ἂν κωμῳδοποιὸς εἴη, ὡς ἀδολεσχῶ, κ. τ. λ. *Phædo*, p. 159; *Apol.* p. 41; *Polit.* p. 92, *et alib.*

Plato's Writings and Philosophy.

only was the opposition to sound philosophy produced in the minds of the vulgar by this distemper of public opinion; but even the better part of society, the more educated and reflecting members of the community, were infected by it. The majority of these would be deterred from taking up a profession exposing them to so much dislike and risk. Some of them, too, with a view of standing well with the mass of those amongst whom they lived, and promoting their own interest, would avail themselves of the popular clamour against philosophy, cry down the pursuit of it as innovation and danger, and make it their business to exaggerate, instead of counteracting, vulgar prejudices on the subject.

These obstructions to the teaching of philosophy are pointedly referred to by Plato, as existing in his time, and demanding his attention, in order to the success of that mission of reform which he had undertaken. He treats the vulgar prejudice against philosophy as not altogether unreasonable,[1] in consequence of the perverse opinions which had been popularly inculcated; and endeavours to disarm the public hostility, by alleging the causes of the disrepute into which philosophy had unjustly fallen. Alluding, as it seems, particularly to the instance of Alcibiades, he points out, that it is not philosophy which corrupts the young, but the passions of the young and high-spirited which pervert the means of good to the greatest mischief. None but those of the highest order of talent and natural gifts are fully susceptible of its influence; but then these are the very cases, he observes, which are also capable of the most mischief, through their greater susceptibility of the seductions of the world. There cannot but be objections against philosophy, he further observes, as long as the mass of mankind is, as it is found, incapable of appreciating real essential good for its own sake; and as long as those of superior nature, who should be its devoted friends, and examples of its influence, are drawn away from it in pursuit of popular opinion. He endeavours, accordingly, to evince that there is no just ground for alarm, at least in those days, at the power of philosophy. It was now deserted and helpless, fallen amongst those who were not its own people. If disgrace now attached to philosophy, it must be imputed to the unworthy alliance into which it had been forced. The mean artisan, who has made his fortune, now quits his prison, and decks himself out, and aspires to the hand of the daughter of his master in her poverty and destitution.[2] It was no wonder, therefore, that such spurious fruits, of so unsuitable alliance, were then seen in the world, and that the few who clung to the true profession were like strangers in the world, living away from public affairs, as unwilling to join in the general iniquity, and unable to resist it effectually by their single strength.[3]

If Plato thought it necessary thus to apologize for the pursuit of philosophy, it is clear that there was yet reason to apprehend an outbreak of violence against its professors. In fact, however, he appears not only to have escaped all such outrage, but, whilst he propagated, by his oral teaching and his writings, a system of doctrines directly contrary to the impure morality and superstition established around him, to have enjoyed an esteem beyond that which any other teacher on the same ground ever obtained.

The explanation of this is in a great measure to be sought in the circumstances under which his philosophy was formed and matured, and to which it was peculiarly adapted.

What Themistocles admitted truly of himself when he answered, that he should not have achieved his glorious deeds if Athens had not been his country, was as truly applied by Plato to himself, when he enumerated amongst his causes of gratitude to the Gods, that he was born an Athenian.[4] For his philosophy was eminently Athenian. Viewed at least as we have it in his writings, it was the expression, by a master-mind, itself imbued with the spirit of the age, but rising above that spirit by its intrinsic superiority and nobleness, of those tendencies of thought and action, which had been working in Greece, and especially at Athens, the centre of Grecian civilization.

The Peloponnesian war terminated with leaving Athens humbled before the confederacy, which the hatred and jealousy of her power had leagued against her. But the loss of her ascendency in Greece was not the worst evil brought on Athens by the result of that war. The machinery of faction, by which the war had been principally carried on, produced the most mischievous effects on the character and happiness of the Greeks at large; aggravating the symptoms of evil already existing in the constitutions of the several states, and, not least, in that of Athens. Not only did the insolence of the Athenian democracy gain strength in the result, and rise beyond all bounds, but the excesses in which party spirit had indulged, drew into prominence the selfishness and ferociousness of a demoralized people. Then might be clearly seen the levity and licentiousness of men, who, living amidst constant hazards, had learnt to regard nothing beyond the enjoyment of the passing hour; the cunning and cruelty engendered by mutual distrust; and the wanton contempt of all law and religion, prompted by the sight of the calamities which the tempests of social life scatter indiscriminately on the good and the evil. On this stock of corruption, speculative irreligion, and speculative immorality, had also grown up as its natural offshoots. Men were found hardening themselves against the reproaches of conscience and the fear of retribution, by arguing against the fundamental truths of religion and morals. In religion, it was contended that there were no Gods; or that if the existence of a divine power were conceded, there was no Providence over human affairs; or, lastly, that if there were a Providence, the wrath of the offended Deity was placable by the prayers and sacrifices of the offender. In morals, the question was debated, whether all was not mere matter of institution and convention, and the device of the weak against the stronger power; and whether right might not change with the opinions of men.

This state of things had produced and fostered a spurious race of philosophers, familiarly known by the name of the Sophists; a name, not at first implying that disrespect, by which it afterwards characterized the pretensions of those to whom it was given. For the Sophists evidently were not the primary corruptors of the public mind in Greece, but themselves the offspring of that moral chaos, which resulted from the internal disorders of the country; and which they sustained, as its own children paying the recompense of their nurture to their genuine parent. They were an evidence of the corruption having reached the higher classes of society: for their instructions were sought by those who could pay for them, and who desired to qualify themselves for office and power in the state. Going about from place to place, and domesticating themselves wherever they could obtain a reception, they undertook to render all that flocked to them adepts in the arts of government, and even in virtue. The pretension would have been absurd and extravagant, but for the prevailing looseness of opinion on moral subjects.[5] But when right was

[1] Ὠ μακαρις, ἠν δ'ἐγω, μη πανυ ὀυτω των πολλῶν κατηγορει, ἀλλ' διαν τοι δοξαν ἑξουσιν, ἐν αὐτοις μη φιλονεικων, ἀλλα παραμυθουμενος, και ἀπολυόμενος την της φιλομαθειας διαβολην, ἐνδεικνυε ὀυς λεγεις τους φιλοσοφους, κ. τ. λ. (*Rep.* vi p. 101.)

[2] Δοκεις οὐν τι, ἠν δ'ἐγω, διαφερειν ἀυτους ἰδειν ἀργυριον κτησαμενου χαλκεως, φαλακρου και σμικρου, νεωστι μεν ἐκ δεσμων λελυμενου, ἐν βαλανειῳ δε λελουμενου, νεουργον ἱματιον ἐχοντος, ὡς νυμφιου παρεσκευασμενου, δια πενιαν και ἐρημιαν του δεσποτου την θυγατερα μελλοντος γαμειν (*Rep.* vi. p. 93.)

[3] *Ibid.* p. 95.

[4] Lactant *Div. Inst.* iii.

[5] *Rep.* vi p. 85.

Plato's Writings and Philosophy.

understood as nothing more than what happened to be instituted and in fashion, there was an opening to every unprincipled teacher to adapt his moral lessons to the varied requirements of each distinct society.[1]

At no place were these universal teachers more cordially received than at Athens. The anxiety with which an expected visit from any one of greater note among them was expected at Athens, and the zeal with which the young hastened to see and hear the wise man on his arrival, are depicted in lively colours by Plato. At Athens, evidently, if anywhere, the Sophist felt himself at his proper home. There was his readiest market. Herodotus may justly have been surprised at the success of so vulgar a deception at Athens, the seat of literature, as that practised by Pisistratus, when he exhibited to the people a woman of great stature, arrayed in full armour, and pompously borne in a chariot into the city, as the goddess Minerva, reinstating him in her own citadel.[2] It would have been still stranger if these impersonations of Athenian wisdom had not succeeded in imposing on the understanding of Athenians. For their minds were in that fluctuating state which disposed them to receive every various form of impression from any plausible teacher. Their general cultivation of mind, and taste for literature, prepared them for listening with pleasure to exhibitions of rhetorical and dialectical skill, such as the Sophists gave. And from admiration of the skill thus displayed, the transition was natural to consider that as the only wisdom, which was capable of maintaining both sides of a question with equal plausibility, and that the only virtue, which could shift and accommodate itself to every expedient with equal satisfaction.

Yet the Athenian was not entirely the creature of those circumstances, which had so considerably modified his character. He yet retained some traces of that high feeling so beautifully touched by his own tragic poet, when that poet speaks of "the pious Athens," and appeals to the ancient associations of religion which consecrated the land. Religion indeed had acquired the name of superstition, or the fear of supernatural powers, δεισιδαιμονια; but even this marks that there were some who cherished, though in that degenerate form, a veneration for the truths of the Divine Being, and the Divine agency in the world. Nor was the Athenian ever insensible to his pride of birth, and rank among those of the Grecian name.[3] He dwelt on the recollections of a remote antiquity of origin, as distinguishing him among the members of the Greek family. He claimed to be the offspring of the Attic soil, αὐτοχθων, whilst others were descended from successive immigrations of strangers. Amidst his fickleness, and susceptibility of every passing impulse, he yet felt himself strongly influenced by his veneration for the past, and loved to connect himself with the ancient glories of his country. In the Athenian character, accordingly, may be observed the union of extremes; devoutness of deep inward feeling, accompanied with superficial irreligion and profane dissoluteness of morals; a mercurial temperament, ever eager for change, floating like a light cloud over a deep-rooted reverence of antiquity, and the traditions of ancestral wisdom and virtue.

Now, on accurately studying the writings of Plato, we find them, both, a reflexion of this state of the public mind at Athens, and a corrective of it. Full of imagination and of severe subtile thought, they are formed to attract and fix the attention of the literary Athenian. Bringing the Sophist on the scene, and giving sketches of the social life of Athens, and making conversation the vehicle of his instructions, Plato in a manner transferred to his own teaching, what was every day witnessed at Athens in the professorial exhibitions of the Sophists themselves. His philosophy, a counterpart, in its way, to the drama of the comic poet, instructed the people, at once, through their wisdom and their folly. As Aristophanes spoke to them under the mask of folly, and gave utterance to lessons of severe wisdom under that mask; so Plato, on the other hand, put on the mask of the sage, and in grave irony ridiculed and exposed the light-hearted folly of his countrymen. Both were wiser than they seemed to the outward observation; as was indeed the volatile Athenian, to whom they addressed their counsel. Both presupposed that delicacy of perception and quick tact in their fellow-citizens, which would be flattered by such indirect modes of address, and would, at the same time, appreciate the jest of the one, and the irony of the other. Both speak with the freedom of the democratic spirit. But the counsel of Aristophanes is that of the privileged jester of the sovereign-people amidst festal scenes and the enthusiasm of mirth; whilst Plato appeals to the Athenian at the moment of quiet, serious reflection on the surrounding folly, and treats him as a contemplative spectator, rather than himself an actor in it.

Before the time of Plato, there were no philosophical writings which answered the requisitions of the Athenian mind. There were poems of the early philosophers. There were didactic writings of the later Pythagoreans, and even dialogues discussing speculative questions. Anaxagoras, too, whose name was well known at Athens, had published a treatise of philosophy.[4] But none of these, if they were even accessible to the Athenian, were calculated to attract his attention. The philosophical poems differed nothing from prose but in the metre, and were exceedingly dry and uninviting to the general reader. The books of Pythagoreans were very few, at least at this time, and hardly known to any but the devoted student of philosophy.[5] Nor would the dialogues of Zeno or Euclid, concerned about mere logical subtilties, or the physical discussions of Anaxagoras, possess any charm for the lively Athenian. Even afterwards, the instructive writings of Aristotle did not obtain that reception which could save them from a temporary oblivion. But the dialogues of Plato supplied exactly what was yet wanting in this department of Athenian literature. They were the proper development of the philosophical element in the genius of the people. The shrewd practical talent of the Athenians had been strikingly exhibited in the successful achievements of their great generals and statesmen, and in the lead of Athens itself amongst the states of Greece at the close of the Persian war. Their taste in arts, and poetry, and general literature, had put forth splendid fruits in the works of Athenian artists, Athenian masters of the drama, and of history. But their genius for abstract speculation as yet had nothing which it could claim as strictly its own. Socrates indeed laid the basis for such a work. During the half century preceding the appearance of Plato as the leader of a school of philosophy, Socrates had been engaged as a missionary of philosophy, awakening the curiosity of men; turning their thoughts to reflection on themselves, as creatures endued with moral and intellectual faculties; and inspiring them with longings after some information on questions relating to their own nature, and a taste for discussions addressed to the resolution of such questions. Plato succeeded him, and carried the philosophical spirit, now fully called into action, to its result. His works accordingly display this spirit at its maturity; exemplifying at the

[1] See *Meno*, pp. 371–380; *Theæt.* p. 127; *Soph.* pp. 232–234.

[2] Herodot. *Clio*, 60.

[3] *Ibid.* vi. 59; Ἀθηναιος ὢν Λαμψακηνῳ, shews in a few words the Athenian estimation of themselves.

[4] Laertius says that Anaxagoras was the first to publish such a treatise. In *Vit. Anax.* viii.

[5] It must be of the more modern Pythagoreans that Dionysius of Halicarnassus speaks, when he recommends the reading of them, not only for their matter, but for their style. *De Vett. Scr. Cens.* iv.

same time that peculiar combination of qualities which formed the Athenian character. Thus are they at once serious and lively, abstract and imaginative; full of deep thought and feeling intermingled with gaiety and humour; instinctive with the awe of religion and ancient wisdom, whilst they present also an image of Athenian versatility, and frivolity, and love of change. They convey indeed a strong rebuke of the vices of the times. They draw, in no softened colouring, outlines of the evil and misery resulting from the profligacy of existing governments, and the excesses of individual cupidity; the two great causes assigned by Plato for the prevailing evil of his times. But these lessons were calculated rather to interest the hearer or reader by their faithful representation of manners, than to alienate him, as we might at first think, by the justness of the censure. Athenians would give their attention to such descriptions, as they did to the invectives of their orators,[1] acknowledging the general truth of the representation; and each, at the same time, taking no offence at what he applied to others, and to every one rather than to himself. Philosophy too, taught, as by Plato, colloquially, was such as peculiarly to suit the taste of the Athenian, whose life was in the agora, or the ecclesia, or the courts of law; and who regarded the interchange of words as no unimportant ingredient in everything that he had to do.[2] Such conversation, too, as that of Plato's Dialogues, elegant conversation, steeped in the well-spring of Grecian literature, and expressed in language such as Jove, it was said, might use, and adorned with the charms of an exquisite musical rhythm, could not but be highly attractive to Athenian ears. We may see, accordingly, in these circumstances, at once, an occasion for the existence of such writings as those of Plato, and a reason of the peculiar mould in which they were cast, as well as of the success which attended them.

Not only, however, was the general character of his philosophy, as viewed in connection with the writings which convey it, derived from such influences; but the internal structure of it was the natural result of the peculiar education of such a mind as his, under the circumstances to which we have referred. His philosophy was essentially dialectical or colloquial; an examination and discussion of systems, and doctrines, and opinions. According to his notion, the true philosopher is the dialectician; the investigator, who has fought his way, step by step, through every argument capable of being adduced in support of, or against, a particular opinion, refuting those that are unsound, until at length he has found rest in some position that cannot be shaken.[3] Hence he is the disciple of no particular system of philosophy, whilst he brings all systems under his survey, and compels all to pay a tribute to his stock of truth, by discussing them, and rejecting in them what will not abide the test of examination. We have seen that he was engaged in studying the doctrines of Heraclitus, and of the Pythagoreans, and of the other schools, whilst he was also a hearer of Socrates. He had thus begun in early life to analyse different systems by the searching method of Socrates; and his mature philosophy was only the same proceeding more deeply imbibed in his own mind, more extensively carried on, and more vigorously applied. So far, indeed, does the colloquial spirit predominate over his philosophy, so entirely dialectical is it in its whole internal character, that it leaves on the mind of the reader more an impression of a series of discussions, in order to the determination of the questions considered, than the conviction of any thing positively determined. Hence it is that Cicero, speaking of Plato's writings, says, that "in them nothing is affirmed; and much is discoursed on both sides; everything is inquired into; nothing certain is said."[4] So also Sextus Empiricus raises the question, in what respect the philosophy of Plato differs from that of the Sceptics.[5] And again his doctrines have been characterized as brilliant clouds, which we seem at the point of grasping, when they vanish from our hands. This effect is doubtless partly to be ascribed to the disguise of his irony; to the artist-design which presides over his whole instruction. But it is also the proper effect of that dialectical philosophy which is worked out in the Dialogues. Whilst he is a consummate artist throughout, he is also illustrating the lessons which he had learnt from Socrates, by bringing false opinions to the test of discussion, and leaving truth, for the most part, to be collected from refutation of error, rather than positively enunciating it, or exactly defining it.

For when we come to examine his philosophy more closely, we find, that it begins and ends, like the lessons of Socrates, with a confession of the ignorance of man. Socrates had led him to perceive how much was taken for granted in the popular opinions and systems of philosophy; how even those who had a reputation for wisdom and talents took up principles which they had never examined, and which they could not satisfactorily account for, or defend, when pressed in argument. Imbibing, accordingly, the spirit of the Socratic method, he did not endeavour to *teach*, in the proper sense of the term, so much as to explore and test the minds of men; to ascertain, how far they really understood the doctrines and opinions which they professed. The fundamental error of the Sophists was, that they assumed all current opinions to be true. They did not think it necessary to examine this preliminary; whether the opinions on which they built their fabric of knowledge were true or false. It was enough for them, that certain opinions were *actually* held; and to these, as given principles, they directed their whole system of teaching. Their teaching, accordingly, was entirely πρὸς δοξαν, relative to opinion; and it must, consequently, stand, or fall, as existing opinions could be maintained or impugned. Now, with Plato, as with Socrates, the investigation of this preliminary point (that is, whether existing opinions are true or no), is everything. The presumption that they are true, is what he will by no means admit. He demands a positive evidence of them. And as the presumption of their truth is a bar to all inquiry concerning them, he commences with the opposite presumption of their falsehood, or at least a confession on the part of the inquirer, that as yet,—until he has investigated,—he does not *know* the *truth* of his opinions.

For the same reason, he avoids all dogmatism in his conclusions. Those might aspire to communicate the knowledge of new truth to the mind, who, as the Sophists did, assumed that knowledge was entirely subjective; or who held that any opinion which could be produced in the mind, was simply true, was really known, because it was there. But as Plato denied the truth of Opinion, if it had no other evidence, but that of its mere presence in the mind; so, neither would he concede that any process of the mind in itself, or any argumentative and persuasive instructions, could produce, *by their own force*, a conviction of truth in the mind. In other words, he required the student of philosophy, not only to begin, but to end, with a confession of the ignorance of man.

We have an apt illustration of this in the dialogue entitled the *First Alcibiades*. There Socrates is introduced,

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[1] Thucyd. iii 38; Demosth. *passim*.

[2] Ου τους λογους τοις ἐργοις βλαβην ἡγουμενοι, ἀλλα μη προδιδαχθῆναι μαλλον λογῳ προτερον, ἢ ἐπι ἃ δεῖ ἐργῳ ἐλθεῖν, κ. τ. λ. (Thucyd. ii. 40; also iii. 42.)

[3] Ὥσπερ ἐν μαχῃ δια παντων ἐλεγχων διεξιων, κ. τ. λ. (*Rep.* vii. p. 167.)

[4] Cic. *Acad. Quæst.* i. 12.

[5] Sex. Emp. *Pyr. Hyp.* i. 33; Diog. Laert. in *Vit. Plat.* 33.

questioning Alcibiades concerning his plans of life, and shewing how entirely he had presumed on his knowledge of matters with which he was unacquainted; and that until he could be brought to feel and confess his ignorance, there was no possibility of his being able to direct himself or others aright.

In the *Meno*, the same is illustrated by the comparison of the effect of the searching questions of Socrates, on the mind of the person submitted to them, to that of the torpedo. Meno says, he had thousands of times, and to many a person, and with much credit to himself, as he thought, spoken on the subject of virtue; but on conversing with Socrates, he was quite at a loss now to say even what virtue was.

To the same purport is the general application by Socrates in the *Apologia*, of the oracle which pronounced him the wisest of men. The oracle, he observes, had only used his name by way of example, as if it had said, "He, O men! is the wisest of you, whoever, like Socrates, is convinced, that he is in truth worthless in respect of wisdom."[1]

The method of Plato, accordingly, is the reverse of didactic. The Sophists could employ a didactic method; because they assumed principles as true, from which they might proceed to argue and persuade. But this was precluded to Plato, assuming, as he did, that all opinions demanded a previous examination. It was necessary for him to extort a confession of ignorance, to make men sensible of the difficulties belonging to a subject. It only remained, therefore, for him to proceed by Interrogation. In a colloquial philosophy, Interrogation is what experiment is in physical inquiry. It is the mode of discovering what the real state of a person's mind is, in regard to the opinions which he professes. The whole art of Socrates consisted in putting questions to the person with whom he conversed, so that an answer bearing on the point in debate might be elicited; that the grounds on which a given opinion was held might fully appear; and the person's own answers might open his mind to see it in its proper light. This method Plato has followed out in the interrogatory of his Dialogues. Under such a method of philosophy, the answerer is brought to teach himself. The lesson thus given by the philosopher, consists wholly in the questions which he puts. He preserves, from first to last, the simple character of the inquirer; and he *pronounces* only so far as he approves or rejects the answer given.

The popular opponents of this method called it a method of producing doubt; and regarded it as dangerous to the principles of the young. Plato carefully obviates such a misrepresentation of his proceeding, and guards his method from being confounded with that of the Sophists. The Sophists taught the art of exciting doubts on every subject; a mere effort of gladiatorial skill. They professed to make men apt to cavil and dispute on any given subject.[2] All principles, according to them, were equally stable; all were equally open to be impugned. They, therefore, did not care how they unsettled the minds of men, if their skill could only find materials on which to exercise itself. In Plato's hands, however, the awakening of doubt has for its object, to remove the unstable ground on which opinions may happen to be rested, and to lead to more settled convictions. With him it is exalted into a regular discipline of the mind. With the Sophists, it was perverted to strengthen that universal scepticism in which their whole teaching was based. So strictly does Plato confine the application of his method to the single purpose of investigating the truth, that he strongly objects to the use of it as a mere exercise of ingenuity; lest the young, led on by the pleasure of refuting and perplexing others, should think, at last, that there were no real distinctions of right and wrong.

Plato seems the more anxious to distinguish his method of inquiry from that of the Sophists, as his method did in some measure resemble theirs. It was inquisitive on every subject, as theirs was. It did superficially appear to be nothing but questioning, and doubting, and cavilling. It did appeal to the reason of every man, and oblige him to see how he could defend his opinions. And on this very ground Socrates had been attacked: for he was accused of corrupting the young, by making them "doubt," ἀπορειν ποιουντα.[3] Plato fully admits that this practice, as pursued by the Sophists, was dangerous to the principles of the young. In fact, he observes it would be even better to suffer them to remain under the guidance of some principles, which, though not true, served as restraints on their passions, than to remove everything from their minds, and leave no check whatever to licentious indulgence. By a beautiful illustration, he compares the effect produced by the sophistical method, to the case of a child brought up amidst wealth, and luxury, and high connections, and the society of flatterers, but in ignorance as to his real parentage. Suppose, he observes, such a person to come to know that those, whom he has hitherto believed to be his parents, are not so, and at the same time not to know who his real parents are. It is clear, that whilst in his state of ignorance concerning his supposed parents, he would respect and attend to them more than to his flatterers; but on finding out his mistake, unless he were of a superior character, such as is rarely met with, he would attend to his flatterers more than to those whom he once supposed to be his parents. So would it be, then, he shews, with one who should find out that the popular principles of morals in which he had been trained, were not the truth, without arriving, at the same time, at the real truth. He would no longer be controlled by those moral principles of which he had discovered the falsehood; but having nothing to substitute in their place, he would give way afterwards, without reserve, to the seductions of pleasures, the flatterers, whose blandishments he had before in some measure resisted.[4] In opposition to such a system of cavilling, Plato holds an even course between the scepticism which merely doubts about everything, and the dogmatism which pronounces on everything without examination.

The method by which he accomplishes his object, carried out to the fulness of a regular system and discipline of the mind, is, what he calls by a term conveying to a Greek ear its colloquial origin and application, DIALECTIC. As contrasted with the spurious method of the Sophists, or the method of contradicting on every subject, and involving the mind in endless perplexity, it was the true art of Discussion. As contrasted with the mere wisdom of opinion, δοξοσοφια, which the Sophists inculcated, it was philosophy, real science, or knowledge of the truth. The method of his philosophy, and his philosophy itself, thus run up into one, and coincide under the common name of Dialectic.[5]

To trace the manner in which this coincidence was effected, will lead us to a perception of the true character of Plato's philosophy, as a system mediating between the dogmatism of the sciolist on the one hand, and the scepticism of the disputant on the other.

The hypothesis, we observe, on which he founded the whole of his proceeding, was the fallaciousness of Opinion; the Sophists, on the contrary, assuming the truth of Opinion

[1] Ὥσπερ ἂν λεγοι ὅτι· Οὗτος ὑμῶν, ὦ ἄνθρωποι, σοφωτατος ἐστιν, ὅστις, ὥσπερ Σωκρατης, ἐγνωκεν, ὅτι οὐδενος ἄξιος ἐστι, τῃ ἀληθειᾳ, προς σοφιαν. (*Apolog. Soc.* p 53.)

[2] *Rep.* vii. p. 177.

[3] *Apolog.* p. 54; *Gorg.* p. 162; *Meno*, p. 347; *Polit.*; *Conv.*

[4] *Rep* vii. pp. 174–178

[5] Ἀλλα μην το γε διαλεκτικον οὐκ ἀλλῳ δωσεις, ὡς ἐγῳμαι, πλην τῳ καθαρῶς τε και δικαιως φιλοσοφουντι. (*Soph.* p. 275.) Ὁ μεν γαρ συνοπτικος διαλεκτικος· ὁ δε μη, οὐ. (*Rep.* vii. p. 173.)

universally. Whilst to the Sophists every opinion served as a ground of argument, and for them there was no need to look beyond the *apparent;* it was necessary for Plato, to seek for some Criterion of Truth out of the region of mere Opinion. Commencing with denying the sufficiency of what metaphysicians call Subjective truth, or the assumption that whatever is perceived by the mind is true, because it is so perceived; he had to search after Objective truth, truth independent of the mind of man, and exempt from the contingencies and variations of human judgment, as a foundation of his system of knowledge.

The hypothesis, accordingly, of the fallaciousness of Opinion from which his Method set out, involved a corresponding hypothesis in philosophy of the fallaciousness of the senses. It is the joint application of these two fundamental principles that combines his Method and his Philosophy in one master-science of DIALECTIC. Opinion, according to him, is the kind of knowledge derived from the information of the senses, and is therefore no proper knowledge at all, but mere belief or persuasion, πιστις; whereas true knowledge is founded on that which is purely apprehended by the intellect, without any intervention whatever of the senses. Dialectic, as it is Philosophy, is conversant about that which IS, or which has BEING, as contrasted with presentations to the senses, which have only the semblance of Being; as it is a Method, it investigates the reason, or account of the Being of everything;—the account of everything as it IS, and not as it APPEARS; not being satisfied, like its sophistical counterpart, with opinions of which no account can be given, but bringing all to the test of exact argument and definition.

In order, therefore, to give his Method a firm basis, and his Philosophy a distinct object, it was required, that he should establish a sound theory of Being, or, in other words, a sure Criterion of Truth. Such, then, was his celebrated Theory of IDEAS.

There are four distinct views embraced in this theory as it is developed by Plato; four phases, as it were, under which it is presented.

I. The first, and most strictly Platonic view of it, according to what we have already stated, is in its connection with logical science. None of the great philosophers before Plato; none, that is, of those who had speculated on the universe at large, as Thales, Pythagoras, Heraclitus, Parmenides, Anaxagoras, were conversant with logical science. Zeno the Eleatic, and Euclid of Megara, were known indeed as dialecticians. But the kind of logical science which they professed, was a rude and imperfect art, consisting chiefly in the knowledge and use of particular fallacies, and not founded in any deep study of the nature of thought and reasoning. They were, besides, mere dialecticians, rather than philosophers in the most extended sense of the term. Plato's mind, however, while it was engaged in logical studies, was also no less intent on the investigation of the first principles of all things. And, as has been often observed in other cases, the favourite study of his mind gave its complexion to his theory of first principles, or doctrine of Ideas.

The term "Idea" does not indeed convey to the understanding of a modern any notion of a connection of the theory with logical science. In our acceptation, it belongs exclusively to metaphysics. But in Plato's view there was no separation of the two branches of logic and metaphysics. Both were closely united in the one science to which he gave the name of Dialectic, and which was accordingly at once a science of the internal reason,—that is, of the processes of the mind in its silent speculation on things; and of the external reason,—that is, of the processes of the mind in communicating its speculations to others in words. The terms, therefore, belonging to the one process, are indiscriminately applied to the other. Thus, to "give a reason" of the being of a thing, διδοναι λογον τῆς οὐσιας, was equivalent to a scientific view of it; and the word λογος denoted at once the terms of language by which that reason was expressed, and the reason itself as it existed in the mind. Thus, too, the word ἰδεαι, or ideas, was only a little varied from the logical term εἰδη, or species, which indeed is sometimes substituted for it in the phraseology of Plato. The simplicity, accordingly, and invariableness, and universality, which belong to terms denoting the agreement of a variety of objects in certain characteristics, were transferred to supposed counterparts in the mind itself, or to the notions represented by the terms which are the name of the species. Hence the idea, or *eidos*, was conceived to be, not simply a result of a process of the mind, but something *in* the mind, and as having a being independent of the mind itself. As the species expressed in words was universal, so its counterpart in the mind was the universal nature in which the individuals to which it referred, participated. In that, the mind, perplexed by the variety and anomaly of individual objects, found an invariable sameness. In the contemplation of it, the mind no longer wavered and doubted, but obtained a fixedness of view. The idea, or species, therefore, was to be explored and reached in order to a just theory of everything, and was in itself that theory.

Further, as there is a relative classification of objects by means of words; some standing for characteristics common to a greater number of objects, whilst others stand for characteristics of only some out of that number; this property of words was in like manner conceived to have its counterpart in the mind. A graduated series of species was supposed to exist, first in the mind, and then independent of the mind, by means of which, as by steps, the mind might rise to the highest species, the ultimate idea itself, in which all others were comprehended. And hence there was no real perfect science but that which penetrated to this ultimate nature or being; and all other ideas, or theories, were truly scientific only as they participated in this.

This notion of "participation" of the ideas, was a still further application of logical language to the business of philosophy in general. For, as the several particulars belonging to a species all possess those characteristics which constitute their species, as well as those which connect them with a higher species or genus of which they are the species, their logical description is made up of an enumeration of those characteristics, together with the name of the higher class or genus under which the whole species is included. The higher class is an ingredient in the specification of a lower; or, conversely, a lower class participates in a higher. So Plato considered everything in the universe, as being what it is, by a "participation" of the Ideas; and consequently, that to explore its nature we must ascertain the idea which thus constitutes it. The Pythagoreans before him spoke of things as existing by "assimilation" to the essential being. Plato's logical views occasioned this change of phraseology; for he varied only the term, as Aristotle observes, whilst he followed the Pythagoreans as masters in the fundamental conception of his theory.[1] Aristotle, indeed, whilst he assigns the logical studies of Plato as the occasion of the form of the ideal theory, more particularly accounts for the theory, from Plato's observation of the importance of Definitions in the ethical discussions of Socrates. Plato found how effectual an instrument Definition had been in the hands of Socrates in silencing the impertinencies of false opinion on moral subjects. As it had brought moral questions to an issue, so it might be applied, he thought, generally, as a stay to the extravagancies of opinion on all subjects whatever. Accordingly he had only to generalize the principle of definitions, and the result was the theory of

Plato's Writings and Philosophy.

[1] Aristot. *Metaph.* i. 6.

Plato's Writings and Philosophy.

Ideas, or the universal science of reasons, and the ultimate criterion of all truth.

To understand, however, rightly how Plato was led by logical considerations to his theory of Ideas, we should observe more particularly what his view was of the nature of logic. We should greatly misapprehend him if we supposed that he had that notion of the science which has prevailed since the systematic exposition of it by Aristotle. As it was conceived by Plato, it answered strictly to its original name of Dialectic, rather than to that of Logic; being the art of discussion, or the art of drawing forth the truth from the mind by questioning, rather than the art of deducing consequences from given principles. It was a higher, more comprehensive science, than the art of Deduction. For it was conversant about the discovery and establishment of principles; whereas the logical science which is employed about Deduction, assumes the principles in order to speculate about their consequences. It left the latter inquiry to be pursued by subsequent research, whilst the more ambitious flight of those who first speculated on the nature of Discourse was directed to the discovery of truth. In Plato's hands it was an energetic reform of the quibbling shallow logic, which was as yet known and practised in the schools. This logic had no concern for truth, but only for victory and display. It consisted in a skill of wielding certain sophisms, known by familiar names in the schools, and founded on the equivocations of words. An appearance of truth being all that it aimed at, it did not exact of the student any consideration of the nature of things. It was enough that he could give the word reason, the mere logos, the symbol or counter. He was not taught to go beyond this legerdemain of language, or to search out the reason of the being of things, and correct the paralogisms involved in the use of words, by reference to the realities represented by them. This sophistical method affected indeed to be a didactic art; to instruct and furnish the mind with principles applicable to every subject of discussion. It considered, forsooth, language as an universal science of nature already constructed; and, proceeding on this supposition, professed to enable the student to apply the wisdom already embodied in language, to the purpose of appearing wise himself, and imparting to others the same apparent wisdom. But going no further than this, it ended in mere δοξα, mere opinion. It produced, that is, in the result, only a wavering state of mind, subject to be changed by every new impression of opposite arguments, and, after all, imparted no steady knowledge.

It was a great reform, then, which Plato undertook, in following up the example proposed in the conversations of Socrates, and instituting a proper science of Dialectic, a science of the reason of the being of things. It was a change from an empirical system, a vain art of words, to a scientific method or investigation of the reasons themselves, on which an instructive use of words must be founded.

For, we must observe, it was still a science of words which he teaches as the true Logic or Dialectic. It had throughout a reference to discussion. Still it was a real science as compared with the verbal and technical logic of his predecessors. Though it was a science of words, it had for its object the determination of such words as should fully correspond to their intention as symbols, in characterizing and denoting the proper being of the thing signified. These reasons of the being of things, the λογοι της ουσιας, were the Ideas.

His logical method, accordingly, was an analytical, inductive method. Setting out on the assumption of the erroneousness of opinion as such, it examines hypothesis after hypothesis on each subject proposed for discussion, rejecting and excluding, as it proceeds, everything irrelevant. The scrutiny instituted consists in searching for the grounds of contradiction with regard to each opinion, and shewing that opposite views on point after point in the matter discussed, are at least as tenable as the assumptions contained in the given opinion or hypothesis. Hence it consists almost entirely of refutation, or what both he and Aristotle denominate *elenchus*, a process of reasoning by which the contradictory of a given conclusion is inferred.

A method of this kind was calculated fully to put to the test every unsound opinion. It collected everything that could be said either for or against a given opinion. It made the maintainer of it state on what grounds he maintained it, what consequences followed from it; and either forced him to self-contradiction in his defence of it, or obliged him to modify it according to the requisitions of the argument. And the result was, that whatever stood its ground after this complete sifting of the question, might be regarded as stable truth. When refutation had done its utmost, and all the points of difficulty and objection had been fully brought out, the dialectical process had accomplished its purpose; and the affirmative which remained after this discussion might be regarded as setting forth the truth of the question under consideration. For everything connected with it, and yet not founded in the truth of things, was then removed. And the result therefore might be accepted as a simple truth of being, an object which the eye of the intellect might steadily contemplate, and therefore matter of Science.

The process throughout corresponds with the process of investigation in modern philosophy. Only we must conceive the dialectical investigation of Plato as nothing more than an admirable scheme for clearing a question of everything foreign to it; whilst the latter draws out the true law of nature from the promiscuous assemblage of phenomena under which it is presented to observation, and lies concealed until analysis has done its work on the mass. The nomenclature of the two methods varies accordingly. Argument is the instrument of the former; experiment that of the latter. Refutation is the primary business of the former; rejection and exclusion of irrelevant phenomena that of the latter. Definitions of words, as they are signs of the being of things, are the result of the former; whilst the latter develops laws of nature.

Both processes are carried on by Interrogation. But whereas the analysis which investigates a law of nature proceeds by interrogation of nature, the analysis of Plato's dialectic proceeds by interrogation of the mind, in order to discover the true being or "idea" of the thing discussed. Therefore it was that Socrates called his art, in his own playful manner, μαιευμα, a kind of midwifery;[1] a delivering of the mind of the notions with which it was pregnant. Thus the dialectic of Plato, being entirely directed to observation on the mind, and not to external nature, takes the state of knowledge as it exists in the mind for the ground of its proceeding. It deals with things; that is, as they exist in the forms of thought; going, as Plato says, "from species to species, until it arrives at the principle of all things,"[2] and following throughout the steps by which the mind advances in obtaining an exact view of any object of its contemplation. It is, in fact, the true thought spoken out. The process of thinking by which it is attained, is the dialectical process of interrogation. The decision of the mind when its conviction is settled, is the dialectical conclusion.[3]

The chief logical instrument employed in this method is Division. The being able to divide according to genera, and not to consider the same species as different, nor a different one as the same, is stated to belong especially to dialectical science.[4] In searching out the true definition of the being of a thing, this portion of the internal process of

[1] *Theætet.*

[2] *Rep.* vi. p. 124.

[3] *Theætet.* p. 151.

[4] *Soph.* p. 274.

Plato's Writings and Philosophy.

the mind would naturally strike the attention. General ideas being founded on general resemblances of objects, the first step towards a more distinct idea of an object is to see that the generalization is complete; that it neither excludes nor includes any objects which it ought not to exclude or include. The true idea of any object would be that which characterized every object belonging to the idea, and none other. The analysis accordingly pursued by Plato is conversant about Division, using the induction of particulars in subordination to this.[1] We find, indeed, a constant use of Induction by Plato, after the manner of Socrates. But it is always in reference to the main purpose of determining, not a general fact, but the dominant Idea in every object of thought.

At the same time, we may observe, the Dialectic of Plato is truly a method of investigation, though it does not penetrate to the depth of the modern analysis. It employed deductive reasonings; but these were not essential parts of its method; since the whole was a process of ascent to the theory of the Ideas.

Afterwards, indeed, Dialectic approximated to what is now commonly understood by Logic. The transition was first to the consideration of it as a method of drawing out the probable conclusions deducible from given premises. This was natural. For in Plato's method every opinion was admitted as an hypothesis to be examined, in order to rejecting the falsehood and eliciting the truth that might be contained in it; and so far his Dialectic might be regarded as a speculation on probabilities. This transition prepared the way for a further one, when Dialectic became strictly the science of Deduction. Attention would be drawn more and more to the use of words as instruments of reasoning, when Dialectic was once exalted into the rank of a science.

The progress seems to be this. The science being cultivated primarily with a view to discussion, the importance of language in order to reasoning could not fail, from the first direction of the mind in this channel, to strike the philosophical observer. The phenomena of sophistical argument would suggest the necessity of inquiry into words as they are employed in reasoning. Philosophers, accordingly, would be led to examine into the nature of words considered as signs and representatives of thought. Thus they would proceed to arrange words into classes, according to their import in this respect. Thus would be obtained that great division of words into those that denote an individual alone, and those that stand both for many and for one, or into singular and common;—the fundamental principle of logic properly so called, or of logic as the science is now considered. The use of Division and Definition would soon appear. These processes, indeed, would be naturally discovered in the very prosecution of discussions addressed to the refutation of false opinions and popular fallacies. The early dialectics, accordingly, abounded in the use of them.[2] Afterwards, as the analytical power of language came to be more particularly observed, the connections of words in propositions and arguments would attract speculation. The possibility of exhibiting any given proposition or argument under abstract formulæ, in which unmeaning symbols were substituted for the terms themselves of the proposition or argument, would at length be discovered. Thus in the result would be erected a formal science of logic, in which language would be considered as an artificial system of signs, and the validity of arguments would be explored in their abstract forms, independently of the subject-matter about which they happen to be conversant.

When Plato, however, drew his Theory of Ideas from the logical speculations in which his mind was engaged, there was no such system as that now found in treatises of logic. There are the materials in the writings of Plato for constructing a method of dialectic, such as the science presented itself to his view; but that method remains, even to this day, to be fully explored and stated. It is clear that he had such a system, and that his writings proceed on regular method; though he has nowhere accurately sketched it, and perhaps never even proposed it to himself in the form of a system. His thoughts were engaged in this, as in other subjects, in giving the great outlines of his philosophy. It was enough for him to have seized the bearings of logical truth on all truth; and to this general view of the science he has made everything secondary and subservient.

II. The next aspect under which the Theory of Ideas should be considered, is that in which it sums up and measures the infinites of the sensible world. In this point of view, it more immediately represented its Pythagorean prototype, than under its logical aspect. It is in reference to this intention of the theory that Aristotle objects, that whilst it professes to give the account of things, it introduces an additional number of objects in the Ideas themselves; an absurdity, he observes, like that of attempting to facilitate a calculation by adding to the numbers to be calculated.[3] It was, accordingly, an endeavour to reckon up the individuals of the universe, and exhibit their sum in one statement. As Plato's logical speculations gave their colour to his whole philosophy, so the devotion of the Pythagoreans to mathematics led them to form a mathematical theory of the universe. The universal nature of Number gave them the ground for this application of their peculiar studies. For all things are in number; and there is nothing from which the notion of number may not be abstracted. That number, then, which alone measures all other numbers,—Unity,—would be regarded as the common measure of all things. And thus the philosophy of the universe would be reduced to a system of calculation; and the infinity of existing things summed up in definite proportions of numbers. The Greek word *logos*, whilst it combined in it the notions of "word" and "reason," also further combined that of "ratio," and reasoning and calculating were expressed by the one term λογιζεσθαι. This marks the connected trains of thought by which the arithmetical theory of the Pythagoreans was formed. The effects of this combination of thought are seen, not only in the fundamental conception of the theory, but in our ordinary phraseology on the subject of reasoning even at this day; as, for example, in our use of the word "Term,"—that is, "limit," or "boundary,"—for words, not only in their logical signification, but even in their familiar use.[4]

It appears to have struck the mind of Plato that the theory of the Pythagoreans was not sufficiently comprehensive, or even ultimate, as an account of the Being of things. The simplicity of Number did not adequately explain the great variety of natures found in the universe; and though the science of Arithmetic held almost the highest place in his scale of knowledge, on account of its ab-

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[1] Πολυ δε μαλιστα και πρωτον την μεθοδον ταυτην τιμᾷν, τοῦ κατ᾽ ειδη δυνατον εἶναι διαιρειν. (*Polit.* p. 66.)

[2] Τουτων δη εγωγε αὐτος τε ἐραστης, ὦ Φαιδρε, τῶν διαιρεσεων και συναγωγων, ἱν᾽ οἱοστε ὦ λεγειν τε και φρονεῖν· ἐαν τε τινα ἄλλον ἡγησωμαι δυνατον εἰς ἑν και ἐπι πολλα πεφυκοτα ὁρᾷν, τοῦτον διωκω, κατοπισθε μετ᾽ ἰχνιον ὡστε θεοῖο· και μεντοι και τους δυναμενους αὐτο δρᾷν, εἰ μεν ὀρθως ἡ μη προσαγορευω, θεος οἶδε· καλῶ δε οὖν μεχρι τουδε διαλεκτικους. (*Phædr.* pp. 362, 363.) Plato appears to have been the author of a work "On Divisions," not now extant.

[3] Ὡσπερ εἴ τις ἀριθμῆσαι βουλομενος, ἐλαττονων μεν ὀντων, οἰοιτο μη δυνησεσθαι, πλειω δε ποιησας ἀριθμοιη. (Aristot. *Metaph.* i. 7.)

[4] Hobbes uses the mathematical phraseology throughout. Reasoning, with him, is "reckoning," and words are "counters." (*Leviathan*, i. 4, *et alib.*

Plato's Writings and Philosophy.

stract nature, and its leading to the consideration of Being, apart from the changeable objects of sense; he still viewed it as practically implicated with the physical sciences, and, as such, therefore, not strictly and exclusively conversant about Being. In like manner, the science of Geometry, though purer than the physical sciences, as being conversant only about abstract magnitudes, is excluded from the highest place. Geometry, no less than Arithmetic, might seem to be simply an intellectual contemplation; since, though it employs visible figures in its demonstrations, the demonstrations do not properly refer to these, but to the abstract notions which the diagrams represent. Yet Geometry, as it assumes its principles, and its truths consequently depend on assumptions which in themselves demand evidence, cannot, he observes, rank as a science of perfect intelligence.

Perfect intelligence, *νοησις*, implies an absolute stay to the thought; something beyond which no further inquiry can be made, which may be seen as it were by the mind's eye immediately in itself. And such an object only is furnished by the Idea. Though, accordingly, Plato thus carried his theory beyond that of the Pythagoreans, we find him still cherishing the Pythagorean doctrine of Number, by assigning to it the second place in his scale of knowledge, and only barely distinguishing it, in regard to scientific value, from his own Theory of Ideas.[1]

When we come indeed to look more closely into his theory, the mathematical approximation will distinctly appear. The ideas are the finite, applied to the infinite of the sensible world, and thus producing measure and proportion in the universe.[2] The physical sciences, as, for example, astronomy and music, are not truly scientific, because, addressing themselves to what is passing before the senses in the world, they do not consider the immoveable beings themselves, which are only imperfectly represented in the observed physical movements. The astronomer computes the actual velocities of the heavenly bodies; the musician counts the intervals of sounds. But neither of these is intent on the real beings, the Ideas themselves of velocity and of harmony. We can discern in such language as this, a mathematical basis of thought. Perpetual variations, as contemplated in their inconstancy, admit of no calculation. To estimate them, we must find the limit to which they continually approximate, and we thus, as it were, reduce to fixed order the apparent disorder and irregularity, and see the variable in its ultimate form of invariableness. This notion is not fully developed by Plato. But it is conveyed in his doctrine of a twofold class of sciences, under the same names; a popular astronomy, for example, and an higher astronomy; a popular music, and an higher music; the latter of which are sciences of the invariable and the finite, and run up into his Theory of Ideas.[3]

III. The third phasis of the Theory is that in which it is a philosophy of Being, in opposition to the mere knowledge of sensible phenomena. According to the school of Heraclitus, the sensible world was ever flowing, ever in a state of "becoming" or incipiency; being a mere development of successive phenomena, displacing each other without cessation. As duration is no positive existence as a whole, but is made up of an infinite number of moments, each of which is gone as the succeeding moment appears; so was it asserted generally in the doctrine of that school, that every object in the universe was a mere collection of successive phenomena. Of nothing could it be affirmed that it IS. The very sensations, no less than the objects of them, were in constant production; being the momentary, ever-varying results of the concourse of agent and patient. Colour, for example, as the object, and sight of the colour in the eye as the sensation, are momentary relations simultaneously produced by something that acts in the coloured object, at the moment, on something that receives the impression in the eye.[4] This doctrine resolved all knowledge into sensation, and (which was equivalent to this) made "man the measure of all things," according to the celebrated enunciation of Protagoras.

Plato saw that, if these views were admitted as an account of the universe, his whole dialectic must fall to the ground. It would be nothing but miserable trifling to try to call forth those reasons of things which he conceived to be in the mind, if knowledge were of this fluctuating character.[5] There could not, in fact, be then any such reasons. There was nothing stable, nothing that remained in the mind, to serve as the standing criterion of true and false opinions. There would be no distinguishing whether all that passed in life were not a dream, or whether the occurrences in dreams were not rather the realities.[6] Some sure criterion was therefore wanted, to which the phenomena of sensation might be referred. The theory of Ideas, as a theory of Being, furnished this.

Plato admitted, accordingly, the perpetual flux of sensations and their objects, as taught by Heraclitus, whilst he refuted the sophistical extravagancies into which the doctrine had been carried. Granting, therefore, that there was no test of truth or falsehood in the sensations themselves, he points out, that the ground of fallaciousness is in the judgments formed by the mind concerning the impressions of the senses. The soul is endued with a common power of perception, to which the reports of the different senses are referred, and by means of which the mind is enabled to compare past and present sensations of the same kind, as also different sensations with one another. It is in the conclusions then formed on these comparisons that we are to seek for knowledge; or in the purely mental processes, abandoning altogether the mere informations of sense.[7]

He was led, accordingly, to examine these processes of the mind, in order to discover the grounds of truth and knowledge. He observed, that when the mind compares two sensations, and decides on their similarity or difference, there is always some ground on which that judgment is made. When, for instance, it decides on the equality of two things, there is a standard to which they are referred, the general notion of equality itself, which serves as a middle term for testing the equality of the two things compared. In like manner, there is always, whenever a comparison is made by the mind, some general principle, which is the medium of the comparison. And this is a principle not in any way produced by the sensations; for it is evidently prior to them, and independent of them; being appealed to by the mind as a criterion of them. This general principle, then, is in every instance the Idea; and not being formed by the sensations, it is not subject to their variableness. It remains unmoved, and the same, amidst the flow of the sensations, or of the objects of the sensations;—the standing criterion of all the judgments of the mind to which it applies.[8]

Hence we may see the peculiar meaning of the term "Idea" in Plato's philosophy. It consists in its contrast with the objects of sensation. The latter never attain to any definite perfect form—to any clear outline, as it were, to

[1] *Rep.* vi. *ad fin.* The importance assigned to arithmetic in the early philosophy, is shewn in that line of Æschylus: Και μην ἀριθμον ἐξοχον σοφισματων, ἐξευρον αὐτοις. (Prom. 459.)

[2] *Phileb.* pp. 234–240.

[3] Ὡς εἰσι δυο ἀριθμητικαι, και ταυταις ἀλλαι δυο τοιαῦται ξυνεπομεναι συχναι, την διδυμοτητα ἐχουσαι ταυτην, ὀνοματος ἑνος κεκοινωνηκυιαι. (*Phileb.* p. 303; also *Rep.* vi.)

[4] *Theætet.*

[5] *Ibid.* p. 90.

[6] *Ibid.* p. 82.

[7] *Ibid.* pp. 139–144.

[8] *Phædo*, pp. 170, 230–236; *Rep.* vii. pp. 145–147; *Theætet.*

Plato's Writings and Philosophy.

the eye. They flow and have vanished before they could attain to such form; since, in the very succeeding one another, they not only pass away, but undergo alteration. But the standard to which they are referred in the mind, is a positive defined shape, or form, or species, simple and uniform, analogous to an object of sight of which we can clearly trace the whole outline by the eye.[1] For the like reason, the term *exemplar*, παράδειγμα, is also applied to denote the Idea. As the one perfect standard to which all the reports of the senses are referred, it appears in the light of a pattern, to which they would be conformed, but for that incessant mutability which necessarily belongs to them. This, however, was rather the Pythagorean view of general principles than the Platonic, though Plato himself not unfrequently recurs to it.

Plato, at the same time, in thus constituting Ideas the sole absolute criteria of real existence, did not intend to deny all reality whatever to conclusions drawn from our sensible experience, such as those of the physical sciences. But he means, in the first place, to shew the delusive character of all informations of sense which are not corrected by the internal reason of the mind. In the next place, his design is to point out the inferior knowledge which every other kind of evidence conveys, but that which is drawn from the intuitive perceptions of the mind. The informations of sense, he teaches, are only a knowledge of semblances or idols, εἰκασία, conjecture founded on mere images of the truth. He describes this kind of knowledge by an admirable illustration from a supposed case of men placed in a long cavern, with their bodies so chained from infancy, that they can only look before them, whilst the light of a fire from behind casts on the side opposite to them, the shadows of vessels, and statues of stone and wood, carried along a track leading upwards from the cavern by persons who are themselves concealed by a wall, like the exhibitors of puppets. As men so circumstanced would see nothing of themselves, and of each other, or of the things thus carried along, but the shadows, they would mistake the shadows for the realities; they would speak of the shadows as if these were the things; and if any voice was heard from the persons carrying along the figures, they would think the sounds proceeded from the passing shadow.[2] Just like this, he declares, is the influence of education in the lower world of sense on the minds of men. They must be carried up from this cavern, in which they see everything only by an artificial light, to the light of the sun itself, to the region of Ideas, where alone objects are seen as they are in themselves.

As to the knowledge conveyed by the physical sciences, neither is this properly Science. It amounts only, as he states it, to belief or opinion. These are less intellectual than the mathematical sciences, because they are conversant about human opinions and desires, or about the production and composition of things, or about the means of sustaining things produced and compounded.[3] They are therefore as unstable as the things about which they are. But they are still not devoid of evidence, so far as they collect the real informations of the senses, and do not learn from mere shadows. This is implied in his calling such knowledge belief, and distinguishing it from conjecture; though he is rigid in preserving the exclusive prerogative of Truth to the knowledge of the Ideas.

The evidence of Experience was necessarily slighted in such a philosophy, and condemned as insufficient for the discovery of truth. For what is Experience but the memory of several similar previous informations of sense, combined into one general conclusion? And though Aristotle allows that such a general conclusion, in which the mind acquiesces, might be regarded as scientific,[4] this could not be admitted by a philosopher who placed the objects of sensation out of the pale of Being. It was not enough for Plato's system to answer in favour of the scientific value of Experience, that though this and that particular instance of an information of sense had no immoveable truth in it, yet, from the observation of a number of similar instances, a general uniformity might be inferred, and an immoveable general principle established. He would grant that generalization was a corrective of experience. For this he did when he granted some importance to the arts in education, and for the purposes of life. But truth with him must be *universal*, not simply general: it must be that which is always the same, not simply that which is only for the most part. And the highest degree of the evidence of experience, even that which amounts to what is called moral certainty, falls short of this absolute universality. It might be urged, for example, that though what was sweet to one person and at one time, might be bitter to another person and at another time; and though what seemed the same sensation of sweet, was not in fact the same at two successive moments, but a reproduction; still it was possible, by combining recollections of many similar instances, to form a general notion which should adequately characterize that sensation. Still Plato would say, this was only belief or opinion, and not science. The object of science must be such as cannot be otherwise: it must be absolutely one and the same permanent being: you must altogether quit the stream of the world of sense, and land on the rock of unchangeable eternal Being.

Thus Rhetoric is strongly reprobated by Plato, on the very ground on which it is systematically taught by Aristotle, of its being nothing more than an instrument of persuasion, or an art speculating on the means of persuasion. Much of his invective indeed derives its point from its application to the servile rhetoricians of his day. Still we find him condemning Rhetoric on the abstract ground of its having no higher view than persuasion. In the modern view of the subject, as in Aristotle's, Rhetoric is a real science, so far as it is framed on just conclusions respecting those modes of speaking, or writing, which excite interest and produce conviction. With Plato it is mere quackery; and for this reason, that it is founded on experience of what persuades, being only an ἐμπειρία or τριβή, a knack acquired by experience and converse with the world; an accomplishment, learned by practice, without any real knowledge, in flattering the passions of men. He in fact regarded Experience as corresponding with what we call empiricism; contrasting it with the conclusions of abstract reason, as we contrast an illiterate and unscientific use of experience with that of the philosopher.[5]

Looking to that sort of Experience on which the popular teaching of the Sophists was founded, Plato, we should say, was fully justified in his condemnation of the experimental method of his day. It was in truth mere quackery. It was content with shadows and images of the truth, and entirely directed to *producing* a desired effect, without caring for the absolute truth;—a shallow philosophy of sensation, not founded in the nature of things. He had thus to contend against a system, which distorted that criterion of truth, which man has in himself, by the right use of his reason conjointly with his experience, to the undermining of all truth and reality. This empirical system was the crying evil of those times.

[1] Hanc illi ideam appellabant, jam a Platone ita nominatam; nos recte speciem possumus dicere. (Cicer. *Acad. Qu.* i. 8.) Formæ sunt, quas Græci ἰδέας vocant, &c. (Cicer. *Topic.* 7.)

[2] *Rep.* vii. *ad init.*

[3] *Ibid.* p. 165.

[4] Ἐκ δ' ἐμπειρίας ἢ ἐκ παντὸς ἠρεμήσαντος τοῦ καθόλου ἐν τῇ ψυχῇ, τοῦ ἑνὸς παρὰ τὰ πολλά, ὃ ἂν ἐν ἅπασιν ἓν ἐνῇ ἐκείνοις τὸ αὐτό, τέχνης ἀρχὴ καὶ ἐπιστήμης· ἐὰν μὲν περὶ γένεσιν τέχνης· ἐὰν δὲ περὶ τὸ ὄν, ἐπιστήμης. (Aristot. *Analyt.* part ii. c. *ult.*)

[5] Gorgias, p. 117, *et seq.*; *Phædr.*

Plato's Writings and Philosophy.

It had infected politics, and education, and private intercourse, as well as philosophy. In opposition to it, he had to take up an antithetical position; to call in question the existing acceptation and use of the human criterion of truth; to limit it within its proper bounds, and guard against its perversion. Accordingly the whole stress of his philosophy is on this point. It is a perpetual polemic against the sophistical principle, that "man is the measure of all things."[1] This amply accounts for his disparaging so much as he does, the scientific value of Experience, and insisting on the necessity of the existence of higher principles than those of Experience, in order that the mind may duly receive and appreciate the information of sense. He taught men, at any rate, to perceive that the popular notion of that evidence of truth which man has in his own nature was false and deceptive, and that in all judgments and reasonings there is also something more than is merely of man.

IV. The fourth leading point of view under which the Theory of Ideas remains to be considered, is its aspect as it is a theory of the Cause of the universe. Under this aspect it is identified with the speculation into the Chief Good. Here it is an account at once of the first principle of motion, and of the end to which all things tend as their perfection and ultimate good. According to Plato, there was no other cause worthy of the name, or which really accounted for the phenomena of the universe, but "The Good," or, as it is technically called, the Final Cause. The early speculations of philosophers had been chiefly directed to the material phenomena of the universe, and had attempted to account for them in a rude manner, by referring them to some one or more of the material elements. Some indeed had introduced also moral influences into their theory. The Pythagoreans combined with their speculation of the mysterious Unity, the notion of Love as the one-making principle. The Ionic school, however, appears to have led the opinion of philosophers in regard to the cause of the universe at the time of Plato. And though Anaxagoras asserted the ascendancy of Mind, he had lost sight of his great theory in the explanations from material causes, to which he descended in the completion of his system. Socrates began a strenuous opposition to the physical philosophers. Plato carried on that opposition, and, blending the familiar ethics of Socrates with the moral and theological mysticism of the Pythagoreans, established the Final Cause or theory of "the Good," as supreme over the domain of science.

Anaxagoras had certainly prepared the way for the theory. Plato took up his doctrine of a Divine Intelligence, and gave it that development which, as it had been taught by Anaxagoras himself, it yet waited to receive. It was but a vain theory of a Supreme Mind (sublime and important as the simple enunciation of the great truth was), which did not also exhibit the Supreme Mind as operating in the universe by design, and as diffusing the energy of its intelligence and goodness, as well as of its power, throughout its operations.

The Supreme Mind, therefore, according to Plato, must be conceived, as exemplifying the attributes of its own nature in the works which have proceeded from it. If it be granted that there is a Supreme Mind, that must be the true measure of all things in the universe. All things must have been framed according to the scheme which such a mind would contemplate in their production. As intelligence, it cannot be regarded but as working for some object, ἕνεκα του; for by this is intelligence distinguished from unintelligent force; and the only object to the Supreme Intelligence is the most perfect nature, which is itself. The pattern of its own perfections, therefore, must have been present to it, and in its design, in the construction of the universe. In other words, the Deity himself is not only the author of all things, but he has designed to exemplify in them his own attributes. The principle, accordingly, by which all true philosophy must hold, and which it must carry out into its speculations, is, that "God is the measure of all things."[2] And hence, whenever the proper being of any thing is to be explored, it must be studied in that light in which it is seen as a work of the Supreme Mind, designed after the pattern of the Divine perfections. In such a contemplation, the theory of the Best is the view by which philosophy must be guided; for, in Ancient Philosophy, an object of intelligent aim, and good, are equivalent terms. The object at which the most perfect Intelligence aims, must be, therefore, that which is best; and in tracing out, accordingly, the workings of the Divine Mind in the world, we must look for "the best" in everything. That notion of everything by which it is "best," is both its real nature, and the cause of its being produced.

But why is not everything, as it is actually seen, a work of "the best?" why is not good visibly impressed on everything as it stands forth to the view? why must we, in short, resort to the Idea of good, in order to ascertain its nature, instead of taking it simply as it appears?

The antagonist force of unreason in the nature of that which has body, and is apprehended by the senses, occasions all the imperfection and evil in the world, as the world actually exists. It subsisted already in the mass of disorder and confusion which the Divine Intelligence, by its operation, had brought into order and regularity of motion; and it still subsists, though reduced into subordination to intelligence. It is overruled so as to minister to the designs of mind, but still impedes by its contrariety of nature the development of good in the world. And thus Plato says that it is impossible for evils to perish out of the world, for that there must ever exist a contrariety to good.[3] Evil pre-existed, and evil accordingly must be displaced by the presence of good; as contraries are displaced by contraries; and as all generation, or production, is carried on by a process from contrary to contrary. Thus, though evil retires before good in the world of generated things, evil still manifests itself in the very act of its retiring before good; and a perpetual opposition of good and evil remains. What we see, accordingly, in the world, is not the perfect accomplishment of good, but effort and tendency after good in all things. The effects of a struggle between reason and unreason are manifested, on the one hand, in the evanescent imperfect nature of all sensible things; and, on the other hand, in their constant renewing, or in that undying vigour with which they flow on, and are reproduced, and aim at a perfection beyond themselves.[4]

Though, therefore, the Divine Artificer has designed everything in the world for the best, they are not actually the best as they are presented to our senses. They are the best that such things can be, but they do not attain to the Idea of good, according to which they have been made. Time, for example, only imperfectly represents the divine eternity, which is its true Idea. In eternity there is no distinction of past, present, and future. But the bodily nature of things will not admit of this co-instantaneous development of the divine Idea. Existence is here broken up into successive moments; and these successive moments, marked by the periodic motions of the heavenly bodies, introduce the distinctions of number into the simple idea of duration.[5] Again, the velocities of the heavenly bodies, which are observed by the astronomer, must be conceived as very in-

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1 Παντων χρηματων μετρον ἀνθρωπος. (*Theætet.*; *De Leg.* iv.)

2 *De Leg.* iv.

3 Ἀπολεσθαι τα κακα, ἀδυνατον· ὑπεναντιον γαρ, κ. τ. λ. (*De Leg.* iv.)

4 *Timæus*; *Polit.* p. 30.

5 *Timæus*.

Plato's Writings and Philosophy.

adequate representatives of the "real velocities performed in the true number and true figures,"[1] which are the "Ideas' after which they have been established. Or, again, it is clear that the ideas of the good, and the just, and the honourable, and the beautiful, as they are seen in the world around us, are only imperfectly developed. Our thoughts are distracted by the contemplation of them in the world, by the multiplicity of forms under which they are apprehended by men, and it seems to the superficial glance as if there were no one perfect standard of each. At the same time, we are able to trace evident signs of such a standard, when we look thoughtfully at the course of things. We cannot doubt, on such examination, that these principles exist, and are working their way, and that the universe has been constructed after the pattern of them. But all that the most attentive study will disclose to us as actually observed, is *tendency* towards these principles—a "becoming" or incipiency of being.[2] We do not see their full effect, or what would be their effect, if the world were such as to give them free scope and exercise, and if the impressions of sense did not diversify and obscure the presentations of them to our minds. Must we not say, then, that if we formed our notions of these principles from the visible world, and the impressions of sense, that we must estimate them improperly? And must we not rather elevate our minds to the Ideas themselves, after which the universe has been constituted in its present order, and take our measures of them from the Divine Being, whose goodness, and truth, and beauty, they represent?

Thus did the Theory of Ideas serve as a moral explanation of the course of nature, and meet the demand of philosophy, by removing the perplexity of the mind on the contemplation of the apparent disorder of the world, and giving a firm stay to the thought in this direction. This apparent disorder has been the constant appeal of the atheist and the sceptic in all ages. And in Plato's time there was need, we find from several passages of his writings, of an answer on the part of philosophy to speculative objections on this ground. The Theory of Ideas supplied this answer. By the theory of a perfect model of good, imperfectly wrought out in the visible universe, the existence of evil was accounted for in some degree, and the eye of thought was enabled to see a chain of goodness, and beauty, and order, binding together the most untoward appearances of the moral world. As the Pythagoreans enchained these disjointed portions of the moral fabric, by supposing a fundamental Unity pervading the whole, and reducing the multiple and the unlimited to definite proportion—a sort of key-note, modulating the apparent discords of nature[3]—so Plato made the one moral good the all-pervading moderator of the system of the universe. The abstract notions, the genera, and the species, and the definitions, which dialectical science brought out by the aid of language, presented the materials for extending the moral view to other notions besides those strictly moral; and thus a theological and moral complexion was spread over the whole region of philosophy.

Ideas of evil were evidently excluded. "The good" could not be the cause of all things, but only of those that were well constituted; of evils it was causeless.[4] Evil, as we have seen, had no exemplar or pattern in the nature of the Author of the universe. It was a condition of that bodily nature on which the good was actively displayed. Evil arose from the nature of the "diverse"[5] inherent in body; that nature in body by which it was contradistinguished from the "sameness" belonging to the Ideas.

In considering the Theory of Ideas under the different aspects which it presents, we have in fact taken a summary view of the whole of Plato's philosophy. This theory is the cardinal principle of the whole. The speculations on particular branches of philosophy are all included in this one theory, which binds them together and explains them. For when the mind had once risen to the contemplation of the Ideas, it needed no further helps from observation or study of nature to understand all knowledge. The mind was then in possession of the only true principles of knowledge; and to enter into the consideration of material and sensible phenomena, was only to return to the darkness and the dreams from which the eye of the intellect had been purified,—to quit the light of the sun for the cavern of shadows.

Accordingly, all his writings are devoted to the establishment of this theory. Proceeding on that notion of the importance of the theory which he inculcates, he bends every thought to this one point. No one science is set forth by him in detail; no one subject obtains with him a full and explicit consideration. All is resolved into its most abstract and general view, that the mind may be led to see the common principles of all truth; so intent is he throughout on his theory of Ideas, whatever may be his immediate subject of discussion. He assumes hypotheses, and examines them, and refutes them, in the way of argument, without pronouncing on either side of a particular question, as if indifferent about the establishment of any mere opinion, and desirous only of clearing his way for the perception of his theory.

But to place that theory in its full light, we should advert to the theories of Knowledge and of the Soul, which are intimately connected with it. These theories contain his account of the origin of the Ideas.

Knowledge, according to Plato, is Reminiscence, Ἀνάμνησις, a recovery of forgotten truth, which had been possessed by the soul in a former state of existence. His dialectic professed to do nothing more than to lead the mind, by apt interrogation, to perceive the Truth for itself. It abandoned the attempt to communicate the Truth by didactic propositions. It only removed falsehood, and left the truth to its own course, to suggest itself to the mind, now disabused of its error and prejudice. It appealed to principles as certain criteria of truth, and yet confessed its inability to state those principles, and place them distinctly before the mind of the learner. They were simply referred to, as existing in every mind, whatever might be the peculiar opinions of the individual to whom the questions of the dialectician were addressed. How, then, could those principles have been acquired? No time in the present life could be pointed out when they first appeared in the mind. They are prior to the sensations, for the sensations are referred to them; and the sensations we have had from our birth. These standard principles, then, must have been acquired in a previous state of existence, and what is commonly called learning, is, in fact, Reminiscence; and to know, is, properly speaking, to remember.[6]

In proof of this account of the origin of the Ideas, Plato

[1] *Repub.* vii. p. 158; also *Philebus*, p. 303.

[2] Παντα τα ἐν ταῖς αἰσθησεσιν ἐκεινου τε ὀρεγεται τοῦθ' ὁ ἐστιν ἰσον και αὐτου ἐνδεεστερα ἐστιν (*Phæd.* 170); προθυμεῖται μεν παντα τα τοιαῦτα εἶναι οἷον ἐκεινο ἐστι δε αὐτοῦ φαυλοτερα (*Ibid.* 171). He goes on to say this applies to all subjects as well.

[3] Δεσμῶν δ' ὁ καλλιστος, ὃς ἂν αὐτον και τα ξυνδουμενα ὁτιμαλιστα ἑν ποιῆ, τοῦτο δε πεφυκεν ἀναλογια καλλιστα ἀποτελεῖν· ὁποταν γαρ ἀριθμῶν τριῶν, κ. τ. λ. (*Timæus*, p. 307.) The Pythagoreans were fond of describing moral ideas by terms drawn from mathematics and music. The good man, for example, was τετραγωνος ἀνευ ψογου; and the words πλημμελῶς, ἐμμελῶς, and the like, borrowed from their philosophy, are familiarly used in a moral sense.

[4] Ὀυκ ἄρα παντων γε αἰτιον το ἀγαθον, ἀλλα τῶν μεν ευ ἐχοντων αἰτιον, τῶν δε κακῶν ἀναιτιον. (*Rep.* ii.)

[5] Θατερου φυσις. (*Tim.* p. 315.)

[6] *Phædo*, pp. 166–174.

Plato's Writings and Philosophy.

introduces Socrates making an experiment on the mind of an uneducated person. Socrates is represented putting a series of questions to a slave of Meno, one of his disciples, and at length eliciting from the youth, after repeated correction of his errors, a right enunciation of a geometrical truth. Socrates then points triumphantly to the instance, and bids Meno observe how he had *taught* the youth nothing, but simply *interrogated* him as to his opinions, whilst the youth had himself recalled for himself the knowledge thus evidently existing in his mind.[1]

Again, in illustration of the same, Plato refers to instances of association. Often, on the sensation of a particular object, we are reminded of something else not present to us. On seeing a lyre, or a dress, which one whom we love has used, a thought occurs of the person to whom it belonged. So also, on seeing pictures of objects, persons and objects will be suggested to the mind, unlike as well as like to the objects in the picture. Or one of two friends, being presented to our view, we are reminded of the other who is absent.[2]

Now the instances here referred to, both those of association, and those of the self-teaching of the mind by the excitement of its reflection, are highly interesting and important in the history of the origin of ideas. But they do not prove the point for which Plato adduces them. The case of the slave interrogated by Socrates certainly shews, that there are principles in the understanding, which are not derived from external information, but which only wait to be developed by occasions apt to call them forth. And as to the instances of association, we can only say, it is an ultimate fact of our mental constitution, that particular objects serve to bring others before our thoughts. All such instances are illustrations of the fact, that the mind is not passive in its admission of truth, receiving knowledge simply as something infused in it from without; but that its knowledge is, in great measure, owing to its exertion of its faculties, and its bringing to bear on the instruction given its own intuitive convictions;—that consequently the excellence of all teaching consists, not so much in the positive mass of instruction conveyed, as in stirring up the mind to exercise the powers with which it is gifted, and to learn from itself.

The stress of Plato's argument in favour of the theory of Reminiscence, and of the previous existence of the Soul as a consequence of it is laid, we find, on the ground of the priority of the ideas compared with the several particular sensations which are referred to them as criteria. But the priority which he here claims for the Ideas, is not, in fact, a precedence in the order of time, but of logic. In the process of reasoning, general principles are prior to, and more known than, the particulars which fall under them; because in possessing them we possess the particulars, and the particulars, as yet unknown, are known by deduction from them as already known. Thus we familiarly speak of a conclusion as *following* from the premises. Now, Plato appears to have transferred a priority of this kind to the Ideas, and then to have concluded their priority ABSOLUTELY, as principles existing in the mind independently of the occasions on which they are called forth. But to establish a theory of Reminiscence, it was further required to be shewn, that the ideas are prior in the order of *time*,—that we possess them antecedently to, and independently of, all experience. The instance which he has given of the way in which a mathematical conclusion is reached by the simple leading of the mind in the right track, is an instance of what has in modern philosophy been more properly called "Suggestion,"—not of Reminiscence. So far from being an instance of Reminiscence, it shews, on the contrary, that the general principles of the mind are developed *subsequently* to the particular occasions which suggest them. It shews, further, that these principles are in some way dependent on such occasions for their development, though not dependent on them for their truth and reality; for the mind accepts them as true, and as the criteria of all other truth, at the moment when they are presented to it. This, then, is what is really illustrated in Plato's instance in the *Meno*. Geometrical science is the best illustration of it, though it is seen also in all our judgments and reasonings; because the remote conclusions to which we are brought by the chain of exact demonstration in that science from a few very simple definitions, present the fact most strikingly. Those conclusions are clearly far beyond the apparent compass of the definitions themselves. They are strictly deduced from them, however, and with an irresistible cogency of argument. The wonder is accounted for by the fact to which Plato has called our attention. The demonstration of the problem appeals in every successive step to the intuitive convictions of the mind. Ideas are suggested by which the statements at each point of the proof are tested; and we sanction the conclusion ultimately, because the process by which we arrive at it has been approved throughout by clear principles of our own minds.

But though the theory of Reminiscence has not been satisfactorily made out by Plato, he has the merit of having distinctly noticed and marked, in speculating on the origin of the Ideas, a class of notions of which no previous account, as it seems, had been given. The philosophy of sensation had before his time chiefly engaged the attention of thinking men, whether of those of the Eleatic school, who made everything "stationary," or of the Ionic, who made everything "flow."[3] It had been carried into the extreme of refinement by the Sophists, its devotees, when Plato commenced his antagonist system. He found that this philosophy was too narrow a basis for the structure of science, and that it could not stand alone. He saw that it left altogether unexplored the perceptions of the mind itself, such, for example, as the notions of equality, identity, time, causation, right, &c.; and that these notions were, in truth, more important for the establishment of science, than those which had previously chiefly attracted the attention of philosophers. He applied himself accordingly to examine and characterize these principles. The main thing to be accomplished in such an inquiry, was to distinguish them accurately from the informations of sense; to shew that they were not included in, or in any way derived out of, the informations of sense, but developed by the workings of mind. This fact he has recorded in his theory of Reminiscence,—a term expressing the point of contrast in his method, to that of the empirical philosophers before him exclusively founded on Sensation.

The truth and importance, accordingly, of Plato's Theory of Ideas, appear in this; that by that theory he laid a stable foundation of science, in the principles themselves of the human mind. His error is, that he carried that theory too far; that he included in it notions which are not part of the fundamental principles of the mind, and thus involved his theory in vagueness and paradox. The war of Nominalism and Realism is well known to every one who has looked into the History of Philosophy, or of theological opinion. This found its occasion in the wide generalization of the Ideal Theory. Had Plato restricted his theory to such notions as really exist in the mind; and had he not extended it, without discrimination, to those which belong to general terms, and which are purely notional; there would not have been that ground for controversy on the subject. As the case has been,—one class of disputants, looking to the generalizations of language, the genera and species of logic, took the nominalist view of the subject,—

[1] *Meno*, pp. 352–361. [2] *Phædo*. [3] Plato characterizes them; the one, as the τοῦ ὄντος στασιῶται; the others, as οἱ ῥέοντες. *Theæt.*

imputing to the whole of the ideas the attribute of one portion of them;—the other class of disputants, justly observing the reality of certain general principles, became the advocates of realism throughout. What has been already said on the dialectical origin of the theory, will sufficiently account for the confusion of two such dissimilar classes of principles in Plato's system.

How shall we wonder, therefore, that the great logical philosopher who followed him should find it necessary to combat the theory of Ideas in the undefined form in which it had been left by its author. As thus left, it stood in the way of those exact arrangements of the objects of thought which the rigorous method of Aristotle required, and introduced a class of existences for which he could find no place in his system.

Nor, further, will it be matter of wonder that controversies should have arisen in the schools respecting the nature of the Ideas; such as, whether they subsisted by themselves, or were bodies, or were actually separable from sensible things, or only separable from them in thought; or whether they were locally situated anywhere, or only in the Divine Mind. The establishing of the theory in its general form was the great business of Plato: it was enough for him to have projected it above the horizon of philosophy. Others would elaborate it after him with more or less skill. Various speculations would be raised concerning it; and controversy would at length reduce it to more definite form, and a precision beyond the contemplation of its author.

But, however just and important the Ideal Theory is in its connection with metaphysical science, it is but too clear that it retarded the advancement of sound physical philosophy, by its substitution of final causes for physical, and consequently withdrawing attention entirely from the latter. It would follow, indeed, from the suspicion thrown over the informations of sense, and the undervaluing of experience, that physical science would be slighted under such a system of philosophy. But the dominion of the theory of Ideas would necessarily exclude any other consideration in order to the truth, but that of tendencies or final causes. No other view of nature, but that supplied by this theory, would be conceived to possess the stability which science demanded. Accordingly, hypotheses would occupy the place of investigation here. The philosopher would be speculating on what ought to be, instead of observing accurately what IS; and assuming *a priori* notions of "the best," in order to determine the law of physical facts. The principle, "that all things are constituted for the best," no doubt holds good in physics as well as in other studies of the Divine workmanship; but it is here the termination of inquiry, not the commencement. It may even be employed instrumentally in the process of inquiry, to lead the mind to a point to which investigation should be directed. And this it may effect in two ways: either, from considering the good intended in the structure of some object, we may be led to see the parts of that structure in a way which discloses their real organization, and which we should otherwise not have observed; or, from taking our view of an object, not as it is actually exhibited in inferior specimens, or in those states of it in which it is seen only in progress, or under distortion, but from the most perfect specimens,—those most answerable to a divine intention or tendency to the best,—we may judge what it *is*, by considering what it *would* or *should be*. But to lay down final causes as principles from which the truths of physics may be deduced, is, as Bacon says, to corrupt natural philosophy with theology, and to render it barren of all fruits.

Such, then, is the state of Plato's Natural Philosophy. In fact, though he asserts the importance of physics in his own sense of the term, the science has no place in his philosophy. He goes so far indeed as to say that no art can flourish apart from a knowledge of physical truth; and he attributes the imperfect Rhetoric of his day to its want of such a foundation.[1] But even whilst he imputes the superiority of Pericles as an orator to his studies under Anaxagoras,[2] he strongly objects to the system of that philosopher, as we have already seen, on account of his leaving out all consideration of final causes.

Accordingly, in the dialogue which fills up this department of his system, he speaks in the person of the Pythagorean, Timæus, and strictly follows the Pythagorean notions. The detail of this dialogue consists of a history of the order of the formation of the universe in all its parts; commencing with an account of the universe at large, and the hierarchy of the heavens, and ending with a minute explanation of the structure of man, in regard to his moral and intellectual, as well as his physical powers. And here mathematical figures and proportions are the principles into which the composition and motions of all bodies are resolved. But the theory on which the whole speculation turns, and which gives the explanation of the phenomena, is the theory of "the BEST." It is an account of Good operating throughout the universe, conforming everything to itself, and constraining the untoward nature of body to yield to its sovereign power. An intelligent and good author of all things is assumed; and his order of proceeding is inferred from that which presents itself to our view as "the best." Thus the Father of the universe constructs it after the eternal unchanging pattern; "for that is the noblest of generated things, and the best of causes." He formed by his immediate operation whatever is of eternal unchanging nature. Nothing, indeed, but Himself, is immortal and indissoluble by its own nature; but, good as he is, he can never be disposed to destroy what is good. And therefore the fabric of the universe and the celestial beings, the generated and visible divinities included in it (with the highest order of whom Plato's description identifies the luminaries of the heavens), subsist eternally, not of themselves, but by virtue of their participation of Good."[3] Whatever is subject to death,—as the bodily nature of man and brutes,—being imperfect, is the work of the generated divinities, imitating the power of the Supreme. It is with these secondary Gods that he connects the popular mythology; deriving from them the parentage of Saturn, and Jove, and the other objects of heathen worship; and leaving the further account of their origin to be given by the current tradition. Thus the supreme God is described as the author of all good throughout the universe; and where anything of evil or imperfection is, the agency of the subordinate powers, and the irrational nature of body, are interposed to guard him from imputation of evil.

Derived as his history of the universe evidently is from the early theogonies, it is very remarkable that it keeps clear altogether of the oriental dualism. There is but one active principle in his system of the universe, the principle of Good; and nothing forms or moves but that only. "Let us not," indeed, he expressly says in another place, "conceive that there are any two gods, of contrary sentiments, causing the revolution of the universe."[4] He seems indeed to personify the irrational force of body, where he describes it under the name of Αναγκη, necessity.[5] But he is evidently only speaking in metaphorical language here (that language probably derived from personifications found in the early cosmogonies), intending to represent that inert power by which Nature, as we speak, acts according to its laws.

It must have been observed all along how important a place the nature of Body, σωματοειδες, occupies in Plato's philosophy. He has nowhere, however, attempted to give any positive description of the nature of Body. It is, in

[1] *Phædrus.*

[2] *Ibid.*

[3] *Timæus*, pp. 303, 325.

[4] Μητ' αὖ δυο τινε θεω φρονοῦντε ἑαυτοις ἐναντια στρεφειν αυτον. (*Pol.* p. 30.)

[5] *Timæus*, p. 339.

Plato's Writings and Philosophy.

truth, rather a condition in order to the development of the ideal theory in connection with the phenomena of sensation, than any positive nature, according to his conception of it. He has left it in the most mysterious form: nor does he seem indeed to distinguish it from Space, when he shadows it out by negatives of the attributes of all actual existence. In giving an analysis of production or "becoming," γενεσις, he enumerates three principles as concerned in the process: 1. The thing produced; 2. That in which it is produced; 3. That from which the thing produced takes the pattern of its production; depicting them under the analogy of the father, the mother, and the offspring.[1] The notion of body is here represented by the intermediate term of the three, namely, that in which the production takes place. "The nurse," "the general receptacle," and "the laboratory," ἐκμαγεῖον, are also expressions by which he endeavours to characterize it, as being in its own nature incapable of being presented to the senses or the intellect. "As a person," he says, "observing a perpetual succession of figures moulded of gold, if asked during the process what was moulded, could only safely answer, that it was gold;"[2] so we must be content to speak of this nature, calling it only a receptacle of forms or species, and not attributing to it any particular species whatever. The tendency of this theory of Body is obviously to remove all material phenomena from the class of real existences. And it seems to point to the origin of Plato's ideal theory in some older philosophy avowedly idealistic. At any rate, the speculation concerning body, as it stands in his system, leaves a hiatus in the transition from the world of Ideas to that of material existence.

The doctrine of Soul, as delivered by Plato, is properly the connecting link between the worlds of "being" and sensation. Hence is derived the importance of the theory of the Immortality of the soul in his philosophy. For it is in the soul that the eternal and immutable is found in the presence of the incipient and evanescent; the intellectual idea in contact, so to say, with the phenomena of sense. The soul partakes of change, as it is connected with the bodily nature: it is eternal and unchangeable, as it is the seat of intelligence.

Soul, then, according to Plato, is the necessary condition for the development of intelligence in the universe, as Body is for the existence of sensation. Soul, therefore, was necessarily prior to Body, as the first condition in order to the constitution of the universe. It was the animating principle by means of which the Deity, when he brought the world out of the disorder and confusion of unreason, communicated intelligence to it, fashioning it after the pattern of the eternal ideas. And not only is the whole universe thus ensouled by the immediate agency of the Deity; but every particular system in it, in which any degree of intelligence is found united with body, has in the very gift of that intelligence a soul originally imparted to it by the Father of the universe himself.

This is the ultimate account of that immortality which Plato attributes to the soul of man. It is not as a *human* soul that it is immortal; but it derives an eternal existence from its being among the original intelligent units of the animated universe. We see indeed a constant production of living things in the world; but it is not, as they have "being," that they are thus *produced* or *generated* or "become." This is the result of that "diverse" nature which was blended in their original composition with their higher principles, with the principles, forsooth, of "sameness" and "being."

For these are the three principles into which Plato analyses Soul,—the principles of the SAME and the DIVERSE, and BEING;[3] and by these he explains the phenomena of its actual existence. No time can be assigned, then, to the origin of that which by its nature IS, and is the SAME essentially. No one soul, therefore, can now *begin* to exist. And again, whatever once exists can never cease to exist, unless there is anything capable of destroying its principles of Sameness and Being. But Death, as he shews, has no such power. It may disengage the soul from its present body by dissolving the body; but it cannot affect the essential vitality which is in the soul. This essential vitality is the direct contrary to death. It therefore recedes when death comes, according to that law of Contraries, which holds throughout the world of generation and corruption, and which is the agent in all changes. But it still lives as vigorously as ever, and returns to animate another body in the course of Generation.[4] Nor, for the same reason, can it maintain an unvaried perpetuity of existence. It remains ever undestroyed; but from that "diverse" principle which enters into its composition, it both alters in its internal character, and only imperfectly imitates the Eternal Nature by a successive re-appearance in the forms of new bodies.[5] Thus, whilst it returns to the sensible world, it migrates from the male to the female sex, or to forms of the lower animals, according to that condition of purity in which it departed from its last body, or its previous degree of intellectual cultivation. For, as we may observe, there is no original distinction, according to the theory, between the soul of one man and another, and the soul of man and brute. All are equal in intelligence and goodness, as the immediate work of the Divine Author. The varieties in the characters of souls arise from the operation of the inferior deities who framed the bodies of men and brutes, and the use which individuals may make of their circumstances in the world. Whilst the number of souls, then, remains the same, they are continually changing their habitations, and passing by death from one body to another in the different forms of animal life; undergoing degradation with the forms of inferior animals, or elevation with those of superior nature, according to their state in a former existence.[6]

The theory of the immortality of the soul thus rests entirely on the Theory of Ideas. It is the universality, and being, and truth, and perfection of the Ideas which prove the soul to be eternal.[7] Ideas are found existing in the mind, but their acquisition cannot be traced to any particular period of a man's present life. They have been there from time immemorial, for no one can say when they first appeared in his own mind. They were therefore born with us; and if so, they must have had existence before our birth: and who can limit that existence? They have existed, for ought we know to the contrary, from all eternity: and who, then, shall limit their existence by any future period? why may they not be born with us in a life subsequent to the present, as they were born with us in the present life, and so on to all eternity in endless generations? This is in substance the train of reasoning by which Plato seeks to establish the immortality of the soul. A similar argument has been reproduced in modern metaphysical treatises, variously modified and stated, but the same in substance. How little calculated it is to produce practical conviction, whilst we admire its ingenuity, is evidenced by Cicero's confession, that whilst he wept over the *Phædo*, his mind retained no deep impressions from the argument.[8]

This brings us to the consideration of Plato's ethical system, in its vital connection with his physical and metaphysical doctrines.

The two great principles on which his ethical system re-

[1] *Timæus*, pp. 342–344.
[2] *Ibid.* p. 344.
[3] *Ibid.*
[4] Ανωλεθρον δε ον γενομενον, ἀλλ' ουκ αἰωνιον. (*De Leg.* x. p. 106.)
[5] *Phædo*; *Meno.*
[6] *Timæus*, p. 433; *Phædo, ad fin*
[7] 'Ουκοῦν, ει ἀει ἡ ἀληθεια ἡμῖν τῶν οντων ἐστιν ἐν τῇ ψυχῇ, ἀθανατος ἀν ἡ ψυχη εἰη. (*Meno*, p. 361.)
[8] Cicero, *Tusc. Qu.* i. 11.

poses, are; 1*st*, that no one is willingly evil;[1] 2*d*, that every one has in his own will a power of inducing changes in his character.[2]

These principles are only the counterpart ethical expressions of his theories of immutable Being, on the one hand, and of the world of phenomena, or mere Becoming, on the other.

For the soul of man, so far as it has any good or truth in it, is framed after the pattern of the eternal Ideas of the good and true. These Ideas, under the various moral aspects which they present, constitute its moral nature. All its desires, therefore, naturally tend to the Good and True. These qualities are what the soul would be. They are the mysterious realities to which it is striving to attain, in all those various efforts after Pleasure which it makes in the present life;—unconscious it may be, as it is in fact in the depraved, of the true nature of the objects to which its affections ultimately point. Still, if it be conceded that Ideas are the only proper Beings, and that everything else is phenomenal, or the mere product and offspring of the generating power of the eternal Ideas, it must also be admitted, that nothing else can be the real source of moral phenomena but the Good and True. In the moral, no less than in the physical world, a constant succession of passing events is found to take place. We perceive a variety of affections in the nature of man as he is in the world, directed to a variety of objects, each aiming at some particular gratification; one desire and its gratification passing away, and others succeeding it in endless flow. All this restless course, then, of moral events exhibited in the life of man is phenomenal; not in the sense of its having no reality whatever, but of its having no permanent reality—of its being no more in the result than effort towards being—restless, endless effort towards that which may give rest and full satisfaction, and stable being.

This ultimate object, then, however indistinctly sought, is the aim of every individual soul of man. Some, indeed, avowedly make mere sensual gratification the end of their desires. They endeavour to satisfy themselves with the limited and the evanescent. But the true cause of all that perverted activity which they display, is the Good itself. They know not what the Good is; but they love it in spite of themselves, and bear evidence, by their life of unceasing pursuit, that they are secretly actuated by the desire of it,—and that they can find no rest in anything short of it. Their soul, originally formed in the likeness of the Deity, can never willingly be separated from its Divine image. In the midst of its wildest aberrations, it feels the attraction of like to like, impelling, and at the same time reclaiming it to right.

This accordingly is Plato's meaning in the principle, which he so emphatically lays down, that "no one is willingly evil." It is very different, we may observe, from saying that no one commits evil willingly. And Plato himself takes care to guard his theory from this misconstruction. He readily grants, that acts of wrong are distinguished by being voluntary and involuntary, without which there could be neither merit nor demerit; but he strenuously maintains that this distinction does not apply to evil itself. It is in all cases involuntary. No one can choose it in itself. It is necessarily the object of aversion, as the good is invariably the object of choice and pursuit.

How is it, then, it will be inquired, that men do become evil;—that whilst they are really seeking to be conformed to a divine pattern, they practically do what is evil, and, losing more and more of their likeness to the Eternal Being, conform themselves rather to the fleeting character of the world of sensation?

Plato's Writings and Philosophy.

The explanation is found in the other great principle of Plato's philosophy, the theory of Becoming, to which we have referred. Change is the characteristic of all that belongs to this subject; as immutability is the characteristic of Being. The course itself of successive phenomena may be varied by impressions from circumstances. In the soul there is a principle of change in the power of regulating the desires,—in indulging them to excess, or moderating them, according to the will. And the circumstances in which the soul is placed, as connected with the sensible world by means of the body, present the occasion for such change. The humours and distempers of the body produce discomposure in the soul. It becomes diseased analogously to the body. This state of disease is what is commonly called folly, ἄνοια; and it takes the form either of madness, μανία, or of mere ignorance, ἀμαθία. Where even ignorance only is the result, the internal harmony of the soul is disturbed. Pleasures and pains are unduly magnified; the democracy of the passions prevails; and the ascendancy of reason is cast down. In addition to these disturbances or ailments through the body, come the influences of evil governments, evil public lessons, evil education. Hence the soul is changed from what it was when it first came from the hands of its Divine author. The eternal Ideas after which it was framed are not effaced from it. This cannot be; for then it would cease to have being; but it loses distinct apprehension of them,—mistakes appearances of good for good itself,—and under that delusion willingly does evil, and presumes on obtaining happiness by a course of evil conduct.

But the same principle of change in the soul gives an opening also for its moral restoration. As the soul is deteriorated by the contagion of the body, so it may also be restored to a sound state by remedial treatment. The yielding to every passing desire, and suffering the desires to grow out of proportion, and destroy the harmony of the soul, is the cause of men's falling into that blindness which hides the good from their mental eye. By restraining them, and moderating the desires, the internal disorder is gradually corrected; reason resumes its ascendancy; the soul once more "sees and hears aright," and thus returns to that good to which its desires naturally tend. It is a long process, indeed, by which the restoration is effected; a process of gradual purification, καθαρσις, of the soul, by chastisement and suffering. Nor is it accordingly completed in a single life; many courses of existence must be passed through. Not only is the present life of the soul a consequence of its conduct in a former one; but it is destined to many successive stages of existence, each adapted to the character acquired at the stage next preceding, until its defilements are purged away.

These ethical doctrines of the philosopher, when divested of the extravagance of his theory, so far accord with the truth both of inspiration and experience, as they indicate, that the utmost man can do in the present life is insufficient to restore in him the lost image of God. Whilst they lay down this truth under the disguise of the remedial process of the transmigration of the soul, they further agree with the inspired authority, and with experience, in imposing on man the duty of *commencing* the process of restoration, and in holding him strictly responsible for the state of his mind and affections, through that power of self-direction and capacity of improvement by discipline, with which he has been endued. Thus does he also bear evidence both to the fact of the perfection of man at his creation, and that of his existing corruption. But he differs from the Scripture account of that corruption, in making it originally a physical rather than a moral debasement,

[1] *Timæus*, 218; *De Legibus*, ix.

[2] *De Legibus*, x.; *Ibid.* v. p. 212; *Ibid.* ix. p. 17; *Phileb.* p. 231.

Plato's Writings and Philosophy.

and representing it as taking place by a gradual process, and not by a sudden and entire fall, the effect of a first transgression of a positive divine command.

The Sophists, indeed, boasted of their power of transforming the characters of men, and accordingly made great profession of "teaching virtue."[1] But they coupled with this pretension, the admission, that all opinions on moral, no less than on other subjects, are equally true. All opinions in morals, they said, are true; "but all are not good. What we would effect, therefore, is to lead men to such opinions as we know also to be both good and wise."[2] But this was a mere evasion; for if all opinions are equally true, then must also each man's view of good be true, as well as that which his instructor would inculcate on him; and there is no fixed standard to which he may be conformed. Plato's theory of good, as the sole object of desire,—or the invariable tendency of the will to good, and its invariable aversion from evil,—was a strong ground of opposition to the sophistical doctrine. It pointed out that there was a principle in man superior to instruction, and independent of the accidents of worldly circumstances, the Θεος μετρον, the "God-measure," the fixed Divine standard, to which all moral teaching should be directed, and from a reference to which all moral discipline obtained its value.

From this mode of enunciating the fundamental principles of morals, it followed, that the practical morality which Plato teaches, should be directed to the means of removing the false appearances of good by which the mind is deluded to evil. He shews, accordingly, that there are false pleasures as well as false opinions—that men's ignorance extends, not only to mistakes in regard to their wealth or bodily accomplishments, but as to their moral characters; for that most men think themselves better than they really are.[3] Thus does he apply to morals more particularly, the general confession which his philosophy exacts of its disciple on all subjects, that he knows not what he presumed he knew, and sends every one to learn himself, in order that he may be truly a moral man.[4]

This, therefore, according to Plato, is the great purpose for which philosophy must be cultivated. Philosophy alone can open the eyes to see the true value of things, and alone elevate the mind from the evanescent region of the phenomenal world to the seat of true and eternal Being.

For the same reason Dialectic, as *immediately* conversant about the Ideas of the good and true, is the ultimate study of him that would seek to educate and improve the powers of his soul to the utmost.

Philosophy and morality, in fact, in his system, perfectly coincide. The love of truth is also the love of good, and the love of good is the love of truth.[5] The same process by which the good man is effected, philosophically viewed, is a power of analysing pleasure and pains, an art of mensuration, enabling the mind to discriminate between Truth and Good on the one hand, and their semblances on the other, and distinctly to apprehend them, under whatever disguise they may be presented and obscured by the senses.[6] Morally viewed, it is the one motive of the love of truth and good predominating over, and purifying, and absorbing into itself, every desire of human nature.[7] In the first view, it is wisdom or philosophy; in the latter, it is purification,—and perfect virtue,—and discipline of immortality,—the resemblance and participation of the Deity.[8]

These views of moral truth are in themselves certainly grand and ennobling. As guides, however, to duty, they are deficient in that particularity and homeliness of application which are required for the real business of morality. Their tendency, too, to contemplative mysticism is obvious, left as they are by Plato in undefined outline, and clothed in the charms of his imaginative eloquence. Nor shall we wonder that they have easily combined with the feeling of asceticism, so congenial to the human heart. The contempt which they throw over everything belonging to the bodily nature of man,—the delusiveness imputed to the senses, without any limitation of it, or guard against abuse of the theory,—and the abstractedness from the world which they propose,—admit of being construed into a theory of mortification of the body, and of the purifying efficacy of self-inflicted punishments. These tendencies, indeed, of Plato's ethical doctrines, were, not long after his time, exemplified in the apathy and austerity of the Stoic morality. And it is well known to what extent they have been developed in the teaching and practice of religionists of all creeds. It cannot be denied, also, that where they take hold of a morbid and susceptible temperament of mind, they tend to substitute, in such a case, the morality of imagination and sentiment for that of common sense and household feeling, and to fritter away the convictions of duty into mere proprieties of taste; so that even whilst they elevate the character above sordid and vulgar seductions of pleasure, they emasculate and corrupt it, through the very excess of its theoretical refinement.

As bad education was regarded by Plato as the other great cause of human corruption, in addition to the influence of Body on the soul, he directs a large portion of his philosophical disquisitions to correct the evil arising from the second source. His ethical discussions go to the limiting of the desires, and curing the diseases produced by them in the soul. His political discussions have for their immediate object, the laying down right principles of education, and enforcing them by the constitution, laws, and power of the state.[9] His two great works, the most elaborate of his writings, the Dialogues of the *Republic* and the *Laws*, are rather theories of Education than of Government and Laws. The former indeed inquires more particularly into the principles on which a right government may be formed; whilst the latter gives a systematic view of the principles of legislation. Both, however, have in view the improvement of human nature by social institutions expressly framed for that purpose. It has been supposed that in the *Republic* we have his theory of a perfect state, and in the *Laws* a practical exemplification of the theory. But this is clearly a mistake. Both are doubtless intended by Plato as theoretical disquisitions on the political matters of which they treat, whilst the real matter in hand is Education.[10] This is expressly asserted by Plato himself, when he compares his legislation to the method of the philosophical physician.

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[1] Gorgias, however, laughed at the other Sophists for pretending to teach virtue. He professed only the art of words. [2] *Protag.*

[3] Πολυ δε πλεῖστοι γε, οἶμαι, περι το τριτον εἶδος ἐν ταῖς ψυχαῖς τουτων διημαρτηκασιν ἀρετῆς, δοξαζοντες βελτιους ἑαυτους, οὐκ ὀντες. (*Philebus*, p. 285.)

[4] Το γνῶθι σαυτον, λεγεις, ὦ Σωκρατες, κ. τ. λ. (*Ibid.* p. 284.) This is drawn out in a beautiful passage of the *Charmides*. Σχεδον γαρ τι ἐγωγε αὐτο τουτο φημι εἶναι σωφροσυνην, το γιγνωσκειν ἑαυτον, κ. τ. λ. (*Charm.* pp. 130–135.)

[5] Μητ' εἰς τινας ὠφελείας ἐπιστημῶν βλεψαντες, μητε τινας εὐδοκιμιας, αλλ' εἰτις πεφυκε τῆς ψυχῆς ἡμῶν δυναμις ἐρᾶν τε τοῦ ἀληθοῦς, και παντα ἑνεκα τουτου πραττειν. (*Philebus*, p. 305.)

[6] *Polit.*; *Protagoras.* He also characterizes it as a knowledge of geometrical equality, opposed to πλεονεξια.

[7] *Conviv.* p. 247, *et seq.*

[8] Διο και πειρᾶσθαι χρη ἐνθενδε ἐκεισε φευγειν ὁτιταχιστα· φυγη δε, ὁμοιωσις θεῷ κατα το δυνατον· ὁμοιωσις δε, δικαιον και ὁσιον μετα φρονησεως γενεσθαι, κ. τ. λ. (*Theætet.* p. 121.)

[9] *De Legibus*, vii. p. 354.

[10] Πρῶτον δη οὖν προς τον λογον, ὁρισωμεθα παιδειαν τι ποτ' ἐστι, και τινα δυναμιν ἐχει· δια γαρ ταυτης φαμεν ἰτεον εἶναι τον προκεχειρισμενον ἐν τῷ νῦν λογον ὑφ' ἡμῶν, μεχρι περ ἀν πρὸς τον θεον ἀφικηται. (*Ibid.* i. p. 41.)

Plato's Writings and Philosophy.

When the mere empiric, he observes, should hear such a physician discoursing to his patient of the origin of the disease, and ascending to the speculation on Nature, he would be disposed to object that such proceeding was folly; "for it was not healing the sick man, but rather educating him, as if he wanted to become a physician, and not to be made well."[1] The like objection, he says, might be applied to his method of legislation; for, "whoever pursues the inquiry concerning laws," he adds, "as we are doing now, educates the citizens, but does not legislate."[2] And he goes on to say, in the person of the chief speaker, addressing the other interlocutors of the Dialogue, that in their work of legislation they were at leisure, as speculators on the subject, to consider, not what was most necessary, but what was best.[3]

We are not to suppose, then, that Plato had in view the actual foundation of a state, according to the principles of government and legislation laid down in his two famous dialogues. His object was to give an example of the most perfect life,[4] free from those impediments which all existing governments and laws threw across the path of the virtuous man. As philosophy is the guide of private life, elevating it to the knowledge of the Good and True, so he would have philosophy also seated on the throne of government, and exhibit the eternal Ideas of Good and Truth, modifying society after their pattern. Hence it is that he overlooks impossibilities in his arrangements; as is pointed out by Aristotle in his acute comments on the leading points of Plato's political theories.[5] All is sacrificed, in fact, to the one great object of Plato's mind, the sketching of the Idea of the Good as a social principle, apart from the evil influences of existing society.

The most extravagant hypotheses, accordingly, are put forward in this part of his philosophy; not indeed with a view of their being ever exemplified in any institutions of real life, but in extreme contrast with the existing selfishness of human society, and as theoretic developments of the unchangeable idea of good. Such, for example, is his theory of a community of wives and children, and the training of women to the hardiest exercises of the gymnasium and of war. We justly take exception at the immorality and unnaturalness of such hypotheses. But Plato looks down upon man from the height of his sublime theory. He sees everything in the unity and invariableness of that theory, and overlooks distinctions deeply founded in the nature of man. Thus it is that in his view man himself becomes a thing of little consideration or importance,—a sort of plaything of the Deity, θεου τι παιγνιον, scarcely worth any serious attention. "You disparage altogether the race of man," says an interlocutor in the Dialogue of the Laws. "Wonder not at it," replies the Athenian; "but make allowance for me; for it was from looking off to the Deity, and under this impression, that I said what I have now expressed. However, let it be granted that our race is not insignificant, if you like, but worth some serious consideration."[6] It is in this spirit that he himself sports with human nature, as if human beings were only so many chessmen, to be moved on the board, so as to display the admirable design of the disposing mind, and illustrate the working of the eternal Ideas. His fault is the same as in his physical speculations, that of commencing from the final cause, or the notion of the Best, and forming the world of social life after that, instead of rising from the study of its actual formation to the notion of the Best;—or at least in supposing, that he could arrive at a just view of the divine pattern of Good, by presenting a theoretic copy of it, after his own conceptions of the Best. But such extravagancies as those we have referred to, could only have proceeded from so bold a mind as that of Plato,—a mind, not checked by the repulsiveness of particular consequences from pushing a theory to the utmost.

At the same time, this fundamental notion of the Divine standard and pattern on which he proceeds, imparts a solemn dignity, in the midst of these excesses of the spirit of theory, to the substance of his speculations on government and laws.

Religion is thus secured as the basis of all right government and legislation. That government only which most resembles a theocracy is, in Plato's view, a true polity. All others, popularly termed governments, as democracy, oligarchy, aristocracy, monarchy, are merely settlements of cities, and not *Polities*,[7] being called after that power which has the ascendancy in each over the other parts of the state. So far as a state is truly such, it ought to be named, he says, after the true God, the lord over all intelligent beings. Governments, as they exist, are only the results of the struggles of contending factions: whence we find, as he observes, one party in the ascendancy excluding and depressing another, in order to its own maintenance, and no concern taken for the welfare of the whole community. To remedy this general evil of existing governments, he would have the simple and straightforward course of the divine procedure brought before the minds of men, and a conformity with that procedure inculcated on them as the only rule of life and happiness. "God," he teaches, in an animated and noble passage,[8] "as the ancient story is, holding the beginning, and end, and middle of all things that are, describes a straight line, according to nature, as he walks his circuit.[9] In his train ever follows Justice, the avenger of those that are left behind by the divine law; to which, he that would be happy, keeping close, follows in the train, humble and orderly; but whoever is puffed up with high boasting, or elated with wealth, or honours, or grace of person, together with youthfulness and folly,—his soul burning with insolence, as presuming, that he requires neither ruler nor any guide, but is competent even to be a guide to others,—is left, forsaken of God. And being left, and taking to himself others besides, such as he is, he frolics, throwing everything into promiscuous confusion. And to many he seems to be some one; but, after no long time, undergoing a retribution, of which he cannot complain, to Justice, he utterly subverts himself, and his house, and his city."[10]

Here we have emphatically recognized the great truth, that the foundations of all government and law are laid in the unchanging nature of the Divine Being. The law of right, as exemplified in the dominion of party, is the law of the strongest, fluctuating with the accidents of power, and never attaining to any permanent being. Such was the law of right, as taught by the Sophists, from city to city, and which was fully established in public opinion throughout Greece,—not only as manifested in the factious character of the particular governments, but avowedly declared and acted on as a principle of conduct. "It is nothing," say Athenian ambassadors, "out of the course of the established opinion of men concerning the Divine Being, or

[1] *De Legibus*, ix. p. 11. [2] *Ibid.* [3] *Ibid.* p. 12.

[4] Πᾶσα οὖν ἡμῖν ἡ πολιτεια ξυνεστηκε μιμησις τοῦ καλλιστου και ἀριστου βιου. (*Ibid.* vii. p. 380.) Ταῦτα δη καθαπερ ἰσως ἐν μυθῳ, τανῦν λεγομεν' ἐστιν εὐχαι· πολυ γε μην ἀριστα, εἰπερ γιγνοιτο ἐν πασαις πολεσι γιγνοιτο ἀν. (*Ibid.* viii. p. 423)

[5] Aristot. *Politic.* ii. app. 1, ver. 4. [6] *De Legibus*, vii. p. 353. [7] *Ibid.* iv. 178.

[8] Χρῆν δ' εἰπερ τοῦ τοιουτου την πολιν ἐδει ἐπονομαζεσθαι, το τοῦ αληθοῦς τοῦ τῶν νοῦν ἐχοντων δεσποζοντος θεοῦ ὀνομα λεγεσθαι. (*Ibid.* p. 179.)

[9] The train of thought is entirely mathematical: 'Αρχην τε καὶ τελευτην και μεσα τῶν ὀντων ἁπαντων ἐχων, εὐθεῖαν περαινει κατα φυσιν περιπορευομενος. (*Ibid.* iv. p. 185.)

[10] *Ibid.*

Plato's Writings and Philosophy.

their sentiments concerning themselves, that we expect or do. For we hold that the Divine Nature, so far as we can judge of it, and human nature, as we see clearly, by an instinctive necessity, ever exercise power where they can obtain the mastery. Nor are we the first, either to propose the law, or to use it when laid down: it was in being when we took it up; and it will subsist for ever, for us to transmit to others after us; and we merely act upon it; convinced, that yourselves, no less than others, were you placed in the same power in which we are, would do so."[1] Here, then, is the law which belongs to the region of instability,—to that nature which is ever *becoming*, and never *is*. Contrast with this Plato's principle, which deduces the origin of law from the eternal IDEA of GOOD, and it will then be more distinctly seen what the spirit of Plato's legislation really is.

It follows, indeed, from his principle, that all instituted law is imperfect.[2] And he admits, accordingly, that if a perfectly virtuous ruler could be established on earth, it would be best that the business of government should be carried on by his will; which would in such a case be only the copy of the Divine exemplar of right. But as this is past hope in the present condition of human things, the substitute for the more perfect system is the institution of laws framed after the eternal Idea of Good; not laws adapted merely to the preservation of a particular form of polity, but embodying in them the immutable principles of right. And even such laws, as being matters of institution, are inferior in dignity to unwritten laws—the principles of right—which, themselves resting on no external sanction, are yet the conserving principles of all positive laws.

Having his eye fixed on the eternal pattern of the good and the true, Plato looked with a feeling of disappointment and disgust at the several forms of polity which the states of Greece exhibited. He is generally thought to have inclined to a preference of aristocracy, and to have regarded with aversion all popular government. But though it is probable, that, from what he saw of the tyranny of an unrestrained democracy, he sighed in secret for a better order of things, we cannot conclude from his political speculations that he regarded any single polity as the best. He, in fact, condemns all particular forms;[3] and when he asserts a preference, it is for a polity such as was nowhere seen in his times, combining in it monarchy, aristocracy, and democracy.[4] But in his view, as governments then existed, they were all one-sided; the dominion of one part of a community over the rest, and not the dominion of good over the whole. This dominion, as we have observed, was only to be found in the government of God over the world, and to it, therefore, he would have all human government conformed. His sole preference, then, is for a theocracy, if such could be realized on earth. His slighting manner of speaking of the lower orders of society, and of all indeed but those who are gifted with superior talents and other natural endowments, is to be ascribed to his general low estimate of human nature, considered apart from that cultivation, which the highest and most intellectual studies impart to it.

Respect for antiquity and prescriptive authority is strongly inculcated by Plato. In nothing was the changeableness of all generated things more evident than in the ever-varying forms of the states of Greece, and especially of Athens itself. The democracy of Athens had been an universal market, παντοπωλιον, as Plato terms an extreme democracy, of all sorts of politics.[5] And laws had so far lost their force there in the most corrupt times, that everything was transacted by the decrees of the day; the variable determinations of popular assemblies being substituted practically in the place of standing Laws, the records of former experience and wisdom. Early legislators had devised expedients for counteracting this love of change on the part of their countrymen, as Solon, for instance, and Lycurgus had done. And in some instances, we find a temporary and partial expedient adopted, by the popular assembly itself fixing the penalty of death to the proposal of rescinding a measure before a certain period.[6] Plato's expedient was supplied by the principle itself of his philosophy. If the Idea of Good was eternal and unchangeable, the constant pursuit of change must lead men astray from their happiness and the truth. They must be called back, therefore, from that which is present and passing, to the recollection of the past. They must not look on wisdom as a thing which is different to-day from what it was yesterday, or in former times, but hold it as what by its very nature is unalterable. To regard it as susceptible of improvement in the lapse of time, would be to deny its proper Being, to reduce it to the condition of mere Becoming. A distrust in the wisdom of any existing generation of men, and a sacred reverence for that of former generations, and especially for the earliest traditions of knowledge, would naturally be inculcated in such a philosophy. Thus he highly commends the Lacedemonian and Cretan politics for the provision, that no young man should inquire whether the laws were good or bad, but that "all should with one voice and with one mouth agree in declaring that everything in them is well appointed, as being by the appointment of gods;" and that no other sentiment should be allowed to be expressed. Further, not even does he permit a young person to be present when such matters are considered by the old.[7] In the same spirit, the Egyptian immutability in the arts for thousands of years, is admired, as a proof of admirable legislative and political wisdom.[8] Even in regard to the fine arts, and to sports and amusements, he reprobates the tendency to innovation, as dangerous to the serious institutions of a state, on the ground, that changes in these lighter matters "imperceptibly change the manners of the young, and bring what is primitive into disrepute, and what is modern into repute;" and that there cannot be a greater mischief to states than such a habit of "blaming antiquity."[9]

All this, which under certain limitations may be true, appears, when thus broadly laid down by Plato, a misapplication of the proper sanction of religious truth to truth in general. In religion, the only question being what is really taught by its Divine author, there can be no addition made in the course of time to the truths revealed, except by another divine revelation, though there may be advancement in the exposition and teaching of it. What is primitive and ancient, accordingly, in this subject, once fully ascertained to be so, is the truth, and the whole truth. Only we must not mistake antiquity of exposition and comment, for primitiveness of the truth itself; for these admit of improved knowledge by human study, when the original truth itself does not. The contest between the advocates of the respective claims of the past and of the present, in the matter of knowledge, is doubtless much older than the time of Plato. But his authority and eloquence have probably been mainly instrumental in starting and sustaining the controversy in modern times, through the early reception of his philosophy into the literature of the Christian church.

But we may further see a reason for the stress which Plato lays on the wisdom of prescription and authority, in that state of public opinion to which he is addressing himself. It was not, as might be supposed, a state of things

[1] Thucyd. v. 105.

[2] 'Οτι νομος οὐκ ἀν ποτε δυναιτο το τε ἀριστον και το δικαιοτατον, κ. τ. λ. (*Polit.* p. 82.)

[3] 'Αλλα την προσηκουσαν αὐτῇ τινα τῶν νῦν λεγεις πολιτειῶν· οὐδ' ἡντιναοῦν ἐστιν, κ. τ. λ. (*Rep.* vi. p. 96.)

[4] *De Leg.* iii. pp. 137, 138.

[5] *Rep.* viii.

[6] Thucyd. ii. 24.

[7] *De Legibus*, i. 24, 25.

[8] *De Legibus*, ii. p. 67.

[9] *Ibid.* vii. pp. 338, 339.

Plato's Writings and Philosophy.

corresponding exactly to a demand for religious or civil changes, in our days, under established governments and institutions. The question of change is now gravely discussed, and deliberately carried or rejected, not with the view of unsettling everything, but in order that some particular institution or law may be *established* for the future. Except in violent outbreaks of human passions long pent up within artificial restraints, exasperated by resistance, and at length forcing their way out, and levelling all barriers before them, as in the instance of the great French Revolution, it cannot be said with truth, of the struggles for particular changes in modern institutions, that they have been actuated by the mere desire of change, and the hatred of everything established. The religion and the civilization of modern times have in some measure presented a check to this. But at the centre of movement in Greece, change was the order of the day. Athens would neither rest itself, nor suffer other states to rest. When its very demagogues are forced on some occasions to endeavour to repress this incessant changeableness; as Cleon was, when he told the Athenians it was better "to have worse laws unmoved, than good laws perpetually changed;"[1]—it is evident that the spirit of change was then developed in its most fearful form. For we find the magician himself who had evoked it, starting in terror at the apparition, and finding it too strong for his direction and control. *Δοῦλοι ὀντες τῶν ἀει ἀτοπων, ὑπεροπται δε τῶν ἐιωθοτων*, "Slaves of every new extravagance, but despisers of accustomed things,"[2] are the words with which he attempts to exorcise it, and which the historian of the times puts into the mouth of one who, as the creature of the system, could most pointedly characterize it. Such was that spirit, then, against which Plato had to contend. It was an enemy not only to the existing government, but to all government, and all law, and all religion and morality. It demanded, therefore, the most forcible counteraction. It was to be met by inculcation of the opposite. According to his own universal principle, contrary was to be expelled by contrary. Everything that was ancient was to be upheld, accordingly, as worthy of veneration and acceptance, simply because it was ancient. The voice itself of antiquity, though speaking without evidence, was to be received with implicit acquiescence and submission. Thus it is that Plato is found strenuously appealing to the instinctive feeling of his Athenian countrymen, which they still retained in spite of the prevailing folly,—the feeling with which they so fondly reverted to their early glories, and delighted to view themselves in the past;—and labouring to correct their vacillations of present opinion by recalling them to the fixed lessons of their *memory*.

Political philosophy, then, according to Plato, is the history of those changes which the will of man produces in the matter of government and laws, and an endeavour to limit those changes by restoring in the social world the primitive order and rule.

Education is the means by which those changes are counteracted. It avails itself of that principle of contrariety by which all changes are carried on; and endeavours to expel the evil by inducing the good. The process by which it carries on this effect is, a discipline of the intellect, prescribed by the state, and promoted by all its institutions and customs, framed, as these are supposed to be, after the idea of the Sovereign Good. That discipline lays down a course of exercise for the body as well as for the intellect, that the body may be brought into the best condition, in order to the exercise of the intellect. The intellect itself it conducts through the steps of the several sciences, from the bodily and sensible to the unembodied and intellectual,—from the phenomenal and changeable to that which has real being, and is unchangeable. And thus in Plato's system it is classed under the two comprehensive heads of Gymnastics and Music; the latter term being understood, according to its derivation, to denote literature in general. Philosophy itself was the ultimate attainment of education,—the result of the whole intellectual training of the accomplished man. Ostensibly, under this system, there was no peculiar discipline of the heart. Indirectly there was; so far as it inculcated purification and self-denial. But the strengthening and elevating of the intellect was its direct object. Its tendency was thus to exalt the virtues of the intellect above those of the heart; and, in opposition to the evidence of facts, to assert the power of knowledge over the determinations of the will. Not that Plato denies the existence of what we call self-command, or that controlling of the passions which is the result of a previous struggle with them. But he did not admit (as Aristotle does, and urges against him[3]) that reason could ever be overpowered by the passions, or that if there were a distinct knowledge of the truth in the mind, it could give way to passion.

In the matter of Religion, Plato's theory of Ideas led him to see that there were truths above the evidence belonging to Experience, and which must be received solely on the ground of the Divine authority. For whilst he taught that the mind of man must work its way up to the Ideas by a course of argument and examination of evidence, yet, having reached the Ideas themselves, it had attained the ultimatum of truth; no further evidence of these was to be sought; they carried their own light in themselves. So, when any truth was presented to the mind, which related immediately to the Divine Being, it was not to be supposed capable of being examined in itself, and established on any higher ground of internal evidence, but must at once be admitted, if there were sufficient external authority for it. The only question respecting such truths is, are they *historically* true? Is it certain, or at least highly probable, that they have descended to us from the Father of Lights himself? Have we reason to think that they were originally real divine communications,—and are they vouched to us as such by a competent evidence?[4] Now, in regard to the primary principles of the mind, such as we have before spoken of, though they are not evidenced by any higher principles, or by any conclusions from Experience, they carry their own evidence, by their invariable presence in the mind on certain occasions, being naturally suggested by such occasions to every rational understanding. But the truths of religion are of a different nature. They cannot be authenticated by the mind itself to itself, as being out of its range of thought. They must therefore be authenticated from without. And in regard to these, accordingly, we must appeal to the Reason and Word of God, as the simple, and proper, and unanswerable vouchers of them.

This is the account of Plato's disclaimer of all evidence, either of demonstration or probability, on matters strictly divine, and his frequent appeal to mythic traditions when his discussion touches a mystery of the Divine Being or the Divine conduct. He resolves the whole authority of such matters into the evidence of "ancient story," *παλαιος λογος*,[5]—and "primitive hearing," *ἀρχαια ἀκοη*,—and "learning hoary with time," *μαθημα χρονῳ πολιον*.[6] In speaking of the generation of the subordinate divinities, in the *Timæus*, he makes

[1] Thucyd. iii. 37.

[2] *Ibid*. c. 38.

[3] Aristot. *Ethic. Nic.* vii. 2. Aristotle, though controverting the extreme view of the doctrine of Plato on this point, in the result nearly coincides with him. *Ibid*. c. 3.

[4] *Ἐαν ουν, ὠ Σωκ., πολλα πολλων εἰποντων περι θεων και της του παντος γενεσεως, μη δυνατοι γιγνωμεθα παντη παντως ἀυ τους αὐτους αὐτοῖς ὁμολογημενους και ἀπηκριβωμενους λογους ἀποδουναι, μη θαυμασης, κ. τ. λ.* (*Timæus*. p. 304.)

[5] *Οπερ ὁ. παλαιοι τε και σοφοι λεγουσιν· ὁ ὁμοιος τῳ ὁμοιῳ.* (*Gorgias*, p. 137.)

[6] *Timæus*, p. 291.

an observation applicable to the whole subject of divine things as treated by him. Instead of entering into explicit accounts of them, he observes that the subject is "too great for us, and that we must believe those who have spoken before, being the offspring of gods, in the way in which they said it, and because they must be conceived to have known their own ancestors;" adding, that we cannot refuse credit to the "sons of gods, although they speak without probabilities and necessary demonstrations, but must follow the rule of believing them on their word, as declaring what belongs to them."[1] He commends, too, the primitive generation of men for their docility in following rules of life founded on oral tradition,—their "holding as true what was said τα λεγομενα, concerning both gods and men."[2] Again, speaking of the state of the dead, and their interest in the concerns of men on earth, he appeals to the same kind of evidence. "We must believe," he says, "the voices of others in such matters, so current as they are, and so extremely ancient; and it is enough for our belief that legislators, unless they be proved absolutely unwise, have asserted them."[3] So justly does he insist on the reasonableness of being content with the voice of a declaratory authority in matters incapable, by their nature, of a direct evidence from our reason.

By the heathen philosopher, in the absence of an authentic revelation, the authority for such truths was naturally sought in ancient traditions,—traditions mounting up beyond all memory of their origin, and therefore referable to times when the world was yet fresh from the hand of God. The voice of remote and undefined antiquity, indeed, by a natural delusion, represents itself to the mind as but little different from the sanction of eternal truth. For it is but a slight and imperceptible transition from the indefinite to the infinite. Many such traditions were found in the heathen mythology, connecting themselves with another order of things, when gods conversed with men on earth. Some of them, certainly, were full of absurdity and profaneness; and all were disfigured with the colouring of fable; but still there were some, beautiful in the conception, and sublime and impressive in the doctrine. Of this latter character, for the most part, are those exquisite mythical legends, with which Plato has diversified his discussions, throwing the solemnity of religion over truths of high importance which he would specially enforce.

Thus, though he has elaborately argued the Immortality of the soul, he is not content to leave the question on those abstract grounds of conviction. He feels that the conviction which may practically influence the conduct, must be drawn from another source,—that of a simple belief in some authority declaring it,—when he closes the discussion, as in the *Phædo*, and in other places, with a scenic representation, from the legends of ancient tradition, of the doctrines which he has been enforcing. The whole of the *Timæus*, in fact, is a legend rather than a philosophical inquiry. It appeals, for the reception of its truths, to the shadows with which it veils them, and the mystic echoes of sounds heard by the listening ear from afar. In that legend, indeed, we have very considerable evidence of the pure source, from which the heathen world drew much of the sacred truth that was wrapped up and disfigured in their fables. We perceive in such a document of ancient philosophy, at once the sure and wide-spread knowledge resulting from a scriptural Revelation, and the obscurity and fallibility of the information of Tradition. To this effect are the description in the *Timæus*, of the universe as the "one" work of the "one Supreme Being,"—as the "visible likeness of one himself the object only of intellectual apprehension,"—as the "only-generated," μονογενης, of the Father of all things; and the strong assertion of the goodness, and beauty, and perfection of the universe; and particularly, in reference to this, that striking passage, "When the Father who generated it, perceived, both living and moving, the generated glory of the Everlasting Divinities, he was filled with admiration, and, being delighted, he further contemplated the working it still more to a resemblance of the pattern."[4] Add to these instances the simple and magnificent words which he has put into the mouth of the Father of the Universe, as an address to the generated gods, respecting the formation of the bodies of men and other living creatures.[5] The attributing to Him a speech at the first formation of man, is alone sufficiently remarkable; and the plural address with which it opens, makes the correspondence still closer to the sacred words, "*And God said, Let us make man in our image, after our likeness.*" The order of the generation of things, it may be further observed, agrees with the order of the Creation. First the heavens and the earth are produced, and then the living creatures; and among these Man, designated as "the most religious of animals."[6] But at the same time there is much confusion and degradation of the high subject. We look in vain for those sublime features of the inspired account, that the Creation arose out of nothing, by the word of God. This is darkly intimated in the shadowy nature which the narrative assigns to Body; but, though it be but a shadow, Body still subsists in his system, as the co-eternal contrary of the Divine Intelligence. Traces of the descent of holy truth, in the like disguise, appear in the references found in Plato to early deluges and genealogies;[7] to the notion of God as the shepherd of his people;[8] and to accounts of variations in the course of the rising and setting of the sun.[9]

Such, then, is the character of Plato's philosophy, both in its general method, and in its results, as a theory of the universe, and an information respecting the leading branches of human knowledge.

It was concerned, we find, more in investigating and establishing first principles, than in drawing out results; in exciting the love of wisdom, rather than in aiding in the research after it. With him, indeed, philosophy and its method of inquiry, as we have seen, are one; and, in like manner, philosophy and its several branches coalesce in his system into one. We have spoken of his logical, and physical, and ethical doctrines, as if they were distinct subjects; but in his mind the one theory of Ideas held these several doctrines in its embrace, and made them indissolubly one with itself. For his design throughout is, to establish universal principles common to every subject, and on these to build a structure of philosophy,—a counterpart in the human mind to the universe itself, and comprehending therefore all that relates to the Deity, to man, and to the universe. He would place the mind of the philosopher far above the scenes in which man lives, and endue him with a keenness and range of vision, extending over the whole region of speculation, and leaving no part, either from its largeness or from its minuteness, unexplored. The problem which he undertakes to solve is, how all things are both one and many; how, amidst the multiplicity of phenomena with which we are surrounded, a real unity still subsists and pervades the whole. He proceeds on the conviction, that to attain to this unity, so far at least as our faculties will enable us to attain to it

[1] *Timæus*, p. 324.
[2] *De Leg.* iii. p. 111.
[3] *De Leg.* xi. 150.
[4] Ὡς δε κινηθεν τι αὐτο και ζων ἐνενοησε τῶν ἀϊδιων θεῶν γεγονος ἀγαλμα ὁ γεννησας πατηρ, ἠγασθη τε, και εὐφρανθεις, ἔτι δη μᾶλλον ὁμοιον προς το παραδειγμα ἐπενοησεν ἀπεργασασθαι. (*Ibid.* pp. 316, 317.)
[5] Θεοι θεων ὧν ἐγω δημιουργος, πατηρ τε ἐργων, κ. τ. λ. (*Ibid.* p. 325.)
[6] Ζωον το θεοσεβεστατον. (*Ibid.* p. 326.)
[7] *Polit.* p. 290; *De Leg.* i.
[8] Θεος ἐνεμεν αὐτους αὐτος ἐπιστατων· καθαπερ νῦν ἀνθρωποι, ζῶον ὂν ἑτερον θειοτερον, ἀλλα γενη φαυλοτερα αὐτων νομευουσι. (*Polit.* p. 36.)
[9] *Polit* p. 28. The same are evidently referred to by Herodotus in *Euterpe*, 142.

Plato's Writings and Philosophy.

(for in itself it is incomprehensible and ineffable), is to find the clue to that maze of sensible things which bewilders human observation. He was not intent, therefore, on distinguishing and arranging the several branches of knowledge, but on bringing all into subjection to his commanding theory of the perfect unity. He has not, in fact, elaborated, or even sketched, any one particular science. He has shewn how the sciences may be distributed, or rather furnished hints for such a distribution. But he has left the task of doing so to others after him, as subordinate agents, filling up the details and supplying the omissions of his system. His was characteristically a one-making mind. It analysed,—not, however, for the purpose of finding and arranging the component elements of a subject, but in search of the one vivifying principle, which gives form, and truth, and goodness, and beauty, to everything. He omits, accordingly, to examine with minuteness into secondary agencies, which are the proper study of the particular sciences, in order that he may direct attention to the master-principle, by which all subordinate principles are held together, and by which they work as concurring causes in the infinite variety of actual phenomena with such energy and constancy of operation.[1]

It was left for his pupil Aristotle to take up the business of philosophy where he had designedly left it unfinished, and, by a more rigorous method, to introduce order into the field of science, by assigning to each particular science its distinct objects and office.

It required, indeed, some philosopher worthy of such a master to take up the subject where Plato had left it, and to carry it out to the fulness of an instructive method, and a systematic exposition of truth; and such a successor was found in Aristotle. Aristotle, as controverting the Theory of Ideas, may perhaps be regarded by some as an antagonist, rather than a successor, to Plato. But every succeeding system of philosophy is partly a polemic against its predecessor, by whose labours it nevertheless has profited. So it was with the great movement of mind commenced by Plato. It languished under Speusippus and Xenocrates, and the still more remote successors in the Academia. But in the Lyceum, the rival school in name, but the rival only as the vigorous offspring of the declining parent, a crowd of hearers such as that whom the great magician of the Academia had called around him, was once more assembled, and Athens again assumed the form of an university. In Aristotle's system, accordingly, we see the productiveness of those germs of philosophy which the genius of Plato had planted and reared. Others cultivated the germs themselves; and some fostered them into a wild luxuriance. It was by being engrafted on the sturdy stock of Aristotle's mind, that they received fresh vigour, and produced fruits, though not strictly their own, yet partaking of their life and richness.[2]

If we take Plato's philosophy as a whole in its complex form, not simply as a system of philosophy, but a system in which philosophy, and eloquence, and poetry, and deep religious and moral feeling, are harmoniously combined, it stands alone in the history of literature. There is nothing which approaches to it under this point of view, nothing which may be properly regarded as a continuation of it. It is a splendid work of rare genius, like the Homeric poems or the Minerva of Phidias, which no other artist has ever equalled. Philosophical dialogues have been written in imitation of those of Plato; but how unlike to them, how altogether inferior to them in conception and execution! There is learning, and eloquence, and grace, in whatever the accomplished mind of Cicero has touched. But compare his most finished specimens in this way with the Dialogues of Plato, and what a deficiency appears! Dignity and refinement of mind, and an acquaintance with the stores of philosophy, shine forth in the Dialogues of Cicero. But we miss altogether the depth and the exquisiteness of thought, the range and the minuteness of vision, the exactness of reasoning, the lively sketches of character and manners, which interest and astonish us by their combination in the Dialogues of Plato. Xenophon had great knowledge of human nature, and has thrown an air of great naturalness over his simple descriptions, whether it is conversations and moral lessons that he relates, or stirring scenes of history. But his Socratic dialogues do not admit of comparison with the elaborate efforts of Plato. They were clearly intended only as accounts of what Socrates had taught, and did not aim at any artist-like effect, as compositions. Or, if we turn to the *Symposium* of Plutarch, there, again, much as the author admired and studied Plato, we observe an entire want of that tact in the management of the dialogue, which so engages our attention amidst the subtilties of Plato's discussions. If we compare, again, the imitations of Plato in the Dialogues of Berkeley and Shaftesbury, we find the like contrast as in those of Cicero. Superior as these are in composition to other efforts of the kind in our language, they still give no proper representation of the spirit or the form of the Platonic Dialogue. There is no life in the interlocutors of these Dialogues; and the author himself is scarcely concealed behind their masks. Nor are there any touches of natural feeling or incident to connect the argument with the personality of the speakers; such as those in the *Phædo*, where the discussion opens with the loosing of the chains from the limbs of Socrates, his bending and rubbing his leg, and expressing the pleasure arising from the contrast of his pain before; circumstances, not merely thrown in by way of dramatic interest, but leading, in immediate application, to the argument in hand. As we have said, then, the philosophy of Plato taken in connection with the admirable compositions in which it is contained, stands alone in the history of literature. It is due to the charm of the composition, that the interest of the reader is sustained amidst much of dry abstract speculation, requiring the closest attention, and considerable acquaintance with the subjects of philosophical discussion, in order to follow it. It was this charm in great measure, doubtless, which rendered the writings of Plato, in spite of their abstruseness and subtilty in many parts, so acceptable to Grecian taste. He had his critics also and censors; but all seem to have concurred in placing him at the head of the philosophical writers of Greece. Objection was taken by some to the severity of his sarcasm against the leading Sophists and other great names. Complaint, too, was made of his putting sentiments and words into the mouth of Socrates which Socrates had never used; and of his anachronisms, in bringing together in conversation, persons, who, from the period at which they flourished, could never have met. But these were merely minute criticisms. It was seen by those who entered into the spirit of his writings, that he was still the great master throughout,—that he was not giving, in his Dialogues, a history of individuals or of the times, but a general character of classes of men, and the prevailing tone, both of philosophical discussion and of popular opinion. The enlightened critic saw that Socrates, for example, is not pourtrayed by him simply as Socrates, but as the characteristic spokesman of the system on which he is engaged;—and in like manner, that when he brings together persons of different periods, he overlooks the anachronism, that he may enunciate the doctrines inquired into, in their proper person.

The perfection to which he wrought the style of his most elaborate Dialogues, will be apparent to those who

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[1] Ταῦτ' οὖν παντ' ἐς, των ξυναιτιων, οἷς θεος ὑπερητουσι χρηται, την του ἀριστου κατα το δυνατον ἰδεαν ἀποτελῶν. (*Tim.* p. 336.) The genesis of the universe is from the union of νους and ἀναγκη, and the dominion of νους over ἀναγκη causes ἀναγκη to bring τῶν γιγνομενων τα πλειστα ἐπι το βέλτιστον. (*Tim.* p. 339.)

[2] Dionysius of Halicarnassus speaks justly of Aristotle, as ὁ γνησιωτατος αὐτου μαθητης. (*Ep. ad Cn. Pomp*)

study them accurately under this point of view. So fastidious, indeed, is the taste with which they have been wrought into their present form, that it cannot be duly appreciated without an accurate and even delicate observation. Every word seems chosen with care, and every clause of his periods made to flow with its proper rhythm; and this effect at the same time is produced out of the ordinary materials of the language. The words and idioms are those of conversation, and the way in which they are put together seems, at the first view, to be as unstudied as mere conversation. But the result is an exquisite composition, in regard to which we are at a loss to pronounce whether the depth and the elegance of the thought, or the grace and propriety of expression, most prevail.[1] It is quite evident that he was not the first to compose Dialogues, were we to look simply to the finished form in which his Dialogues have been executed. They are doubtless not the first efforts in that way. But the school of Elea had preceded him in this style. More particularly, however, we are told that Alcamenus of Teos was the first to write Dialogues; or at least his is the earliest name to which, on the testimony of Aristotle, in a work now lost, the honour of originating the Dialogue has been assigned. But we need look no further than to the Greek drama for the first thought of the Platonic Dialogue. The Mimes of Sophron, and the Comedies of Epicharmus, probably furnished materials from which he was enabled, if not to mould, at least to enrich his Dialogues. The Mimes of Sophron, indeed, it is said, found a place under his pillow.[2] And what are the *Protagoras*, the *Gorgias*, and the *Symposium*, it may be asked—the particular Dialogues in which he has most fully displayed his dramatic power—but philosophical comedies in prose, analogous to the *Clouds* of Aristophanes, and only differing from that play, as addressed to a higher class of hearers, and as intended, not to call forth the applause of spectators, but to elicit thought from a reader.

Nor, in touching upon the peculiar excellences of Plato's Dialogues, ought we to omit to notice especially, under this point of view, the delightful mythic narratives with which he has adorned and relieved his abstract discussions. The art with which he has introduced them is most admirable. They are openings of rich scenery suddenly presented to the view when least expected;—tales of an Arabian night succeeding to a morning's pastime of disputation in some school of Greece;—solemn shadows from an unseen world casting their majestic forms over some ordinary incident of daily life. But they are not to be regarded only as embellishments and reliefs to the argument. They bear an important part in the teaching itself of his philosophy. They soften down the outline of his reasonings,—taking from them that positive didactic form in which they might appear amidst the strife of debate, and as wrought out by discussion. The knowledge which his theory aims at imparting is that of Reminiscence, as we have shown; and he would not, accordingly, have the results of his inquiry present themselves as anything else but Reminiscence. We are, indeed, to search out the reason of things. We are not to rest in mere opinion, but to battle our way against error and falsehood, until we rise to the eternal Ideas, the causes of all knowledge, as they are the causes of all Being. Still, we are not to suppose that we can distinctly comprehend the eternal Ideas in themselves. Though they are at last intellectually discerned, it is only "at the last," and that "scarcely."[3] For they carry up the eye of the soul to the fountain of all knowledge,—the Divine Being himself, who cannot be conceived, much less defined in words.[4] The mythic legends admirably combine with the refutative form of the discussions to leave this impression of indefiniteness on the mind. Whilst the mind's eye is directed steadily to the objects which can alone give stability and certainty to its knowledge, we are thus throughout reminded by Plato that we live amidst shadows and darkness, and that our eye must be purified and endued with heavenly light before it can look undazzled on the TRUTH itself.'

The first edition of Plato's works was that published by Aldus at Venice, A.D. 1513. The next edition was that published at Basle, by J. Oporinus, in 1534. An edition was superintended by Marcus Hopperus, who corrected several errors of that formerly published at Basle. The text of H. Stephanus, in 3 vols., 1578, does not require many words to describe it. The Bipont edition (11 vols. 8vo, 1781–1786) contains a reprint of Stephanus, with the Latin version of Marsilius Ficinus. It was owing to Immanuel Bekker that the text of Plato was first brought into a satisfactory condition in 1816–18. It was accompanied by the Latin version of Ficinus, a critical commentary, an extensive comparison of various readings, and the Greek Scholia, with copious indices. The dialogues are arranged according to the scheme of Schleiermacher. The reprint of Bekker, London, 1826, by Priestley, is a useful edition. Ast's 9 vol. edition of Plato, Leips. 1819–27, contains many emendations of the text. G. Stallbaum gave to the world an 8 vol. edition of Plato in Leipsic, 1821–25; and commenced an elaborate edition in 1827, which is perhaps the best and most useful which has appeared. The text of Baiter, Orelli, and Winckelmann (1 vol. quarto, Zurich, 1839), deserves especial mention.

The translations of separate Dialogues are almost endless. There is no good Latin translation but that of Ficinus. Of the English ones, that of Taylor is by no means accurate. V. Cousin's edition, in French, is careful and elaborate. Schleiermacher's edition, so far as it goes, is unquestionably the best. There is an Italian translation by Bembo. Bohn has published an edition in 6 vols., executed by various hands,—the best in the English language. (R. D. H.)

[1] The fastidiousness of taste with which he touched his compositions is illustrated by the account of the opening of the *Republic* having been found with the clauses variously transposed. Dionys. Hal. *De Comp. Pub.* 25.

[2] Diog. Laert. in *Vit.*

[3] Ἐν τῷ γνωστῷ τελευταια ἡ του αγαθου ἰδια και μογις ὁρασθαι. (*Rep.* vii., p 133.)

[4] *Tim.*, p. 303.

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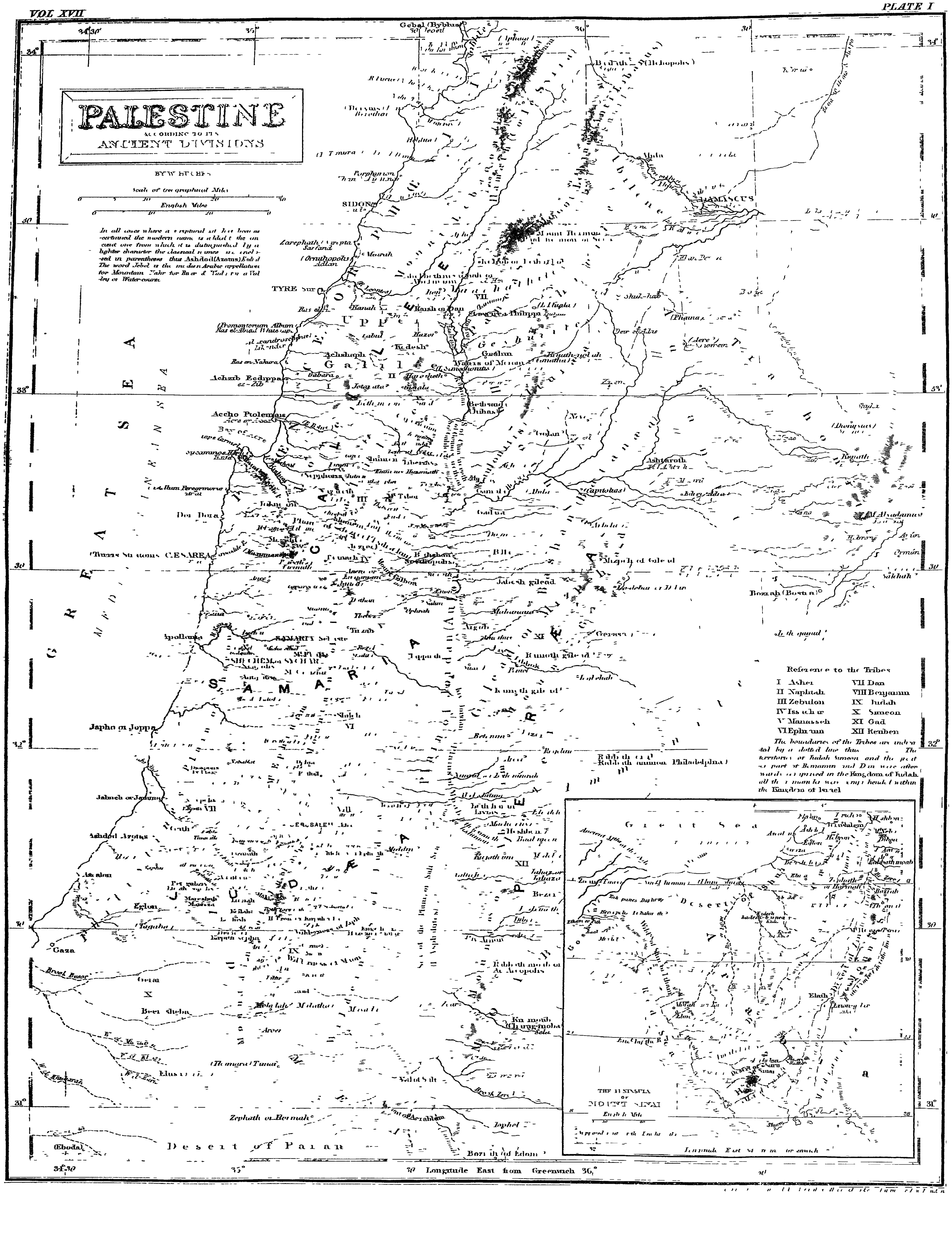
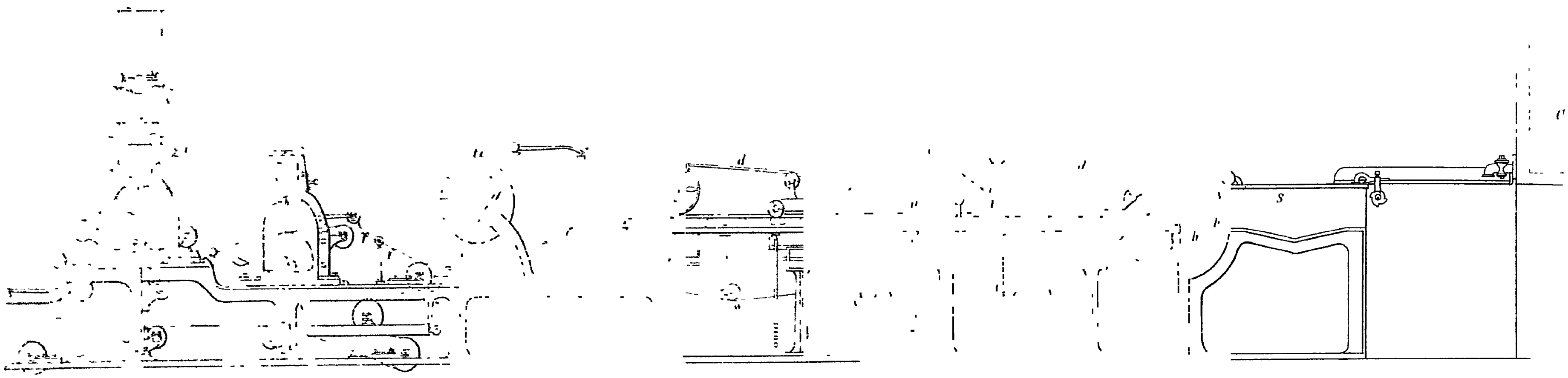
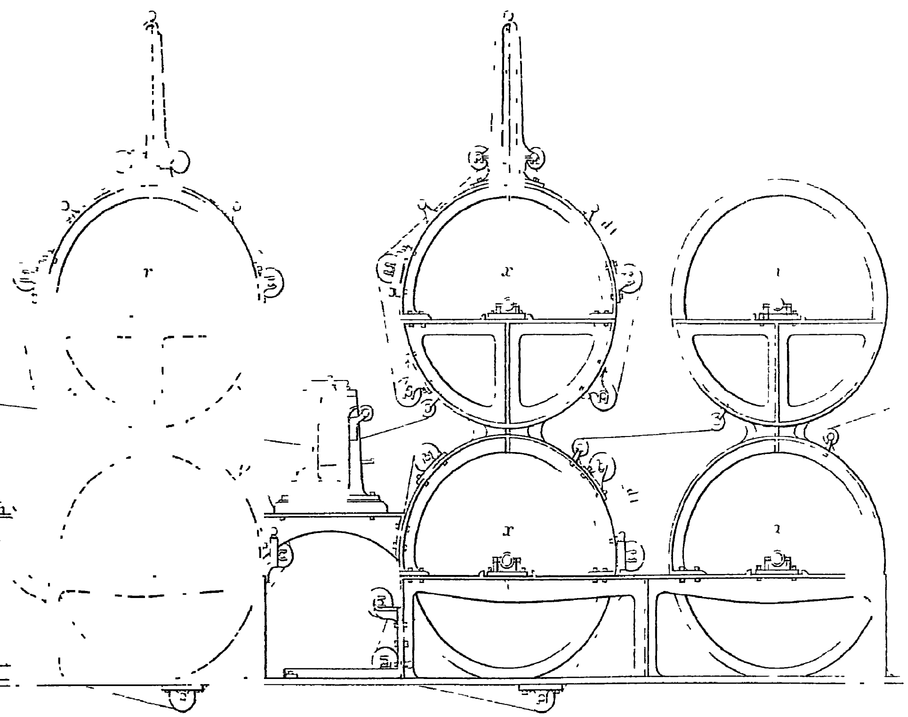

PALESTINE
ANTIENT DIVISIONS
English Miles
Gebal (Byblus)
SIDON
DAMASCUS
Mount Hermon
TYRE
Acho Ptolemais
Achzib Ecdippa
Kedesh
Bethsaida
Jabesh gilead
Ramoth gilead
Apollonia
Japho or Joppa
Jabneh or Jamnia
Ashdod Azotus
Askalon
Eglon
Gaza
Brook Besor
Beer sheba
Valet Salt
Zephath or Hormah
Desert of Paran
Rabbath ammon Philadelphia
Reference to the Tribes
I Asher
II Naphtali
III Zebulon
IV Issachar
V Manasseh
VI Ephraim
VII Dan
VIII Benjamin
IX Judah
X Simeon
XI Gad
XII Reuben
THE PENINSULA OF MOUNT SINAI
Longitude East from Greenwich 36°

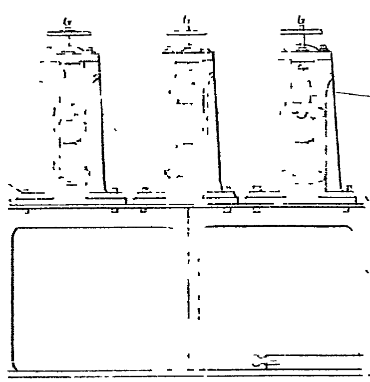
ELEVATION OF A PAPER-MAKING MACHINE

G. Bertram



C	Pulp Chest	uc	Under Roll
S	Strainer or Knotter	kk	First Press Rolls
v	Vat	wf	Wet Felt
hh	Hogs or Agitators	mm	Second Press Rolls
b	Breast Roll	xxxxxx	Drying Cylinders
www	Endless Wire	df	Drying Felts
DF	Deckle Frame	nn	Third Press Rolls
ddd	Deckle Straps	GGG	Glazing Calenders
tc	Top Couch Roll	r	Reel





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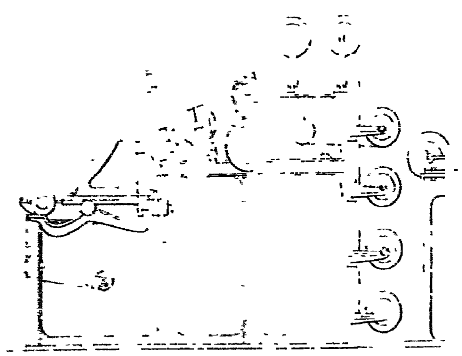

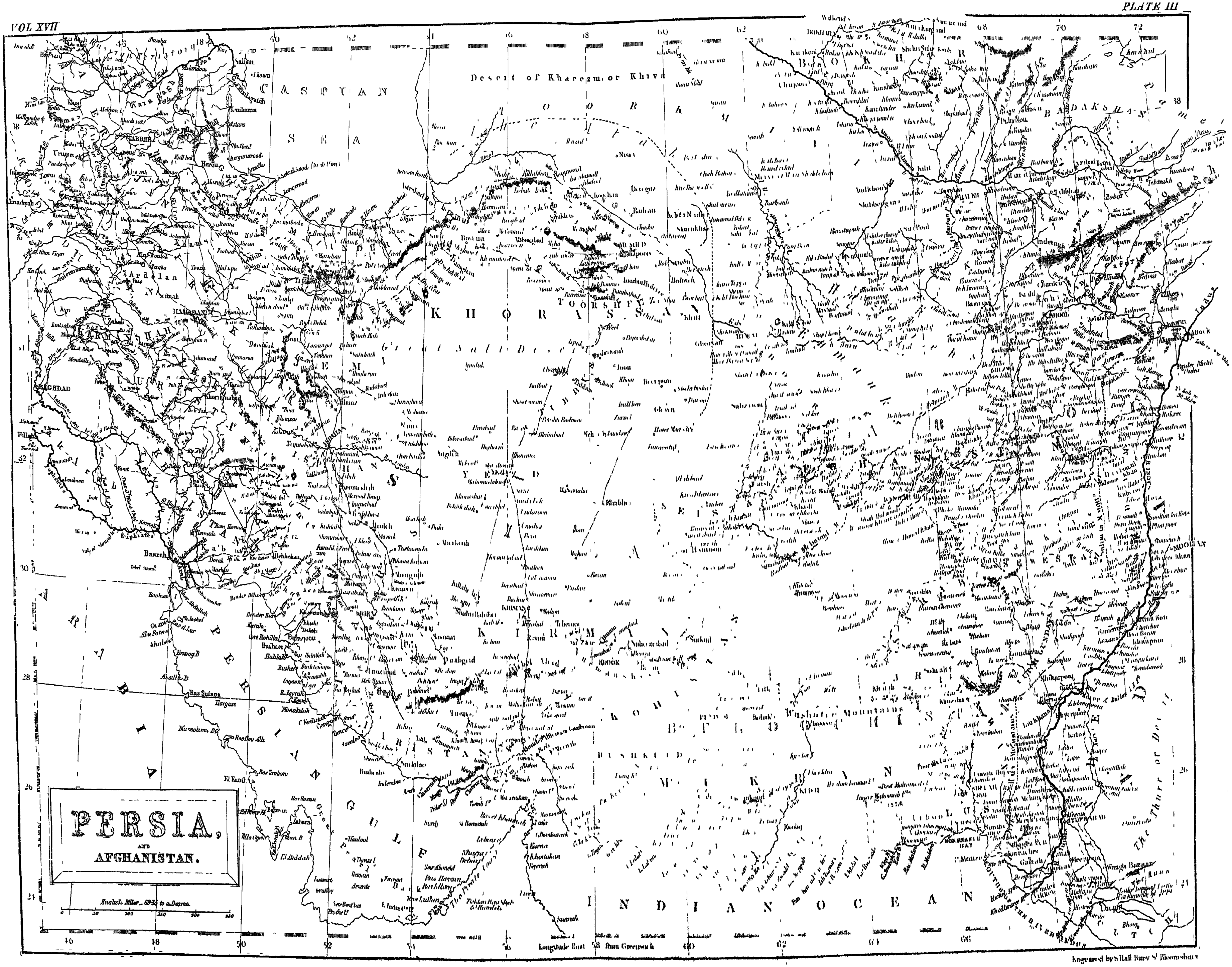

Edinburgh, Published by A & C Black

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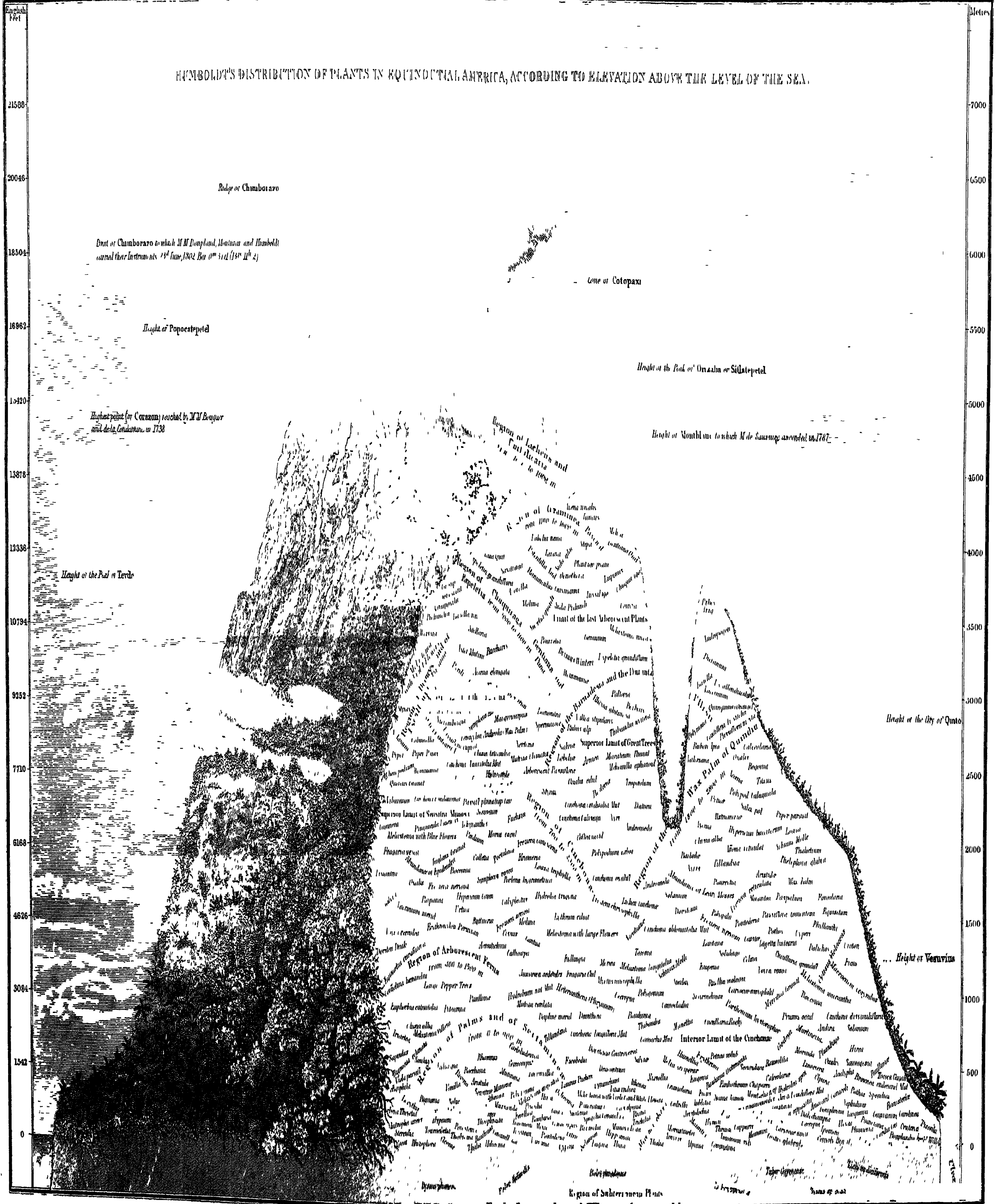
HUMBOLDT'S DISTRIBUTION OF PLANTS IN EQUINOCTIAL AMERICA, ACCORDING TO ELEVATION ABOVE THE LEVEL OF THE SEA.
English Feet
Metres
Ridge of Chimborazo
Cone of Cotopaxi
Height of Popocatepetl
Height of the Peak of Orizaba or Sitlatepetl
Height of Montblanc to which M de Saussure ascended in 1787
Height of the Peak of Teneriffe
Height of the City of Quito
Height of Vesuvius
Superior Limit of Great Trees
Limit of the last Arborescent Plants
Wax Palm of Quindiu
Region of Arborescent Ferns
Interior Limit of the Cinchona
Region of Subterraneous Plants